N00102.AR.000080
NSY PORTSMOUTH
5090.3a

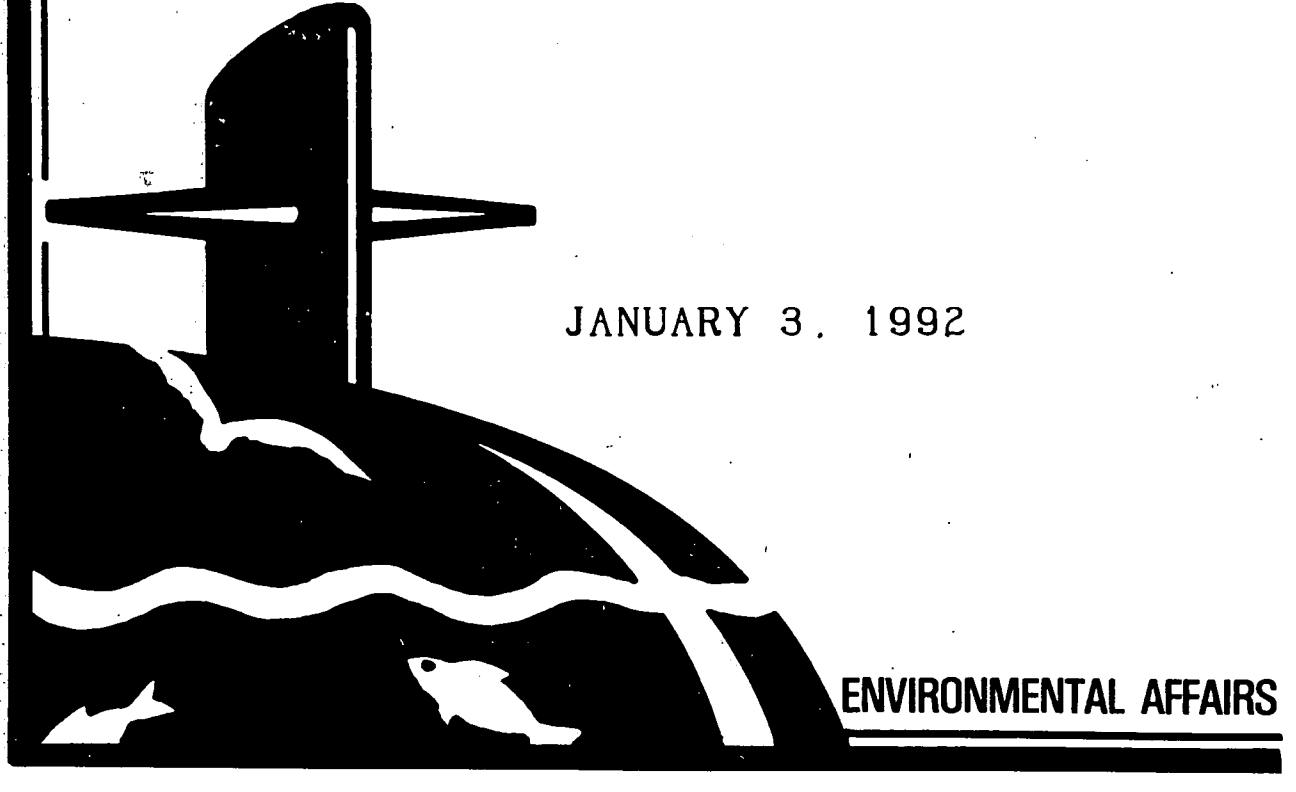
RCRA CORRECTIVE ACTION PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE PHASE IV FIELDWORK--REPORT

PREPARED FOR:

U.S. DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
PHILADELPHIA, PENNSYLVANIA 19112-5094
CONTRACT Nº N62472-86-C-1283

PREPARED BY:

McLAREN/HART ENVIRONMENTAL ENGINEERING CORPORATION
28 MADISON AVENUE EXTENSION
ALBANY, NEW YORK 12203



JANUARY 3, 1992

PORTSMOUTH NAVAL SHIPYARD

RCRA CORRECTIVE ACTION
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PHASE IV FIELDWORK--REPORT

Prepared for:

U.S. DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
PHILADELPHIA, PENNSYLVANIA 19112-5094
CONTRACT Nº N62472-86-C-1283

Prepared by:

McLAREN/HART ENVIRONMENTAL ENGINEERING CORPORATION
28 MADISON AVENUE EXTENSION
ALBANY, NEW YORK 12203

JANUARY 3, 1992

RCRA CORRECTIVE ACTION
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE
PHASE IV FIELDWORK REPORT
CONTRACT N° N62472-86-C-1283
AMENDMENT #7

Page

EXECUTIVE SUMMARY i

1.0 INTRODUCTION 1-1

2.0 JAMAICA ISLAND LANDFILL--(SMWU #8) 2-1

2.1 Surface Soil Sampling 2-1

2.1.1 Sampling Procedures 2-3
2.1.2 Findings 2-3
2.1.3 Laboratory Analytical Results 2-5
2.1.4 Interpretations/Discussion 2-10

2.2 Leachate/Outfall Sampling 2-11

2.2.1 Sampling Procedures 2-11
2.2.2 Findings 2-12
2.2.3 Laboratory Analytical Results 2-12
2.2.4 Interpretations/Discussion 2-15

2.3 Exploratory Excavations/Soil Sampling 2-17

2.3.1 Procedures 2-18
2.3.2 Findings 2-19
2.3.3 Laboratory Analytical Results 2-20
2.3.4 Interpretations/Discussion 2-27

2.4 Drilling/Monitoring Well Installation 2-28

2.4.1 Procedures 2-28
2.4.2 Findings 2-32
2.4.3 Laboratory Analytical Results 2-34
2.4.4 Interpretations/Discussion 2-47

PHASE IV FIELDWORK REPORT
CONTRACT N° N62472-86-C-1283
AMENDMENT #7
(continued)

2.5 Monitoring Well Development 2-50

2.5.1 Development Procedures 2-50
2.5.2 Development Findings 2-52

2.6 Groundwater Sampling 2-54

2.6.1 Sampling Procedures 2-55
2.6.2 Findings (Groundwater Conditions) 2-59
2.6.3 Laboratory Analytical Results 2-59
2.6.4 Interpretations/Discussion 2-63

2.7 Water-Level Measurements/Hydraulic Conductivity Testing . . . 2-68

2.7.1 Procedures 2-69
2.7.2 Findings 2-74

2.8 Seismic Survey 2-83

2.8.1 Survey Procedures 2-83
2.8.2 Survey Results 2-87
2.8.3 Interpretations/Discussion 2-89

2.9 Conclusions/Recommendations 2-90

3.0 MERCURY BURIAL SITES (SWMU #9) 3-1

3.1 Exploratory Excavations/Soil Sampling 3-1

3.1.1 Procedures 3-2
3.1.2 Findings 3-3
3.1.3 Laboratory Analytical Results 3-4
3.1.4 Interpretations/Discussion 3-10

3.2 Groundwater Sampling 3-11

3.2.1 Sampling Procedures 3-12
3.2.2 Findings (Groundwater Conditions) 3-15
3.2.3 Laboratory Analytical Results 3-15
3.2.4 Interpretations/Discussion 3-20

PHASE IV FIELDWORK REPORT
CONTRACT N° N62472-86-C-1283
AMENDMENT #7
(continued)

3.3 Water-Level Measurements/Hydraulic Conductivity Testing . . . 3-21

3.3.1 Procedures 3-22
3.3.2 Findings 3-22

3.4 Conclusions/Recommendations 3-23

4.0 DEFENSE REUTILIZATION MANAGEMENT OFFICE--
DRMO (SWMU #6) 4-1

4.1 DRMO Surface Soil Sampling 4-1

4.1.1 Sampling Procedures 4-1
4.1.2 Findings 4-3
4.1.3 Laboratory Analytical Results 4-4
4.1.4 Interpretations/Discussion 4-13

4.2 Quarters "S" & "N" Soil Sampling 4-15

4.2.1 Sampling Procedures 4-15
4.2.2 Findings 4-17
4.2.3 Laboratory Analytical Results 4-17
4.2.4 Interpretations/Discussion 4-23

4.3 Drilling/Monitoring Well Installation 4-25

4.3.1 Procedures 4-25
4.3.2 Findings 4-30
4.3.3 Laboratory Analytical Results 4-36
4.3.4 Interpretations/Discussion 4-47

4.4 Monitoring Well Development 4-49

4.4.1 Development Procedures 4-49
4.4.2 Development Findings 4-49

4.5 Groundwater Sampling 4-51

4.5.1 Sampling Procedures 4-51

4.5.2 Findings (Groundwater Conditions) 4-55
4.5.3 Laboratory Analytical Results 4-55
4.5.4 Interpretations/Discussion 4-59

4.6 Water-Level Measurements/Hydraulic Conductivity Testing . . . 4-64

4.6.1 Procedures 4-64
4.6.2 Findings 4-66

4.7 Conclusions/Recommendations 4-73

5.0 FORMER GASOLINE STATION INVESTIGATION 5-1

5.1 Soil Gas Survey 5-1

5.1.1 Survey Procedures 5-1
5.1.2 Survey Results 5-5
5.1.3 Interpretations/Discussion 5-5

5.2 Ground Penetrating Radar (GPR)/Magnetometry Survey 5-6

5.2.1 GPR Survey Procedures 5-6
5.2.2 GPR Survey Results 5-8
5.2.3 Magnetometry Survey Procedures 5-10
5.2.4 Magnetometry Survey Results 5-13
5.2.5 Interpretations/Discussion 5-13

5.3 Drilling/Monitoring Well Installation 5-13

5.3.1 Procedures 5-15
5.3.2 Findings 5-17
5.3.3 Laboratory Analytical Results 5-17
5.3.4 Interpretations/Discussion 5-19

5.4 Monitoring Well Development 5-19

5.4.1 Development Procedures 5-20
5.4.2 Development Findings 5-20

PHASE IV FIELDWORK REPORT
CONTRACT N° N62472-86-C-1283
AMENDMENT #7
(continued)

5.5 Groundwater Sampling 5-20

5.5.1 Sampling Procedures 5-21
5.5.2 Findings (Groundwater Conditions) 5-22
5.5.3 Laboratory Analytical Results 5-23
5.5.4 Interpretations/Discussion 5-24

5.6 Conclusions/Recommendations 5-25

6.0 FUEL OIL SPILLAGE AREA (SWMU #27) 6-1

6.1 Environmental Assessment 6-2

6.1.1 Procedures 6-2
6.1.2 Findings 6-2

6.2 Tank Farm Subsurface Soil Sampling 6-6

6.2.1 Sampling Procedures 6-6
6.2.2 Findings 6-9
6.2.3 Laboratory Analytical Results 6-9
6.2.4 Interpretations/Discussion 6-18

6.3 Exploratory Excavations/Drilling/Monitoring Well Installation . 6-21

6.3.1 Procedures 6-21
6.3.2 Findings 6-24
6.3.3 Laboratory Analytical Results 6-24
6.3.4 Interpretations/Discussion 6-30

6.4 Monitoring Well Development 6-31

6.4.1 Development Procedures 6-31
6.4.2 Developing Findings 6-31

6.5 Groundwater Sampling 6-33

6.5.1 Sampling Procedures 6-33
6.5.2 Findings (Groundwater Conditions) 6-36

6.5.3 Laboratory Analytical Results 6-36
6.5.4 Interpretations/Discussion 6-38

6.6 Outfall Sampling 6-42

6.6.1 Sampling Procedures 6-42
6.6.2 Findings 6-43
6.6.3 Laboratory Analytical Results 6-43
6.6.4 Interpretations/Discussion 6-45

6.7 Conclusions/Recommendations 6-45

7.0 BATTERY ACID TANK (SWMU #10) and TANK RELATED SWMUs #13, 16, 21, and 23 7-1

7.1 Drilling/Subsurface Soil Sampling (SWMU #10) 7-1

7.1.1 Sampling Procedures 7-1
7.1.2 Findings 7-3
7.1.3 Laboratory Analytical Results 7-3
7.1.4 Interpretations/Discussion 7-6

7.2 Tank Removal/Soil Sampling (SWMUs #13, 16, 21, and 23) . . . 7-8

7.2.1 Procedures 7-8
7.2.2 Findings 7-10
7.2.3 Laboratory Analytical Results 7-14
7.2.4 Interpretation/Discussions 7-19

8.0 CHILD DEVELOPMENT CENTER (CDC) 8-1

8.1 Surface Soil Sampling 8-1

8.1.1 Sampling Procedures 8-1
8.1.2 Findings 8-3
8.1.3 Laboratory Analytical Results 8-3
8.1.4 Interpretations/Discussion 8-7

8.2 Conclusions/Recommendations 8-10

PHASE IV FIELDWORK REPORT
CONTRACT N° N62472-86-C-1283
AMENDMENT #7
(continued)

9.0 FRESH WATER PONDS 9-1

9.1 Discharge Inventory 9-1

9.1.1 Procedures 9-1
9.1.2 Findings 9-1

9.2 Sediment Sampling 9-1

9.2.1 Sampling Procedures 9-4
9.2.2 Findings 9-5
9.2.3 Laboratory Analytical Results 9-5
9.2.4 Interpretations/Discussion 9-8

9.3 Conclusions/Recommendations 9-10

10.0 SOIL AND DEVELOPMENT/PURGE--WATER DRUM SAMPLING 10-1

10.1 Soil Drum Sampling 10-1

10.1.1 Sampling Procedures 10-1
10.1.2 Laboratory Analytical Results 10-2
10.1.3 Interpretations/Discussion 10-2

10.2 Development/Purge--Water Drum Sampling 10-2

10.2.1 Sampling Procedures 10-2
10.2.2 Laboratory Analytical Results 10-3
10.2.3 Interpretations/Discussion 10-3

10.3 Conclusions/Recommendations 10-4

11.0 BACKGROUND SOIL, GROUNDWATER AND RIVER WATER SAMPLING 11-1

11.1 Background Soil Sampling 11-1

11.1.1 Sampling Procedures 11-1
11.1.2 Findings 11-3
11.1.3 Laboratory Analytical Results 11-4

PHASE IV FIELDWORK REPORT
CONTRACT N° N62472-86-C-1283
AMENDMENT #7
(continued)

11.1.4 Interpretations/Discussion 11-9

11.2 Background Groundwater/River Water Sampling 11-10

11.2.1 Sampling Procedures 11-10
11.2.2 Laboratory Analytical Results 11-11
11.2.3 Interpretations/Discussion 11-12

12.0 REFERENCES

ENCLOSURES
A--JILF TOPOGRAPHIC SITE PLAN
B--SEISMIC REFRACTION PROFILES
C--DRMO TOPOGRAPHIC SITE PLAN

APPENDICES
I--TEST BORING LOGS
II--FIELD NOTE BOOKS
III--SUMMARY OF VALID ANALYTICAL RESULTS
IV--LABORATORY-SUPPLIED ANALYTICAL RESULTS
V--SOIL GAS SURVEY CHROMATOGRAMS
VI--MONITORING WELL/EXCAVATION SURVEY ELEVATIONS
VII--JAMAICA ISLAND LANDFILL AND MERCURY BURIAL SITES HYDROGRAPHS AND SLUG TEST WATER-LEVEL RECOVERY GRAPHS
VIII--DRMO HYDROGRAPHS AND SLUG TEST WATER--LEVEL RECOVERY SAMPLES

LIST OF FIGURES

Figure #	Title	Page #
2-1	JILF (SWMU #8) Surface Soil Sampling Location Map	2-2
2-2	JILF (SWMU #8) Monitoring Well and Test Boring Location Map	2-29
2-3	JILF (SWMU #8) Geologic Cross Section Location Map	2-35
2-4	JILF (SWMU #8) Geologic Cross Section A-A'	2-36
2-5	JILF (SWMU #8) Geologic Cross Section B-B'	2-37
2-6	JILF (SWMU #8) Geologic Cross Section C-C'	2-38
2-7	JILF (SWMU #8) Geologic Cross Section D-D'	2-39
2-8	JILF (SWMU #8) Geologic Cross Section E-E'	2-40
2-9	JILF (SWMU #8) Soil Concentrations Exceeding New Jersey ECRA and/or Proposed Federal Action Levels	2-49
2-10	JILF (SWMU #8) Seismic Refraction Line Location Map	2-84
4-1	DRMO (SWMU #6) Surface Soil Sample Location Map	4-2
4-2	DRMO (SWMU #6) Surface Soil Sampling Results	4-7
4-3	DRMO (SWMU #6) Quarters "S"and "N" Sampling Locations	4-16
4-4	DRMO (SWMU #6) Phase IV Groundwater Monitoring Well Locations Map	4-26
4-5	DRMO (SWMU #6) Cross Section Location Map	4-31
4-6	DRMO (SWMU #6) Geologic Cross Section A-A'	4-32
4-7	DRMO (SWMU #6) Geologic Cross Section B-B'	4-33
4-8	DRMO (SWMU #6) Geologic Cross Section C-C'	4-34

LIST OF FIGURES (CONTINUED)

Figure #	Title	Page #
4-9	DRMO (SWMU #6) Geologic Cross Section D-D'	4-35
5-1	Former Gas Station Soil Gas Survey Sampling Locations	5-2
5-2	Former Gas Station GPR Coverage and Anomaly Map	5-9
5-3	Former Gas Station Example GPR Record	5-11
5-4	Former Gas Station Magnetometry Survey Location Map	5-12
5-5	Former Gas Station Magnetometer Survey Anomaly Map	5-14
5-6	Former Gas Station Monitoring Well Location	5-16
6-1	Tank Farm Soil Sample Locations	6-7
6-2	Tank Farm Soil Petroleum Identification Analysis Results	6-20
6-3	Fuel Oil Spillage Area (SWMU #27) Monitoring Well Location Map	6-23
7-1	Battery Acid Tank Area (SWMU #10) Test Boring Location Map	7-2
7-2	Tank Related SWMUs 13, 16, 21, and 23 Location Map	7-9
8-1	Child Development Center Surface Soil Sampling Locations	8-2
8-2	Child Development Center Surface Soil Sampling Results	8-9
9-1	Fresh Water Ponds Stormwater Discharge Points	9-2
9-2	Fresh Water Ponds Sediment Sampling Location Map	9-3
11-1	Background Soil, Groundwater and River Water Sampling Locations	11-2

LIST OF TABLES

Table #	Title	Page #
2-1	Decontamination Procedures	2-4
2-2	Summary of Metal Concentrations--Surface Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Jamaica Island Landfill (SWMU #8) July 9 - 10, 1991	2-7
2-3	Summary of TOC, pH, and Percent Moisture Results--Surface Soil Jamaica Island Landfill (SWMU #8) July 9 - 10, 1991	2-9
2-4	Leachate and Outfall Sampling Field Parameter Information Jamaica Island Landfill (SWMU #8) July 10 and August 21, 1991	2-13
2-5	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Jamaica Island Landfill (SWMU #8) July 18 - 19, 1991	2-23
2-6	Summary of TOC, pH, and Percent Moisture Results--Soil Jamaica Island Landfill (SWMU #8) July 18 - 19, 1991	2-25
2-7	Monitoring Well Details Jamaica Island Landfill (SWMU #8)	2-33
2-8	Summary of PCB Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Jamaica Island Landfill (SWMU #8) July 9 - 30, 1991	2-42
2-9	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Jamaica Island Landfill (SWMU #8) July 9 - 30, 1991	2-43

LIST OF TABLES (Continued)

Table #	Title	Page #
2-10	Summary of TOC, pH, and Percent Moisture Results--Soil Jamaica Island Landfill (SWMU #8) July 9 - 30, 1991	2-46
2-11	Summary of Atterberg Limits Jamaica Island Landfill (SWMU #8) July 9 - 30, 1991	2-48
2-12	Stabilized Field Parameters Jamaica Island Landfill (SWMU #8) July 22 - August 9, 1991	2-53
2-13	Monitoring Well Casing and Groundwater Elevation Information Jamaica Island Landfill (SWMU #8) August 12 - 15, 1991	2-56
2-14	Groundwater Sampling and Field Parameter Information Jamaica Island Landfill (SWMU #8) August 12 - 15, 1991	2-58
2-15	Summary of Groundwater Conditions During Phase II, III, and IV Sampling Events Jamaica Island Landfill (SWMU #8)	2-60
2-16	Summary of Organic Concentrations--Groundwater Exceeding National Primary Drinking Water Regulations and/or Proposed Federal Action Levels Jamaica Island Landfill (SWMU #8) August 12 - 15, 1991	2-62
2-17	Summary of Metal Concentrations--Groundwater Exceeding National Primary Drinking Water Regulations and/or Proposed Federal Action Levels Jamaica Island Landfill (SWMU #8) August 12 - 15, 1991	2-64
2-18	Transducer, Datalogger, and Associated Accuracy of Water-Level Measurements Jamaica Island Landfill (SWMU #8) September 28 - 30, 1991	2-71

LIST OF TABLES (Continued)

Table #	Title	Page #
2-19	In-Situ Hermit SE2000B Logarithmic Sampling Schedule For Hydraulic Conductivity Testing	2-73
2-20	Average Groundwater Elevations Jamaica Island Landfill (SWMU #8) September 28 - 30, 1991	2-78
2-21	Hydraulic Conductivity Estimates Jamaica Island Landfill (SWMU #8) September 28 - 30, 1991	2-81
3-1	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Mercury Burial Sites (SWMU #9) July 12 and 24, 1991	3-7
3-2	Summary of TOC, pH, and Percent Moisture Results--Soil Mercury Burial Sites (SWMU #9) July 12 and 24, 1991	3-9
3-3	Monitoring Well Casing and Groundwater Elevation Information During Sampling Mercury Burial Sites (SWMU #9) August 13 - 14, 1991	3-13
3-4	Groundwater Sampling and Field Parameter Information Mercury Burial Sites (SWMU #9) August 13 - 14, 1991	3-14
3-5	Summary of Groundwater Conditions During Phase II, III, and IV Sampling Events Mercury Burial Sites (SWMU #9)	3-16

LIST OF TABLES (Continued)

Table #	Title	Page #
3-6	Summary of Metal Concentrations--Groundwater Exceeding National Primary Drinking Water Regulations and/or Proposed Federal Action Levels Mercury Burial Sites (SWMU #9) August 13 - 14, 1991	3-18
4-1	Summary of Semi-Volatile and Pesticide/PCB Concentrations--Surface Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels DRMO (SWMU #6) July 16 - 17, 1991	4-6
4-2	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels DRMO (SWMU #6) July 16 - 17, 1991	4-9
4-3	Summary of TOC, pH, and Percent Moisture Results DRMO (SWMU #6) July 16 - 17, 1991	4-12
4-4	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels DRMO (SWMU #6) Quarters "S"and "N" July 10 - 11, 1991	4-20
4-5	Summary of TOC, pH, and Percent Moisture Results DRMO (SWMU #6) Quarters "S"and "N" July 10 - 11, 1991	4-22
4-6	Monitoring Well Details DRMO (SWMU #6)	4-29

LIST OF TABLES (Continued)

Table #	Title	Page #
4-7	Summary of Total Base Neutral and PAH Concentrations--Soil Exceeding New Jersey ECRA Guidance Values DRMO (SWMU #6) July 11 - 26, 1991	4-38
4-8	Summary of TCL PCB Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels DRMO (SWMU #6) July 11 - 26, 1991	4-40
4-9	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels DRMO (SWMU #6) July 11 - 26, 1991	4-41
4-10	Summary of TOC, pH, and Percent Moisture Results--Soil DRMO (SWMU #6) July 11 - 26, 1991	4-45
4-11	Stabilized Field Parameters DRMO (SWMU #6) July 24 - 31, 1991	4-50
4-12	Monitoring Well Casing and Groundwater Elevation Information During Sampling DRMO (SWMU #6) August 2 - 6, 1991	4-52
4-13	Groundwater Sampling and Field Parameter Information DRMO (SWMU #6) August 2 - 6, 1991	4-54
4-14	Summary of Groundwater Conditions During Phase II, III, and IV Sampling Events DRMO (SWMU #6)	4-56

LIST OF TABLES (Continued)

Table #	Title	Page #
4-15	Summary of Pesticide/PCB Concentrations--Groundwater Exceeding National Primary Drinking Water Regulations and/or Proposed Federal Action Levels DRMO (SWMU #6) August 2 - 6, 1991	4-58
4-16	Summary of Metal Concentrations--Groundwater Exceeding National Primary Drinking Water Regulations and/or Proposed Federal Action Levels DRMO (SWMU #6) August 2 - 6, 1991	4-60
4-17	Transducer, Datalogger, and Associated Accuracy of Water-Level Measurements DRMO (SWMU #6) September 24 - 27, 1991	4-65
4-18	Average Groundwater Elevations DRMO (SWMU #6) September 24 - 27, 1991	4-68
4-19	Hydraulic Conductivity Estimates DRMO (SWMU #6) October 3, 1991	4-71
6-1	Tank Farm Shallow Soil Sampling Results TPH--McLaren/Hart Mobile Laboratory	6-10
6-2	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Tank Farm July 31, August 1 and August 7, 1991	6-13
6-3	Summary of TOC, pH, and Percent Moisture Results Tank Farm July 31, August 1 and August 7, 1991	6-15

LIST OF TABLES (Continued)

Table #	Title	Page #
6-4	Summary of Total Petroleum Hydrocarbon/Petroleum ID Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Tank Farm	6-17
6-5	Monitoring Well Details Fuel Oil Spillage Area (SWMU #27)	6-25
6-6	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Fuel Oil Spillage Area (SWMU #27) August 2 - 7, 1991	6-28
6-7	Summary of TOC, pH, and Percent Moisture Results Fuel Oil Spillage Area (SWMU #27) August 2 - 7, 1991	6-29
6-8	Stabilized Field Parameters Fuel Oil Spillage Area (SWMU #27) August 20 - 23, 1991	6-32
6-9	Groundwater Sampling and Field Parameter Information Fuel Oil Spillage Area (SWMU #27) August 26 - 27, 1991	6-35
6-10	Summary of Metal Concentrations--Groundwater Exceeding National Primary Drinking Water Regulations and/or Proposed Federal Action Levels Fuel Oil Spillage Area (SWMU #27) August 26 - 27, 1991	6-39
6-11	Outfall Sampling Field Parameter Information Fuel Oil Spillage Area (SWMU #27) August 21, 1991	6-44

LIST OF TABLES (Continued)

Table #	Title	Page #
7-1	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values Battery Acid Tank (SWMU #10) July 18 - 19, 1991	7-5
7-2	Summary of TOC, pH, and Percent Moisture Results Battery Acid Tank (SWMU #10) July 18 - 19, 1991	7-7
7-3	Tank Related SWMUs 13, 16, 21, and 23	7-11
7-4	Summary of Total Base Neutral and PAH Concentrations--Soil Exceeding New Jersey ECRA Guidance Values Tank Related SWMUs 13, 16, 21, and 23 November 13 - 18, 1991	7-16
7-5	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Tank Related SWMUs 13, 16, 21, and 23 November 13 - 18, 1991	7-17
7-6	Total Sulfide and Total Organic Carbon (TOC)--Soil Tank Related SWMUs 13, 16, 21, and 23 November 13 - 18, 1991	7-18
8-1	Summary of Organic and Inorganic Concentrations--Surface Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Child Development Center July 10, 1991	8-5
8-2	Summary of TOC, pH, and Percent Moisture Results Child Development Center July 10, 1991	8-6
9-1	Summary of Metal Concentrations--Sediment Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Fresh Water Ponds July 27 and 30, 1991	9-7

LIST OF TABLES (Continued)

Table #	Title	Page #
9-2	Summary of TOC, pH, and Percent Moisture Results Fresh Water Ponds Sediment Samples July 29 - 30, 1991	9-9
11-1	Summary of Metal Concentrations--Soil Exceeding New Jersey ECRA Guidance Values and/or Proposed Federal Action Levels Background Soil Sampling August 12 - 13, 1991	11-6
11-2	Summary of TOC, pH, and Percent Moisture Results Background Soil Sampling August 12 - 13, 1991	11-7

EXECUTIVE SUMMARY

McLaren/Hart Environmental Engineering Corporation (McLaren/Hart), performed the RCRA Facility Investigation Fieldwork -- Phase IV, at the Portsmouth Naval Shipyard, Kittery, Maine, as described in amendment 7 of Contract N62472-86-C-1283. All methodologies and procedures as described in the draft Portsmouth Naval Shipyard RCRA Facility Investigation Proposal (RFIP), August 1989, were followed during the performance of this work. The following is a synopsis of the Phase IV work.

JAMAICA ISLAND LANDFILL (JILF) (SWMU 8)

Surface soil samples were collected from seven locations at the JILF. Soil samples were taken from below the surface grass layer to a depth of twelve inches or refusal, whichever came first. The soil samples were analyzed for Target Compound List (TCL) Organics, Target Analyte List (TAL) Inorganics, Total Organic Carbon (TOC), pH, and percent moisture. Two samples were chosen for particle size distribution analyses.

One surface soil sample exceeded the proposed Federal Action Level for Polychlorinated biphenyls (PCBs) in soil. One sample contained six metals at concentrations which exceeded New Jersey Environmental Clean-up Responsibility Act (ECRA) Guidance Values for metals in soil. All samples had qualitative concentrations, except one which had a qualitative and semi-quantitative concentration, of beryllium which exceeded the proposed Federal Action Level for beryllium in soil.

Three leachate samples were collected at or near low tide, when distinct rivulets emanating from the JILF could be identified and sampled. Also, three outfall samples were collected during stormwater runoff onto and from the JILF. The leachate and outfall samples were analyzed for TCL Organics and TAL Inorganics.

Other than typical inorganic constituents, the JILF leachate and outfall samples had few detectable compounds. Of those detected, only a few qualitative and one quantitative concentration exceeded either National Primary Drinking Water Regulations (NPDWR) or proposed Federal Action Levels.

Three exploratory excavation locations were investigated within the interior of the JILF. Four subsurface soil samples were collected within the excavations and analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Two of the samples were also submitted for particle size and Atterberg limit analysis.

Metal concentrations exceeded the Guidance Values used for comparison in all of the subsurface soil samples collected from the excavations.

Eight soil borings were drilled and completed as monitoring wells at the JILF. Three monitoring wells were constructed in shallow overburden and the remaining five wells were completed in bedrock. Split-spoon soil samples were collected continuously ahead of drilling and soil samples were sent to the laboratory for analysis. The soil samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH and percent moisture. In addition, three soil samples were submitted for analysis of Atterberg limits and two samples were submitted for particle size analysis.

Volatile, semi-volatile, and PCB concentrations which exceeded the Guidance Values used for comparison were limited to soil samples collected at two locations. Metal concentrations, not including qualitative results, which exceeded Guidance Values were observed in soil samples collected at four locations.

Groundwater samples were collected from the twenty-six monitoring wells installed within and around the perimeter of the JILF. All groundwater samples were analyzed for TCL Organics and TAL Inorganics. TAL Inorganics included dissolved (filtered) metals and total (unfiltered) metals.

Groundwater in two wells (JW-16 and JW-13B) showed volatile concentrations which exceeded either the NPDWR or the proposed Federal Action Levels. Qualitative concentrations of the semi-volatile bis(2-ethylhexyl)phthalate exceeded the proposed Federal Action Level in groundwater from four monitoring wells. Groundwater in one well (JW-19) showed pesticide concentrations which exceeded the proposed Federal Action Level for pesticides in groundwater. Twenty wells had one or more total metals (both filtered and unfiltered) which exceeded the NPDWR and/or proposed Federal Action Levels. One well (JW-13S) had selenium dissolved in the water at a concentration which exceeded the NPDWR for that metal. Five wells had qualitative concentrations of antimony, dissolved in water, which exceeded the proposed Federal Action Level for that metal. The concentrations of dissolved metals in the remaining wells was below the regulatory standards used for comparison. This indicates that the metal concentrations measured are primarily associated with suspended particulates in the groundwater.

Groundwater levels were continuously monitored in 24 of the 26 JILF wells, with JW-16 and JW-16B being the only exclusions. Groundwater levels were measured and recorded hourly from September 27 to October 1, 1991. Hydraulic conductivity testing was conducted in the wells upon completion of water level monitoring.

Hydrographs generated from the hourly water-level data show that groundwater levels in 14 of the JILF wells respond to tidal fluctuations. Of these wells, those nearest the embayment or river typically show the greatest and quickest response to the tide. However, wells JW-13B and JW-14B, owing to an impermeable confining layer and low hydraulic conductivity, respectively, exhibit dampened and lagged hydrographs. Hydrographs, groundwater elevations, and salinity data suggest that saline water is encroaching into and/or around the landfill, particularly at and near JW-9. Such data for wells in and near the landfill property also indicate a fresh water lens in the landfill. Groundwater in this

area appears to be flowing toward the embayment, with likely subradial flow toward the landfill perimeter. Hydrographs, groundwater elevations, and salinity data for wells on and near Jamaica Island indicate the presence of a fresh water lens in this area. Groundwater in this area may be flowing radially to subradially away from Jamaica Island. Hydraulic conductivity is generally several orders of magnitude lower in the bedrock than in the overburden; however, some bedrock wells exhibited hydraulic conductivities comparable to that in the overburden. Hydraulic conductivity in the overburden was typically in the 10^{-2} cm/sec range, with the overburden wells along the embayment generally exhibiting the higher values.

A seismic refraction investigation was conducted around the perimeter of the JILF to profile the bedrock surface. Additional survey objectives included identification of weathered or fractured bedrock and characterization of overburden materials.

MERCURY BURIAL SITES (SWMU #9)

Exploratory excavations were conducted at Mercury Burial Site II (Western site) and Mercury Burial Site I (Eastern site). Six subsurface soil samples were collected from the Mercury Burial Sites and analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. In addition, particle size and Atterberg limit samples were collected from Mercury Burial Site I.

The excavation program revealed three concrete mercury cells and one vertical section of a concrete sewer pipe at Mercury Burial Site I, all presumed to contain mercury contaminated material. All of the mercury burial cells appeared to be in reasonably good condition. No mercury burial cells were located as a result of excavations at what had been identified as Mercury Burial Site II.

Two soil samples at Mercury Burial Site II were found to exceed the Guidance Values for semi-volatile compounds. A soil sample from Mercury Burial Site I had a PCB concentration which exceeded the Guidance Values used for comparison. All the soil samples contained one or more metals at concentrations which exceeded the Guidance Values used for comparison. There were no mercury concentrations exceeding Guidance Values. Detected mercury concentrations were comparable to concentrations detected in background soil samples.

Groundwater samples were collected from all six Mercury Burial Site wells and analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals).

As in the Phase III field investigation, volatile organic compounds were detected in monitoring wells MW-2, MW-3 and MW-6. The compounds consisted of benzene, toluene, ethylbenzene, and xylene (BTEX). None of these compounds exceeded the proposed Federal Action Levels or NPDWR. A semi-volatile compound (bis(2-ethylhexyl)phthalate) was detected in MW-3 at a concentration which exceeded the proposed Federal Action Level of 3 ppb. All six wells had one or more total metals which exceeded the NPDWR and/or proposed Federal Action Levels. Phase IV metal concentrations were consistently lower than the Phase II and Phase III sampling results except for monitoring well MW-06. Groundwater in MW-06 continued to exhibit the highest metal concentrations. Based on analytical results, there does not appear to be any mercury in the groundwater attributed to potential releases from either Mercury Burial Site. However, subsurface vaults were not located at Mercury Burial Site II during the excavation program.

Groundwater levels in monitoring wells MW-2 and MW-4 were measured and recorded hourly from September 27 to October 1, 1991, concurrent with water-level monitoring in the JILF wells. Hydraulic conductivity testing was conducted in the same wells on October 2, 1991. Since the three wells at each Mercury Burial Site are screened in the same material and at similar depth, only wells MW-2 and MW-4 were monitored and tested.

Groundwater elevation data suggest that groundwater is likely flowing from MW-2 towards the landfill. The hydrograph for MW-4 shows significantly dampened and lagged water-levels in response to the tide, likely an expression of the clay barrier reported to be in place in this region of the landfill. Groundwater elevation data for MW-4 and surrounding wells indicate that groundwater is flowing towards Clark's Island Embayment, with possible lateral flow toward the landfill perimeter.

DRMO (SWMU #6)

Surface soil samples were collected from nine locations at the DRMO. Samples were obtained from the upper twelve inches of the soil column or until refusal at each location. Samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH and percent moisture. Two soil samples were also selected for particle size analysis.

Three surface soil samples were found to exceed the Guidance Values for semi-volatile compounds. Four samples exceeded Guidance Values for pesticides in soil, and five samples exceeded Guidance Values for PCBs in soil. All of the surface soil samples had metal concentrations which exceeded Guidance Values.

Eleven soil samples were collected in the vicinity of Quarter "S" and "N" to further assess the potential for contamination at depth at those locations where elevated concentrations were previously detected. Soil samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH and percent moisture. In addition, a particle size analysis was conducted on two soil samples.

All of the soil samples contained one or more metals at concentrations which exceeded the Guidance Values used for comparison. Comparing metal results from Phase II soil sampling to results from Phase IV indicate lead, the predominant metal, concentrations decreasing with depth.

Four test borings were drilled and completed as monitoring wells east of the DRMO storage yard. Two monitoring wells were constructed in shallow overburden and two wells were completed in bedrock. Split-spoon soil samples were collected continuously ahead of drilling and soil samples were sent to the laboratory for analysis. The soil samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH and percent moisture. Two samples were additionally analyzed for particle size distribution.

Two soil samples were found to exceed the Guidance Values for semi-volatile compounds. Four samples exceeded Guidance Values for PCBs in soil. A majority of the soil samples contained one or more metals at concentrations which exceeded the Guidance Values used for comparison.

Groundwater samples were collected from the fourteen monitoring wells installed around the perimeter of the DRMO. All groundwater samples were analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals).

Groundwater in one well (DW-09) showed a qualitative concentrations of bis(2-ethylhexyl)phthalate exceeding the proposed Federal Action Level. Groundwater samples from wells DW-02B and DW-06 had pesticide concentrations which exceeded the NPDWR and proposed Federal Action Levels. Groundwater samples from wells DW-02, DW-07 and DW-08 had PCB concentrations which exceeded the NPDWR and proposed Federal Action Level. A majority of the groundwater samples had one or more metals at total concentrations which exceeded the NPDWR and/or proposed Federal Action Levels. Higher metal concentrations appear to be associated with suspended particulates in groundwater.

Groundwater levels from the fourteen monitoring wells at the DRMO were measured and recorded hourly from September 24 to 27, 1991. Hydraulic conductivity testing was conducted in the same wells on October 3, 1991.

The average groundwater elevations indicate that groundwater beneath the DRMO flows in a general southward direction to the river. However, possible groundwater mounding in the vicinity of well DW-5, as indicated by the relatively high groundwater elevation, could result in a local radial deviation from the southward flow direction. The groundwater data indicate upward hydraulic gradients at well pairs DW-7/7B and DW-8/8B; that is, the groundwater elevations are higher in the bedrock wells.

In general, hydraulic conductivity in the bedrock is lower than that in the overburden, except for DW-2B, within which water levels recovered too fast to estimate hydraulic conductivity. The overburden exhibits relatively high hydraulic conductivity, particularly in the wells along the river.

FORMER GASOLINE STATION INVESTIGATION

A soil gas survey was conducted in the vicinity of the underground storage tanks (USTs) at the former gas station. Results of the soil gas survey did not reveal any detectable BTEX concentrations that may be associated with a gasoline plume from the USTs.

A ground penetrating radar (GPR) survey and a magnetic survey were conducted in the vicinity of the former gas station to detect and locate associated USTs. Results of the surveys indicate two parallel USTs. The eastern UST is the smaller of the two USTs and is buried approximately 2 to 3 feet below grade. The western UST appears to be twice the length of the eastern UST and is approximately 2.5 to 4 feet below grade.

A test boring was drilled and completed as a bedrock monitoring well (GW-01) downslope, presumably downgradient of the USTs at the former gas station. Split-spoon soil samples were collected continuously ahead of drilling and a soil sample was sent to the laboratory for analysis. The sample was analyzed for TCL Organics, TAL Inorganics, TOC, pH, percent moisture and particle size analysis.

Only two metal concentrations (beryllium and lead) exceeded the Guidance Values used for comparison. There does not appear to be any evidence of prior releases from the two USTs based on visual observations from the soil boring and soil sample analysis at the boring location.

A groundwater sample was collected from the monitoring well installed downslope of the USTs at the former gasoline station. The sample was analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals).

The groundwater sample showed a concentrations of bis(2-ethylhexyl)phthalate which exceeded the proposed Federal Action Level. Two metal concentrations, cadmium and a semi-quantitative estimate of chromium, barely exceeded the NPDWR and/or proposed Federal Action Levels for these two metals in the unfiltered sample. There were no metal concentrations which approached NPDWR or proposed Federal Action Levels in the filtered sample.

FUEL OIL SPILLAGE AREA (SWMU #27)

An environmental assessment was conducted at the Fuel Oil Spillage Area and the adjacent Tank Farm to identify potential causes for previously observed fuel oil contamination. Numerous releases of #2 and #6 fuel oil were documented at Tanks T1, T2, and T6 and along various segments of buried pipelines at Berth 6.

Twenty-one shallow borings were drilled around the Tank Farm to evaluate the nature and extent of petroleum contamination as a result of documented releases within the bermed areas. Soil samples were collected from all borings and were submitted to an on-site mobile laboratory for petroleum hydrocarbon analysis. Twelve soil samples were submitted to the off-site laboratory for various analyses.

Analytical results for soils collected around the Tank Farm show varying quantities and degree of weathering of #2 fuel oil, #6 fuel oil, and transmission fluid. The sources of petroleum in the soil around the Tank Farm was not clearly identified during the investigation.

Exploratory test pits were excavated along Berth 6 (Fuel Oil Spillage Area) to clear access for drilling and monitoring well installation. Five soil samples were collected during the excavations. Samples were analyzed for TCL Organics, TAL Inorganics, pH and percent moisture. In addition, one sample was submitted for Atterberg limits and particle size analysis, and one sample was submitted for TOC. Six test borings were subsequently drilled and monitoring wells installed in the shallow overburden.

One soil sample had a semi-volatile concentration which exceeded Guidance Values used for comparison. All samples had one or more metal concentrations which exceeded Guidance Values. Chromatograms for two soil samples indicate the possibility of #6 fuel oil in the samples.

Groundwater samples were collected from the six monitoring wells and analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals). All six wells had one or more total metals (both filtered and unfiltered) which exceeded the NPDWR and/or proposed Federal Action Levels. One well (FW-03) had selenium dissolved in the water at a concentration which exceeded the NPDWR for that metal.

Two outfall samples were collected during a stormwater runoff event and analyzed for TCL Organics and TAL Inorganics. There were no organic or inorganic concentrations which exceeded NPDWR or proposed Federal Action Levels.

BATTERY ACID TANK (SWMU #10)

Three test borings were drilled and terminated upon auger refusal. Three soil samples, one per boring, were analyzed for TCL Organics, TAL Inorganics, TOC, pH and percent moisture. In addition, a particle size analysis was conducted on one sample.

One soil sample had a semi-volatile concentration which exceeded Guidance Values used for comparison. All samples had one or more metal concentrations which exceeded Guidance Values.

TANK RELATED SWMUs 13, 16, 21 AND 23

Excavation and removal of the USTs related to SWMUs 13, 16, 21, and 23 were conducted and confirmation soil samples collected along the walls and bottom of the excavations. Soil samples were analyzed for Appendix IX Organics and Inorganics, TOC, particle size analysis and percent moisture. Only one UST (SWMU 21) had visually contaminated product in the excavated soil.

CHILD DEVELOPMENT CENTER (CDC)

Eight surface soil samples were collected in the vicinity of the CDC to further assess surface soil contamination around this sensitive receptor area. The samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH and percent moisture. Two soil samples were also selected for particle size analysis.

One surface soil sample had a semi-volatile concentration which exceeded Guidance Values used for comparison. Two samples had pesticide concentrations which exceeded Guidance Values. Excluding beryllium, three surface soil samples had metal concentrations in excess of Guidance Values. Qualitative concentrations of beryllium were found to exceed Guidance Values in all samples.

FRESH WATER PONDS

A stormwater and process wastewater discharge inventory was conducted on the fresh water ponds to identify any potential sources of chemical discharge into the ponds. No process wastewater was found to discharge into the ponds. Three stormwater discharge points were located. One of the three stormwater discharge points, draining the bermed Tank Farm, was blocked at both ends following a #2 fuel oil release from Tank T6 in 1984.

Eight sediment samples were collected from the two fresh water ponds in approximately the same locations as the Phase III sediment sampling locations. These samples were collected in order to better assess potential risks posed by swimming or fishing in the ponds. All sediment samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH and percent moisture.

Beryllium was detected in all samples in concentrations exceeding Guidance Values used for comparison. In addition, copper and cadmium were detected in samples SD-04 and SD-08, respectively, in concentrations exceeding Guidance Values. The fresh water ponds do not appear to present a significant repository or source of contamination and thus should not require further analytical evaluations.

SOIL AND DEVELOPMENT/PURGE-WATER DRUM SAMPLING

Soil samples were collected from 55 gallon drums containing auger cuttings from Phase III drilling activities. Also, water samples were collected from 55 gallon drums containing development/purge-water. All samples were analyzed to determine the hazardous characteristics of the containerized materials using the Toxicity Characteristic Leachate Procedure (TCLP) and flash point, corrosivity and reactivity tests. Three soil samples collected from the drums exhibited hazardous characteristics as defined under 40 CFR Part 261.20 - 261.24. The soils failed for leachable lead.

BACKGROUND SOIL, GROUNDWATER AND RIVER WATER SAMPLING

Background soil, groundwater and river water samples were collected so that analytical results could be compared with the on-site investigatory samples collected. Background soil samples were collected from nine locations on the shipyard. Four sample locations were selected in areas most likely to contain clean fill. The remaining five sample locations were selected in areas presumed to be native soil. A background groundwater

sample was collected from monitoring well JW-03. Two background river water samples, one at low tide and one at high tide, were sampled from the landing dock within Clark's Island Embayment. Soil samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH and percent moisture. Two soil samples were also selected for particle size analysis. The groundwater sample was analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals). The two river water samples were analyzed for TCL Organics and TAL Inorganics (total metals only).

Beryllium was detected in all background surface soil samples in concentrations exceeding Guidance Values used for comparison. Three soil samples, presumed to be native soil, had concentrations of arsenic, chromium, copper and lead which exceeded Guidance Values. There were no contaminant concentrations exceeding NPDWR or proposed Federal Action Levels in the background groundwater sample or river water samples.

1.0 INTRODUCTION

This RCRA Corrective Action Phase IV Field Work Report is the final phase of field investigations prior to the issue of the RCRA Facility Investigation Report for the Portsmouth Naval Shipyard in Kittery, Maine. The Phase I Field Work Investigation involved initial field work at the Defense Reutilization Management Office (DRMO) facility (SWMU #6), the Jamaica Island Landfill (JILF) (SWMU #8) and the Mercury Burial Sites (SWMU #9). The Phase II Field Work Investigation involved additional studies at the JILF (SWMU #8), Mercury Burial Sites (SWMU #9), and DRMO (SWMU #6). Initial field work was conducted at the Industrial Waste Outfalls (SWMU #5), Battery Acid Tank (SWMU #10), Tank Investigation (SWMU #12), Fuel Oil Spillage Area (SWMU #27), and the Back Channel and the Main Channel of the Piscataqua River. The Phase III Field Work Investigation involved follow-up studies at the JILF (SWMU #8), Mercury Burial Sites (SWMU #9), DRMO (SWMU #6), and Fuel Oil Spillage Area (SWMU #27). Initial field work was conducted at the Child Development Center and the fresh water ponds.

The Phase IV Field Work Investigation involved additional studies at the following locations: JILF (SWMU #8); Mercury Burial Sites (SWMU #9); DRMO (SWMU #6); Former Gas Station; Fuel Oil Spillage Area (SWMU #27); Battery Acid Tank (SWMU #10); tank related SWMUs 13, 16, 21 and 23; Child Development Center (CDC); and the Fresh Water Ponds.

The following field work was conducted as part of the Phase IV Field Work Investigation:

-- New monitoring wells were installed, developed and groundwater samples collected and analyzed from monitoring wells at the JILF, DRMO, Former Gasoline Station, and Fuel Oil Spillage Area.

- Groundwater samples were collected and analyzed from monitoring wells at the Mercury Burial Sites.
- Surface soil samples were collected and analyzed at the JILF, DRMO, and CDC.
- Exploratory excavations were dug and soils sampled at the JILF, Mercury Burial Sites, and Fuel Oil Spillage Area.
- Exploratory borings were drilled and subsurface soil samples collected and analyzed at the Battery Acid Tank, Tank Farm, and Quarters "S" & "N".
- Sediment samples were collected in each of the two fresh water ponds. A discharge inventory was also conducted around the fresh water ponds.
- Leachate samples were collected at the JILF.
- Outfall samples were collected at the JILF and Fuel Oil Spillage Area.
- Hydraulic conductivity testing was conducted and water level measurements obtained at the JILF, Mercury Burial Sites, and DRMO.
- A seismic survey was conducted at the JILF.
- Soil gas, GPR, and magnetometry surveys were conducted at the Former Gasoline Station.
- An environmental assessment was performed at the Fuel Oil Spillage Area and the Tank Farm.
- Tanks were removed and soils sampled at SWMUs 13, 16, 21 and 23.
- Soil and water samples were collected at background locations. Background locations were selected in areas at PNS most likely to contain clean fill and in areas presumed to be native soil.
- Soil and water samples were collected and analyzed from soil resulting from drill cuttings and development/purge water drums.

This report summarizes all field activities which were performed and presents interpretation of the data.

The procedure for laboratory analyses of Appendix IX compounds, Target Compound List (TCL) Organic compounds and Target Analyte List (TAL) Inorganic compounds followed the most current USEPA document "Statement of Work (SOW), Organic Analysis, Multi-Media Multi-Concentration".

The analytical laboratory (CEIMIC) used the required methods and submitted the required deliverables as stated in the July 1987 Revision of the "Statement of Work of the EPA Contract Laboratory Program" (CLP) and follow-up revisions to the "Statement of Work of the EPA Contract Laboratory Program".

It should be noted that data flags Q, J, and R in the analytical tables are indications of data quality as defined in the February 1988 publication "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses" and the June 1988 "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses" prepared for the Hazardous Site Evaluation Division of the USEPA--Region I.

As presented in the tables, values that stand alone (without a qualifier) are the most accurate results, and possess both qualitative and quantitative connotations. Numbers that are flagged with a "J" represent qualitative but only semi-quantitative results. Values flagged with a "Q" indicate results that are qualitative only. Finally the qualifier "R" signifies a result that is unusable based on the QA/QC data validation.

2.0 JAMAICA ISLAND LANDFILL (SWMU #8)

The purpose of this phase of work at the JILF was as follows:

-- Evaluate surface soil quality at the JILF;

-- Evaluate the quality of water discharged from leachate seeps and outfalls;

-- Conduct exploratory excavations within the JILF to evaluate buried materials; further define shallow groundwater quality at the landfill and to define groundwater quality within the bedrock at the landfill;

-- Determine hydraulic conductivity and effects of tides on representative monitoring wells at the JILF; and

-- Further define fill thickness, depth to tidal flat deposits, and depth to bedrock around the JILF through a seismic survey.

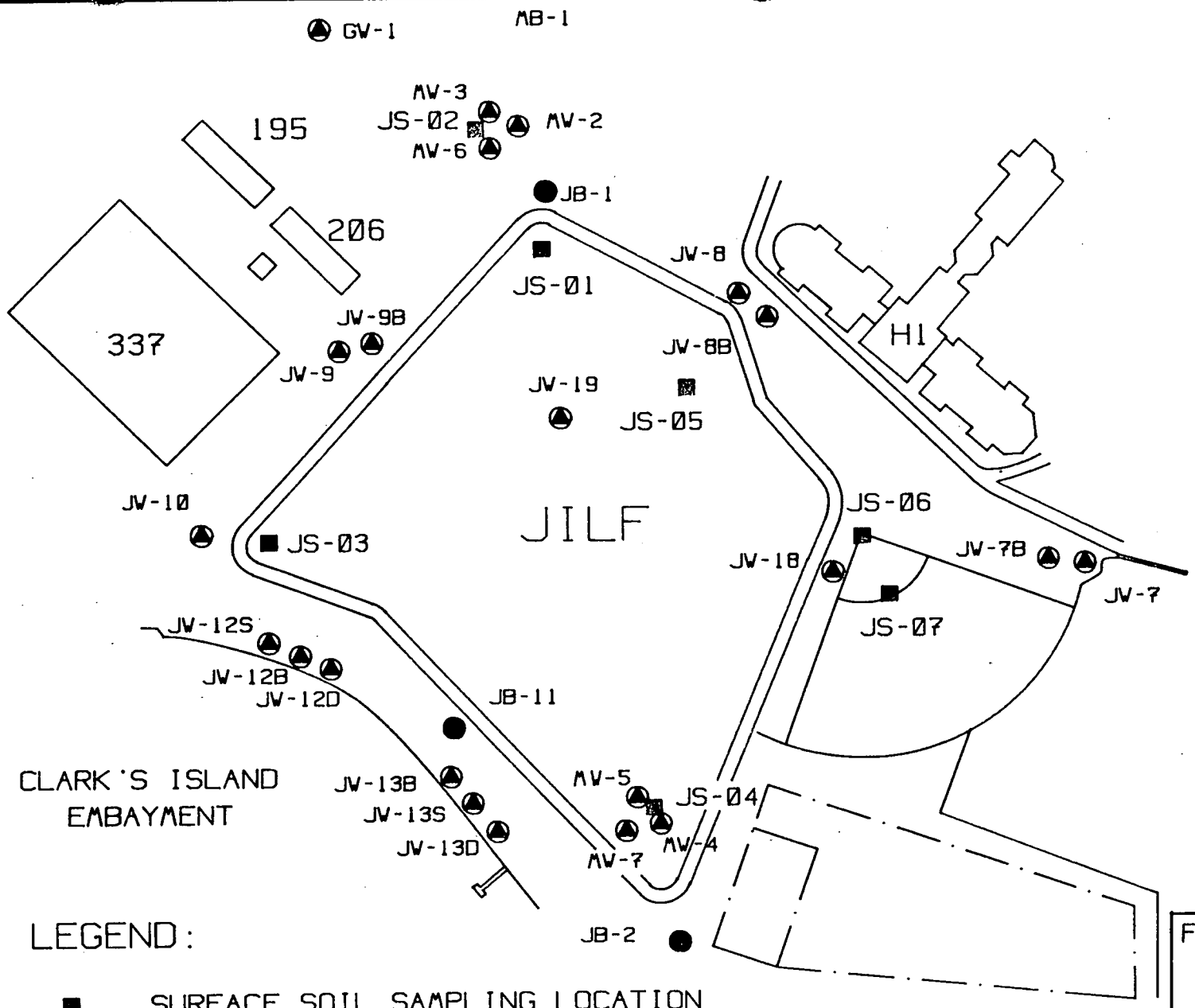
The following tasks were performed as part of the Phase IV field investigation at the JILF:

- Surface Soil Sampling
  Leachate and Outfall Sampling
  Exploratory Excavations and Soil Sampling
  Drilling, Soil Sampling, and Monitoring Well Installation
  Monitoring Well Development
  Groundwater Sampling
  Hydraulic Conductivity Testing and Water Level Measurements
- Seismic Survey

The information gathered from these investigations will be incorporated into the final RCRA Facility Investigation Report.

2.1 Surface Soil Sampling

On July 9 and 10, 1991 surface soil samples were collected from seven locations on the JILF, as shown on Figure 2-1. One soil sample was collected at each of six locations (JS-01 through JS-06). Duplicate sampling was performed at a seventh location (JS-07). One equipment rinseate field blank (JRB-01-04) was collected for QA/QC purposes. All



LEGEND:

■ SURFACE SOIL SAMPLING LOCATION

▲ MONITORING WELL LOCATION

TEST BORING LOCATION

FIGURE 2-1

JILF (SWMU #8)

SURFACE SOIL SAMPLING LOCATION MAP

McLAREN/HART

soil samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Two samples, JS-02 and JS-06, were chosen for particle size distribution analyses.

2.1.1 Sampling Procedures

Surface soil samples were collected by removing the surface grass layer, where present, and digging the soil with a stainless-steel hand trowel and placing the soil in a stainless-steel mixing bowl. In some cases, to facilitate removal of the soil, it was necessary to first loosen the soil with a pickax. All sampling equipment (stainless-steel hand trowel, stainless-steel mixing bowl, and pickax) was properly cleaned and decontaminated prior to use at each sampling location, in accordance with the protocol outlined in Table 2-1. As each hole was advanced, continuous portions of the soil column were removed from the hole with the trowel and placed in the stainless-steel bowl. When the hole was advanced to twelve inches or refusal, whichever came first, the soil in the bowl was sampled. TCL Volatile (VOA) sample containers were filled prior to any mixing of the soil so as to preserve the integrity of this parameter. After VOA sampling was complete, the soil in the bowl was homogenized. TOC sample containers were then filled followed by the remaining sample containers. All samples were placed in a cooler, chilled with ice, and hand delivered via courier to Ceimic Corporation (CEIMIC) of Narragansett, Rhode Island, for laboratory analysis. Chain of Custody Forms were utilized for all sampling efforts during the Phase IV field investigation.

2.1.2 Findings

Described below are the depths and descriptions of the soil encountered at the seven surface soil sampling locations. No abnormal visual evidence or odors were detected in any samples.

TABLE 2-1

DECONTAMINATION PROCEDURES[1]

PORTSMOUTH NAVAL SHIPYARD

A. Sampling devices made of carbon steel (split-spoon samplers), stainless-steel, teflon, glass, and plastic[2].

1. Wash equipment using phosphate-free, laboratory-grade detergent (Alconox(TM) or equivalent) and potable water.

2. Rinse thoroughly with potable water.

3. Rinse with 10% nitric acid for everything except carbon steel (1% nitric acid for carbon steel) followed by another potable water rinse.

4. Rinse with distilled or deionized water.

5. Applicable only when sampling organic compounds:

   a. Rinse with a pesticide-grade solvent. (Isopropanol is recommended; methanol is acceptable).

   b. Allow to air dry (when possible oven dry at 105 °C for at least 1 hour).

6. Wrap in aluminum foil if not ready for immediate use.

B. Drill rigs and large equipment will be steam-cleaned between sampling points and before leaving the site.

---

1 All decontamination liquids generated during the investigation were contained and later stored temporarily at the Portsmouth Naval Shipyard (PNS) Hazardous Waste Storage Area awaiting eventual disposal based on analytical results.

2 This procedure modifies the decontamination outline found in Quality Control in Remedial Site Investigation (Perket, 1986).

JS-01-04	0-5" light brown silty sand; dry at 5" gray clay with gravel-sized stone fragments; hard 5-10" gray brown silty sand; hole ended at 10"
JS-02-04	0-12" dark brown to black silty sand with fine to medium gravel; roots Grain size sample collected
JS-03-04	0-12" light brown silty sand and coarse to fine gravel; roots, segment of metal pipe and valve at bottom of hole Matrix Spike/Matrix Spike Duplicate (MS/MSD) sample collected
JS-04-04	0-12" light tan coarse to fine sand, trace medium to fine gravel; roots
JS-05-04	0-8" tan coarse to medium sand, some medium to fine gravel at 8" grades into very coarse sand near 12" brown silty to very fine sand; damp
JS-06-04	0-3" tan coarse to fine sand, some fine gravel; mica chips, damp 3-12" dark tan to brown coarse to fine sand, little fine gravel; damp Grain size sample collected
JS-07-04	0-12" brown coarse to fine sand, little fine gravel; damp near bottom Duplicate sample JS-08-04 collected

2.1.3 Laboratory Analytical Results

A summary of valid surface soil sampling results is provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV. Since the State of Maine does not have published clean-up guidelines for contamination in soils, New Jersey Environmental Clean-up Responsibility Act (ECRA) Guidance Values and proposed Federal Action Levels documented in the Federal Register (55FR30865, July 27, 1990) are used for comparison purposes.

TCL Volatiles

There were no volatile concentrations exceeding New Jersey ECRA Guidance Values or proposed Federal Action Levels. Only toluene was consistently detected in the soil samples, being present in all but one sample.

A review of the chromatograms indicate a petroleum product present in samples JS-02-04, JS-03-04, and JS-04-04. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum present cannot be made at this time.

TCL Semi-Volatiles

No semi-volatile organic compounds were detected in the surface soil samples in concentrations exceeding New Jersey ECRA Guidance Values or proposed Federal Action Levels. Relatively low concentrations of primarily polynuclear aromatic hydrocarbons (PAHs) were detected in virtually all samples.

TCL Pesticide/PCBs

No pesticides were detected in the surface soil samples in concentrations exceeding proposed Federal Action Levels. Specific guidance values for pesticides are not currently listed under New Jersey ECRA Guidance Values.

One surface soil sample, JS-03-04, had a detectable concentration of PCBs (0.65 mg/kg). This concentration exceeds the proposed Federal Action Level of 0.09 mg/kg in soil, yet is below the New Jersey ECRA Guidance Value range of 1 to 5 ppm for total PCBs in soil.

TAL Inorganics

Cyanide was not detected in any of the surface soil samples.

Detectable concentrations of metals were found in all surface soil samples. Samples containing metals in concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels are shown in Table 2-2.

TABLE 2-2

SUMMARY OF METAL CONCENTRATIONS – SURFACE SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 9 AND 10, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (PPM)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (PPM)
BERYLLIUM	JS-01-04	0.59Q	1.0	0.2
	JS-02-04	0.67Q	1.0	0.2
	JS-03-04	1.30J	1.0	0.2
	JS-04-04	0.73Q	1.0	0.2
	JS-05-04	0.36Q	1.0	0.2
	JS-06-04	0.35Q	1.0	0.2
	JS-07-04	0.52Q	1.0	0.2
	JS-08-04*	0.69Q	1.0	0.2
CADMIUM	JS-02-04	3.20J	3.0	40.0
COPPER	JS-02-04	12,200.00J	170.0	NA
LEAD	JS-02-04	339.00	250-1,000	NA
MERCURY	JS-02-04	1.30	1.0	20.0
NICKEL	JS-02-04	131.00J	100.0	2,000.0
ZINC	JS-02-04	1,250.00J	350.0	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of JS-07-04

TOC, pH, Percent Moisture

Table 2-3 presents the Total Organic Carbon (TOC), pH, and percent moisture results for the surface soil samples. The TOC concentrations ranged from 0.2 to 3.9 percent, with an average of 1.9 percent, and pH ranged from 5.6 to 8.3, with an average of 7.0. Percent moisture ranged from 3 to 8 percent, with an average of 5 percent.

Particle Size Analysis

Described below are the particle size analyses results for surface soil samples JS-02-04 and JS-06-04. As indicated the soil at JS-02-04 is comprised of nearly 40 percent gravel and 40 percent sand, with the balance consisting of primarily silt. The soil at JS-06-04 consists of 72 percent sand, with the balance nearly split between gravel and silt.

Particle size analysis for JS-02-04 is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		38%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		39%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	8%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	18%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	13%	
Silt size, 0.074 to 0.005 mm:		21%
Clay, smaller than 0.005 mm:		2%
Colloids, smaller than 0.001 mm:		ND

ND = Not Detected

TABLE 2-3

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS–SURFACE SOIL

JAMAICA ISLAND LANDFILL (SWMU #8) PORTSMOUTH NAVAL SHIPYARD

JULY 9 AND 10, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
JS-01-04	1.5	5.6	3
JS-02-04	3.9	6.3	8
JS-03-04	2.7	6.3	6
JS-04-04	2.5	6.8	5
JS-05-04	1.3	7.0	3
JS-06-04	0.2	7.6	4
JS-07-04	1.4	8.3	6
JS-08-04*	2.1	8.3	4

* = McLAREN/HART Duplicate Sample of JS-07-04

Particle size analysis for JS-06-04 is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		10%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		72%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	15%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	37%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	20%	
Silt size, 0.074 to 0.005 mm:		16%
Clay, smaller than 0.005 mm:		2%
Colloids, smaller than 0.001 mm:		ND

ND = Not Detected

2.1.4 Interpretations/Discussion

PCBs were detected only in surface soil sample JS-03-04, in which the PCB concentration of 0.65 mg/kg exceeded the proposed Federal Action Level of 0.09 mg/kg for PCBs in soil. The source of the PCBs in the surface soil at this location is not currently known, though it could be associated with the fill material deposited at this location. Also, PCBs may have been in oils potentially used to spray dirt roads for dust control around the JILF. A short section (roughly one foot) of pipe with an attached valve was discovered during sampling at this location, indicating fill material near the surface.

The metals for which concentrations exceeded New Jersey ECRA Guidance Values and/or proposed Federal Action Levels (see Table 2-2) could be associated with sand blast grit, which is prevalent throughout the JILF. Sand blast grit was observed at the JS-02-04 sampling location, and an excavation near this sampling location revealed significant

volumes of sand blast grit. In general, the metals shown in Table 2-2, except mercury, were detected in all other JILF surface soil samples, though not in concentrations exceeding New Jersey ECRA Guidance Values or proposed Federal Action Levels.

2.2 Leachate/Outfall Sampling

Leachate and outfall samples were collected at the JILF on July 10, 1991 and August 21, 1991, respectively, at the sampling locations shown on Enclosure A. This sampling and analysis program was designed to characterize the chemical characteristics of water emanating (leachate) from the northeast face of the JILF and runoff onto and from the JILF.

2.2.1 Sampling Procedures

Leachate samples were collected at or near low tide, when distinct rivulets emanating from the JILF could be identified and sampled. Prior to sampling, a small area was excavated or cleared along the rivulet to permit or facilitate sample collection. Leachate samples were collected by placing the laboratory-supplied sample containers directly into the rivulets, with the container opening facing upstream. Three leachate samples, plus one replicate and one field blank, were collected. Since sampling equipment was not necessary for sample collection, the field blank was collected by pouring laboratory-supplied water directly into the appropriate sample bottles. A separate, small volume of water was collected concurrently during the sampling and analyzed in the field for pH, temperature, specific conductivity, turbidity, and salinity. All leachate samples were stored on ice in a field cooler and transported via courier to CEIMIC for TCL Organic and TAL Inorganic analyses.

Outfall samples were collected during stormwater runoff onto and from the JILF. Sampling of the outfalls was necessary during a stormwater runoff event, since collectable volumes of water did not expel from all sampled outfalls until such runoff occurred. As shown on Enclosure A, outfall sample OF-03-04 was collected upgradient of the JILF, near the eastern pond, whereas samples OF-04 and OF-05 were collected from outfalls apparently discharging runoff from the JILF. As with the leachate samples, the outfall samples were collected directly in laboratory-supplied sample containers. A separate, small volume of water was collected concurrently and analyzed in the field for pH, temperature, specific conductivity, turbidity, and salinity. The outfall samples were stored on ice in a field cooler and transported via courier to CEIMIC for TCL Organic and TAL Inorganic analyses.

2.2.2 Findings

Table 2-4 presents the field parameters for the leachate and outfall samples. The salinity and conductivity for leachate sample JL-01 were significantly different than for JL-02 and JL-03, which together exhibited similar field parameters. The salinity and conductivity values indicate mildly brackish water in JL-01 and seawater in JL-02 and JL-03. The field parameters for the outfall samples indicated fresh water and were relatively consistent between samples.

2.2.3 Laboratory Analytical Results

A summary of valid groundwater results is provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in groundwater, current National Primary Drinking Water Regulations documented in the Federal Register (56 FR 3578, January 31, 1991), National Revised Primary Drinking Water Regulations (effective July 30, 1992), and proposed Federal Action

TABLE 2-4

LEACHATE AND OUTFALL SAMPLING FIELD PARAMETER INFORMATION

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 10 AND AUGUST 21, 1991

Sample N°	Sampling Date	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTUs)	Salinity (°/∞)
JL-01	7/10/91	7.81	14.0	6,000	0.4	4.0
JL-02	7/10/91	7.50	15.6	25,000	0.2	19.0
JL-03	7/10/91	7.66	15.4	29,000	0.7	22.0
OF-03	8/21/91	7.57	20.0	280	2.1	0.0
OF-04	8/21/91	7.08	20.0	255	11.6	0.0
OF-05	8/21/91	6.85	19.0	203	19.1	0.0

JL = Denotes JILF Leachate
OF = Denotes Outfall

Levels documented in the Federal Register (55 FR 30865, July 27, 1990) are used to evaluate the analytical data. For the purpose of discussion in this report, the current National Primary Drinking Water Regulations and the National Revised Primary Drinking Water Regulations will be combined and referred to as National Primary Drinking Water Regulations (NPDWR). The more stringent of the two regulations will be used for this report.

TCL Volatiles

Qualitative concentrations of 1,2-dichloroethene and chlorotrifluorethene in JL-01 were the only detectable concentrations of volatile organic compounds (VOCs) in the leachate samples. Qualitative concentrations of acetone and chloroform in OF-05 were the only detectable concentrations of VOCs in the outfall samples. The presence of chloroform may be due to a chlorinated water supply. None of the detected VOCs were in concentrations exceeding either NPDWR or proposed Federal Action Levels.

TCL Semi-Volatiles

Detectable concentrations of unidentified aliphatic hydrocarbons, not included on the TCL parameter list but identified on the chromatograms as signals indicative of petroleum hydrocarbons, were found in leachate samples JL-01, JL-02, and JL-04 (the replicate of JL-02). However, since a quantitative petroleum identification analysis was not conducted, the specific hydrocarbons are, based on currently available data, indeterminable. A qualitative concentration of Bis(2-Ethylhexyl)phthalate was detected in outfall sample OF-05. None of the detected semi-volatile compounds were in concentrations exceeding proposed Federal Action Levels. Semi-volatiles currently listed on the TCL parameter list are not currently regulated under NPDWR.

TCL Pesticide/PCBs

Pesticides/PCBs were not detected in any of the leachate samples. However, a quantitative concentration (1.10 ug/L) of Dieldrin was detected in OF-05, which exceeds the proposed Federal Action Level of 0.002 ug/L.

TAL Inorganics

Detectable concentrations of metals were present in all leachate and outfall samples. A qualitative concentration (0.25 ug/L) of beryllium was detected in leachate sample JL-01, which may exceed the proposed Federal Action Level of 0.008 ug/L. Qualitative concentrations of beryllium (0.25 ug/L) and antimony (37.00 ug/L) were detected in leachate sample JL-04, the replicate of JL-02, which may exceed proposed Federal Action Levels of 0.008 ug/L and 10.00 ug/L, respectively. Cyanide was not detected in any leachate or outfall samples.

2.2.4 Interpretations/Discussion

The conductivity and salinity of leachate sample JL-01 indicate a characteristic brackish source of water, distinctly different from the characteristic seawater source for JL-02 and JL-03. Such a difference could be attributed to less mixing of seawater with relatively fresh (relative to salinity) groundwater in the vicinity of JL-01, a hypothesis that is partially supported by groundwater elevations and tidal responses, or lack thereof, and salinity measurements in nearby wells JW-4 and JW-5. Except for expressions of tidal influence at JW-5 at high tide, groundwater elevations in JW-4 and JW-5 do not change in response to changes in tide elevations (see Section 2.7.2). Given the proximity of these wells to the back channel, these wells thus do not appear to be in direct hydraulic communication with the seawater. Salinity data collected during groundwater sampling are consistent with this argument; salinity in JW-4 and JW-5 was 0.0 and 3.5 parts per thousand,

respectively. Conversely, the groundwater elevation in JW-15, located near the face along which JL-02 and JL-03 were collected, changes significantly in response to changes in tide elevation (see Section 2.7.2). Further, salinity in JW-15 was 31 parts per thousand at the time of groundwater sampling. In summary, the source of water for leachate seep JL-01 appears to be primarily fresh to slightly brackish water, whereas the source of water for leachate seeps JL-02 and JL-03 is primarily seawater.

Other than typical inorganic constituents, the JILF leachate and outfall samples had few detectable compounds. Of those detected, only a few qualitative and one quantitative concentration exceeded either NPDWR or proposed Federal Action Levels.

The VOCs, 1,2-dichloroethene and chlorotrifluoroethene, detected in JL-01, though only found in qualitative concentrations, are significant in that they represent VOCs or derivatives of VOCs detected elsewhere in the JILF, and thus indicate a possible migration of such VOCs to leachate seep JL-01. The VOCs and the pesticide Dieldrin detected in OF-05 could be attributable to runoff from the hazardous waste storage area, given that the outfall from which sample OF-05 was collected includes the hazardous waste storage area within its drainage basin.

The presence of the unidentified petroleum hydrocarbons in JL-01 and JL-02 is possibly due to migration of such compounds from the JILF to the associated leachate seeps. The source of these hydrocarbons could be associated with previous disposal, relatively current surface activities at the JILF, or a possible former dust control spraying program.

The qualitative concentrations of beryllium detected in JL-01 and JL-04 could be naturally present or from previous disposal activities at the JILF. The antimony detected in JL-04 might be attributable to previous disposal activities at the JILF, for antimony is commonly used as a hardening alloy for lead, particularly in storage batteries and cable sheaths.

The results of the outfall sampling do not indicate an increase in downgradient chemical constituents potentially attributable to the JILF. Although outfall sample OF-05 contained Dieldrin and qualitative concentrations of acetone, chloroform, and Bis(2-Ethylhexyl)phthalate, such compounds could possibly be attributable to runoff from the hazardous waste storage area.

2.3 Exploratory Excavations/Soil Sampling

Exploratory excavations were conducted from July 16 through July 22, 1991 within the interior of the JILF. Test pits were excavated in the vicinity of home plate at the baseball field (JTP-01), east of the fitness area (JTP-02), and north of the heliport area (JTP-03). Exploratory excavation locations and dimensions are shown on the enclosed survey map of the JILF (Enclosure A) and Appendix VI.

The objectives of the exploratory excavations and subsurface soil sampling are summarized as follows:

1) To clear an area (i.e. removal of drums, cylinders, construction and demolition debris, etc.) that is suitable for drilling and the placement of groundwater monitoring wells within the JILF interior;

2) To provide additional information regarding the type and total thickness of indigenous unconsolidated fill material;

3) To assess whether organic compounds and/or inorganic constituents related to past disposal practices at the JILF have contaminated the surrounding soils;

4) To assess whether any organic compounds and/or inorganic constituents in soil samples are present in concentrations that exceed applicable soil standards.

A total of four subsurface soil samples plus two duplicate samples were collected on July 18, 1991 and July 19, 1991 from the JTP-01 and JTP-02 excavations, along with one equipment rinseate field blank. All soil samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Two of the samples JTP-01(5-7) and JTP-02(5-7) were also submitted for particle size and Atterberg limit analysis.

2.3.1 Procedures

Excavating was performed with a 235 CAT backhoe and a 936 CAT front end loader operated by William A. Renaud, Jr., Trucking, Inc. of South Berwick, ME (subcontracted by Drum Hill Construction Corp., North Chelmsford, MA). All excavation work was supervised by McLaren/Hart's geologists and engineers. An HNU photoionization detector or Organic Vapor Analyzer (OVA), Geiger Counter, Dräger pump with chlorine gas tubes, Jerome Mercury Vapor Analyzer, and a PDM-3 Miniram Aerosol Monitor were used to constantly monitor the excavations for organic vapors, radiation, chlorine gas, mercury vapors, and airborne particulates.

The backhoe bucket was decontaminated between excavations by scrubbing with alconox and water to eliminate any gross contamination that may have been encountered and to reduce the possibility of cross-contamination.

Excavations were terminated when either native soils and/or groundwater was encountered. An attempt was made to collect soil samples from five foot intervals within the excavations. The samples were labeled JTP-01 and JTP-02 followed by the footage interval from which the sample was obtained. No soil samples were collected from the JTP-03 location. Soil samples were obtained from within the backhoe bucket using a precleaned stainless-steel trowel. The sample was then placed in a stainless-steel mixing bowl, homogenized and transferred to the appropriate laboratory-supplied container. TCL volatile

samples were collected prior to homogenizing. The sampling equipment was decontaminated prior to use at each location to prevent cross-contamination according to the protocol described in Table 2-1. All samples were stored on ice in a field cooler and delivered via courier to CEIMIC for laboratory analysis.

2.3.2 Findings

A total of five test pits were excavated in a radial pattern from home plate at the baseball field (JTP-01). Test pits were excavated to depths ranging from 12.0 feet to 15.0 feet below grade. Excavations were terminated when either saturated native soils or bedrock was encountered. Fill material was uncovered from approximately 5.0 feet below grade to the top of native soil. Fill material consisted of bricks, glass bottles, wood fragments, remains of a rusted 55-gallon drum, sandblast grit, and a large amount of reinforcing steel and scrap metal mixed with soil. One crushed 55-gallon drum was found intact and contained a yellowish solid resin. The solid resin was sampled and labeled DRJTP-01 for TCLP hazardous waste characteristic analysis. The drum and contents were then overpacked in a DOT approved 85-gallon drum, supplied by PNS. The drum was labeled and later taken to the PNS hazardous waste storage area where it was temporarily stored while awaiting laboratory analytical analysis. Saturated tidal flat clays were found at depths ranging from 11.0 feet to 14.0 feet below grade. Bedrock was encountered at approximately 14.0 feet in the excavation north of the baseball field backstop. The southern most test pit was excavated to a depth of approximately 14.0 feet below grade on the raised portion of the JILF. It appears that a clay layer, presumably a landfill cap, slopes towards the south into the JILF interior. Fill material was less abundant, but a small amount of scrap metal was uncovered. Saturated soils were encountered at 13.0 feet below grade. Soil samples JTP-01(5-7), JTP-01(10-12) and its duplicate sample JTP-01(12-14) were collected

from two separate intervals within the excavation area located southeast of the baseball field backstop.

Test pit (JTP-02) was excavated east of the fitness area within the interior of the JILF to a depth of approximately 16.0 feet below grade. The upper 7.5 feet of soil consisted of silty clay with fine sand, fine to coarse gravel, and small boulders. A silty clay layer was encountered from 7.5 feet to 9.0 feet below grade. Fill material consisted mostly of scrap metal. A large amount of cables, glass bottles, remains of a rusted drum, and large timber with a slight creosote odor were also uncovered from 9.0 feet to 16.0 feet below grade. Saturated fill material was encountered at 12.0 feet below grade. Soil samples JTP-02(5-7), JTP-02(10-12) and duplicate sample JTP-02(12-14) were collected from two separate intervals within the excavation.

Test pit (JTP-03), located north of the heliport, was excavated to a depth where bedrock was encountered at approximately 21.0 feet below grade. Fill material appeared to be free of debris except for occasional wood fragments. The upper 3.0 feet of soil encountered consisted of silt to fine sand, a trace of clay, and fine to coarse gravel. The material from 3.0 to 21.0 feet consisted of clay with fine sand and a trace of fine to coarse gravel. Saturated soil was encountered at 12.0 feet.

All of the excavations were backfilled with the original soil and fill material.

2.3.3 Laboratory Analytical Results

A total of four subsurface soil samples, plus two duplicate samples, were collected from two of the three exploratory excavation areas within the interior JILF. These samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Soil samples JTP-01(12-14) and JTP-02(12-14) are duplicates of JTP-01(10-12) and JTP-02(10-12), respectively. Two sample locations, JTP-01(5-7) and JTP-02(5-7), were also submitted

for particle size and Atterberg limit analysis. A summary of valid soil sample results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in soils, New Jersey ECRA Guidance Values and proposed Federal Action Levels are used for comparison purposes.

TCL Volatiles

Detectable volatile concentrations were found in all soil samples, however, there were no volatile concentrations above New Jersey ECRA Guidance Values or proposed Federal Action Levels.

TCL Semi-Volatiles

Soil sample JTP-02(10-12) and duplicate sample JTP-02(12-14) had detectable total base neutral organic compound concentrations of 13.45 mg/kg and 11.07 mg/kg, respectively. These concentrations are above the New Jersey ECRA Guidance Value of 10 ppm for total base neutrals in soil. No proposed Federal Action Levels are available for total base neutrals.

There were no acid extractable compound concentrations observed exceeding the New Jersey ECRA Guidance Value for acid extractables in soil. No proposed Federal Action Levels are available for total acid extractables.

A review of the chromatograms and listed tentatively identified compounds (TICs) indicate a petroleum product present in all of the soil samples. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum product present cannot be made at this time.

TCL Pesticide/PCBs

There were no detectable pesticide or PCB concentrations in any of the soil samples.

TAL Inorganics

Detectable metal concentrations were found in all soil samples. Metal concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels are shown on Table 2-5. Qualitative concentrations of beryllium that may exceed the New Jersey ECRA Guidance Value and/or the proposed Federal Action Level are also shown on Table 2-5.

TOC, pH, and Percent Moisture

Table 2-6 shows the results for TOC, pH, and percent moisture analyses. The TOC concentrations ranged from 0.3% to 2.1%, and pH ranged from 8.3 to 9.1. Percent moisture ranged from 5% to 30%.

Particle Size Analysis

A particle size analysis was conducted on subsurface soil samples JTP-01(5-7) and JTP-02(5-7). The particle size analysis results for JTP-01(5-7) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		4%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		38%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	3%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	18%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	17%	
Silt size, 0.074 to 0.005 mm:		34%
Clay, smaller than 0.005 mm:		9%
Colloids, smaller than 0.001 mm:		15%

TABLE 2-5

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 18-19, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
ANTIMONY	JTP-02(12-14)**	15.20	10.00	30.00
BARIUM	JTP-02(10-12)	688.00	400.00	4,000.00
	JTP-02(12-14)**	807.00	400.00	4,000.00
BERYLLIUM	JTP-01(5-7)	1.60J	1.00	0.20
	JTP-01(10-12)	2.60J	1.00	0.20
	JTP-01(12-14)*	3.00J	1.00	0.20
	JTP-02(5-7)	1.10Q	1.00	0.20
	JTP-02(10-12)	5.90J	1.00	0.20
	JTP-02(12-14)**	5.00Q	1.00	0.20
CADMIUM	JTP-01(10-12)	4.70	3.00	40.00
	JTP-01(12-14)*	8.00	3.00	40.00
	JTP-02(10-12)	13.50	3.00	40.00
	JTP-02(12-14)**	16.00	3.00	40.00
CHROMIUM	JTP-01(10-12)	118.00J	100.00	400.00
	JTP-01(12-14)*	118.00J	100.00	400.00
	JTP-02(12-14)**	135.00J	100.00	400.00

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of JTP-01(10-12)
** = McLAREN/HART Duplicate Sample of JTP-02(10-12)

TABLE 2-5 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8) PORTSMOUTH NAVAL SHIPYARD

JULY 18-19, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
COPPER	JTP-01(10-12)	2,370.00	170.00	NA
	JTP-01(12-14)*	2,720.00	170.00	NA
	JTP-02(10-12)	286.00	170.00	NA
	JTP-02(12-14)**	282.00	170.00	NA
LEAD	JTP-01(10-12)	1,690.00	250.00 - 1,000.00	NA
	JTP-01(12-14)*	1,400.00	250.00 - 1,000.00	NA
	JTP-02(10-12)	6,160.00	250.00 - 1,000.00	NA
	JTP-02(12-14)**	1,010.00	250.00 - 1,000.00	NA
NICKEL	JTP-02(12-14)**	104.00	100.00	2,000.00
ZINC	JTP-01(10-12)	484.00J	350.00	NA
	JTP-01(12-14)*	752.00J	350.00	NA
	JTP-02(10-12)	411.00J	350.00	NA
	JTP-02(12-14)**	381.00J	350.00	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of JTP-01(10-12)
** = McLAREN/HART Duplicate Sample of JTP-02(10-12)

TABLE 2-6

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS–SOIL

JAMAICA ISLAND LANDFILL (SWMU #8) PORTSMOUTH NAVAL SHIPYARD

JULY 18-19, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
JTP-01(5-7)	0.3	8.4	20
JTP-01(10-12)	0.3	8.8	5
JTP-01(12-14)*	0.5	8.6	6
JTP-02(5-7)	2.1	9.1	30
JTP-02(10-12)	0.3	8.5	6
JTP-02(12-14)**	0.4	8.3	8

* =McLAREN/HART Duplicate Sample of JTP-01(10-12)
** =McLAREN/HART Duplicate Sample of JTP-02(10-12)

The particle size analysis results for JTP-02(5-7) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		1%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		38%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	1%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	11%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	26%	
Silt size, 0.074 to 0.005 mm:		30%
Clay, smaller than 0.005 mm:		14%
Colloids, smaller than 0.001 mm:		17%

Atterberg Limits Analysis

Atterberg limits are water contents where the soil behavior changes. A plastic limit (PL) is defined as the water content at which a thread of soil just crumbles when rolled out to a 1/8" diameter. A liquid limit (LL) is the water content at which a standard groove cut in a remolded soil sample will close over a distance of 1/2 inch at 25 blows of the test cup falling 10 millimeters and whose moisture content boundary exists between the plastic and semi-liquid states of a sample. When a soil has a LL of 100, the weight of moisture equals the weight of the dry soil. A LL of 50 means the soil at the LL is 2/3 soil and 1/3 water. The plasticity index (PI) is the difference between the liquid and plastic limits. The PI gives the range in moisture where a soil is in a plastic condition. A small PI indicates a small change in moisture will change the soil from semi-solid to liquid conditions. A PI greater than 20 indicates a considerable amount of water can be added before the soil becomes liquid.

An Atterberg limit analysis was performed on subsurface soil samples, JTP-01(5-7) and JTP-02(5-7). The Atterberg limit analysis results for JTP-01(5-7) is as follows:

Parameter	Sample Result (%)
Liquid Limit (LL)	36.6
Plastic Limit (PL)	20.1
Plasticity Index (PI)	16.5

The Atterberg limit analysis results for JTP-02(5-7) is as follows:

Parameter	Sample Result (%)
Liquid Limit (LL)	42.3
Plastic Limit (PL)	37.2
Plasticity Index (PI)	5.1

2.3.4 Interpretations/Discussion

Concentrations of TCL Volatiles and a review of chromatograms and listed TICs indicate the presence of a light petroleum product (i.e. gasoline) in soil samples JTP-02(10-12) and duplicate sample JTP-02(12-14). Chromatograms and listed TICs also indicate the presence of a heavier petroleum product in all subsurface soil samples. Phase I soil boring JSB-01, (located approximately 300 feet west of JTP-02), also showed detectable concentrations of ethylbenzene and total xylene in the subsurface soil from 10-12 feet and 15-17 feet below grade. Low concentrations of xylene were also detected from 0-2 feet and 20-22 feet below grade in soil boring JSB-01.

Similar petroleum components (toluene, ethylbenzene, and total xylene) detected in JSB-01 (Phase I), and JTP-02 (Phase IV) may suggest a localized contamination source of lighter petroleum product in the general vicinity. However, the source of petroleum contamination is unknown at this time, but sources may be related to past disposal practices (i.e. contaminated soil, drums, etc.), surficial spillage, proximity to USTs, possible dust suppression for dirt roads at the landfill, etc.

In any future sampling of subsurface soils within the interior of the JILF, a petroleum identification should be requested as part of the analyses to determine the type of petroleum present in subsurface soils.

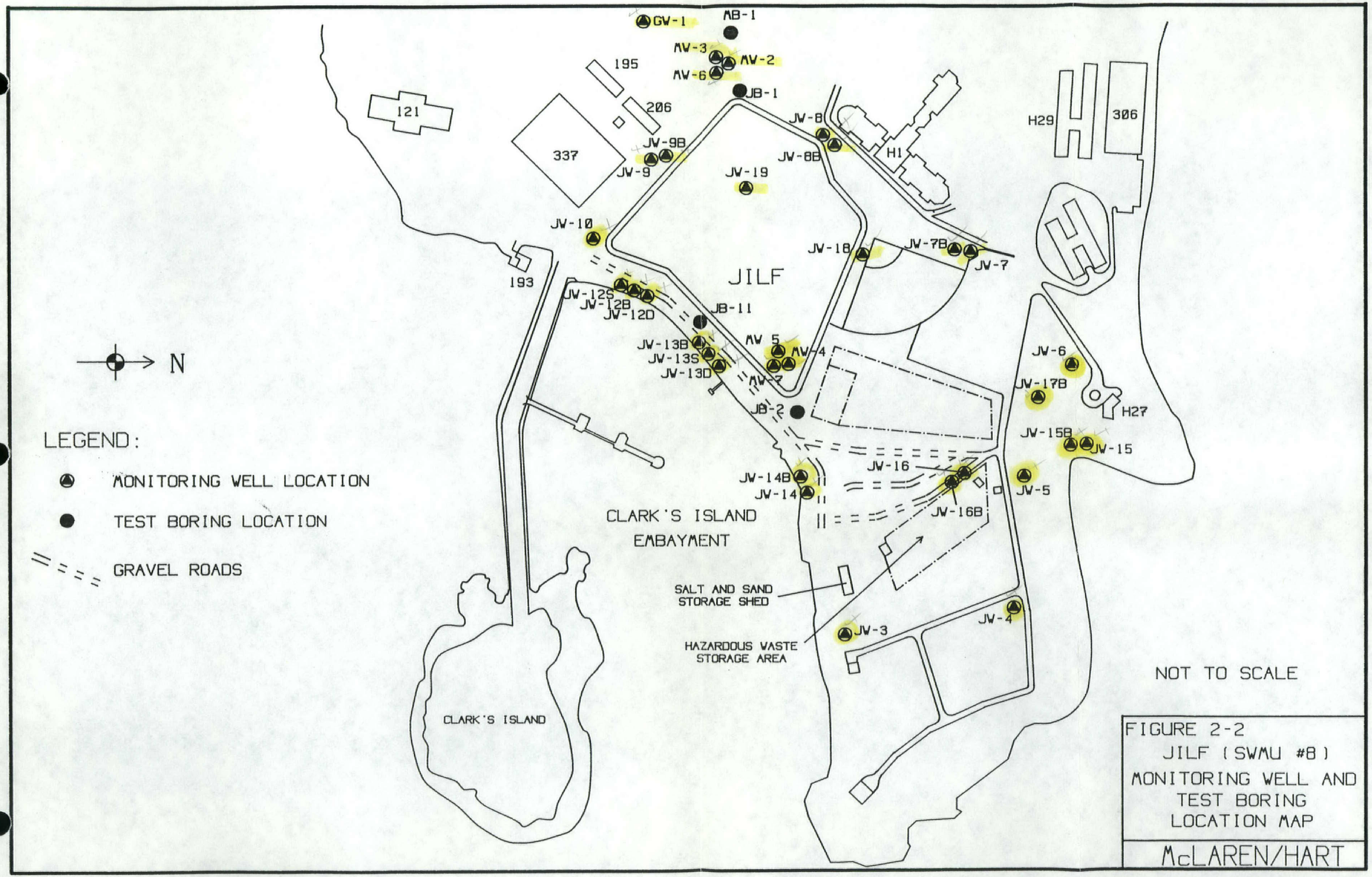
Metal concentrations exceeding New Jersey ECRA Guidance Values and proposed Federal Action Levels were detected in all subsurface soil samples from JTP-01 and JTP-02 excavations. Concentrations of beryllium, chromium, copper, and lead detected in JTP-01 soil samples and barium, chromium, and lead concentrations in JTP-02 soil samples were above the metal concentrations in background soil samples listed in Table 11-1. Sample JTP-02(10-12) also had an aluminum concentration of 59,000 mg/kg which is significantly higher than other soil samples. Elevated metals may be attributed to previous disposal practices within the JILF.

2.4 Drilling/Monitoring Well Installation

Drilling and monitoring well installation at the JILF was conducted from July 9, 1991 through July 30, 1991. The test boring/monitoring well installation program was designed to provide additional information regarding the type, variability, and total thickness of fill and indigenous unconsolidated materials in the vicinity of the JILF, and to better define groundwater quality at the landfill.

2.4.1 Procedures

Eight test borings were drilled and completed as monitoring wells. The monitoring wells are numbered as follows: JW-9B, JW-12B, JW-13B, JW-16, JW-16B, JW-17B, JW-18, and JW-19. Two additional test borings, each one placed at separate locations, were drilled next to preexisting monitoring wells JW-5 and JW-6 and grouted to ground surface upon completion. Test borings and monitoring wells from all phases of work are shown on Figure 2-2. Test borings were advanced using either the hollow-stem auger drilling


GW-1
MB-1
MW-3
MW-2
MW-6
JB-1
195
206
121
337
JW-9B
JW-9
JW-8
JW-8B
H1
H29
306
JW-19
JW-10
JW-18
JW-7B
JW-7
193
JILF
JW-12S
JW-12B
JW-12D
JB-11
JW-13B
JW-13S
JW-13D
MW 5
MW-4
MW-7
JB-2
JW-6
JW-17B
H27
JW-15B
JW-15
JW-16
JW-14B
JW-14
JW-16B
JW-5
CLARK'S ISLAND
EMBAYMENT
SALT AND SAND
STORAGE SHED
HAZARDOUS WASTE
STORAGE AREA
JW-3
JW-4
CLARK'S ISLAND
N
LEGEND:
MONITORING WELL LOCATION
TEST BORING LOCATION
GRAVEL ROADS
NOT TO SCALE
FIGURE 2-2
JILF (SWMU #8)
MONITORING WELL AND
TEST BORING
LOCATION MAP
McLAREN/HART

technique or the ODEX drilling method. CDS of North Chelmsford, Massachusetts performed all drilling under the supervision of McLaren/Hart's geologists. A truck-mounted Mobile Drill B-57, Gus Pech Brat 22, or CME 55 boring rig utilizing 4¼-inch ID, hollow-stem augers, and a truck-mounted Ingersoll-Rand TH-60 air-rotary rig, utilizing 6-inch ID casing were used for drilling. Cuttings produced by the drilling of test borings were contained in DOT approved 55 gallon drums, supplied by the Portsmouth Naval Shipyard (PNS). The drums were labeled and later taken to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results.

Five test borings were terminated in overburden and five test borings were terminated within bedrock. An HNU photoionization detector or Organic Vapor Analyzer (OVA), Geiger Counter, Dräger pump with chlorine gas tubes, and a PDM-3 Miniram Aerosol Monitor were used to constantly monitor each drilling location for organic vapors, radiation, chlorine gas, and airborne particulates, respectively, during drilling.

Prior to drilling the first boring, the drilling equipment was steam-cleaned to remove possible contaminants. All drilling equipment which was to come in contact with the soil, as well as water tanks, pumps, and hoses, underwent the initial cleaning procedure. The drilling equipment was decontaminated between borings to prevent cross-contamination.

Prior to sampling, the split-spoons were decontaminated according to the protocol listed in Table 2-1. Samples to be submitted to the laboratory were placed into labeled, laboratory-supplied sample bottles and stored on ice in field coolers for transport via courier to CEIMIC.

A standard, two-foot, steel split-spoon was used to obtain soil samples in advance of drilling. Samples were obtained continuously. As each split-spoon soil sample was opened, the samples were immediately scanned with an HNU photoionization detector or OVA, a Geiger counter, and a Dräger pump with chlorine gas tubes. Each sample was described in detail by a McLaren/Hart geologist. Detailed sample descriptions including blow counts, grain size, grain size distributions, and color are included in the test boring logs in Appendix I.

Fifteen soil samples, plus three duplicates, were submitted to CEIMIC for chemical analysis of TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. In addition, three soil samples were submitted for analysis of Atterberg limits and two samples were submitted for particle size analysis. Three equipment rinseate field blanks were submitted for chemical analysis of TCL Organics and TAL Inorganics. Poor sample recovery, which occurred when coarse material was encountered in the subsurface, limited the number of samples collected and submitted for laboratory analyses.

A monitoring well was installed at each soil boring with the exception of the borings adjacent to monitoring wells JW-5 and JW-6 as previously discussed. Three wells were installed in overburden (JW-16, JW-18 and JW-19); and five wells were installed within bedrock (JW-9B, JW-12B, JW-13B, JW-16B, and JW-17B).

Monitoring wells were installed within the 4¼-inch hollow-stem augers or 6-inch casing used to advance the soil boring. The installation of method used is summarized on the boring logs in Appendix I. The monitoring wells were constructed of two-inch diameter, threaded, flush-joint schedule 40 teflon riser pipe and 10-slot (0.010-inch) manufactured well screen. The screens were five feet in length except at JW-9B and JW-19 where the screens were ten feet in length. Following placement of the screen and riser pipe, clean silica sand

was added through the augers or casing in increments as the augers or casing was gradually withdrawn. This allowed placement of the sand pack around the screen without permitting the borehole to collapse around the screen. Sand pack was added to encase the entire screen and extend from 1.5 feet to 3.5 feet above the top of the screen. A 0.5 to 1.8 foot thick "sand choker collar", consisting of very fine sand, was subsequently installed above the sand pack. An exception occurred at JW-16 where space limitations precluded the use of a "sand choker collar". A bentonite pellet seal, 1.5 feet to 4.5 feet in length was installed above the "sand choker collar" and hydrated with fresh water, effectively sealing off the screened interval from the rest of the aquifer.

The remainder of each borehole was grouted with a cement or cement/bentonite slurry to land surface while the augers/casing were removed. A lockable protective steel casing was then cemented over each well to prevent unauthorized access and provide protection for the wells. The concrete collar around the protective casing was sloped away from the well to divert surface water run-off from the well. Monitoring well information is summarized in Table 2-7.

2.4.2 Findings

Information from the subsurface boring investigation shows the same overburden materials beneath the JILF as encountered during the Phase I and Phase III investigations. The overburden encountered in Phase IV is composed of fill material, alternating beach and tidal flat deposits, and tidal flat deposits, as indicated in the test boring logs (see Appendix I). Fill material was found to vary in composition depending on location. Alternating beach and tidal flat deposits were found to consist of brown to dark grey, fine to coarse grained sand and gravel alternating with grey silt and clay. These deposits were encountered in borings JSB-5 and JSB-6, adjacent to previously sampled borings. Tidal flat

TABLE 2-7

MONITORING WELL DETAILS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

WELL Nº	SCREEN SETTING (FT.)[1]	SAND PACK (FT.)[1]	SAND CHOKER COLLAR (FT.)[1]	BENTONITE SEAL (FT.)[1]
GW-1*	12-27	10-32	9-10	7-9
JW-9B	19-29	17-30.5	16-17	13-16
JW-12B	36-41	33-41	32-33	30-32
JW-13B	33-38	31-40	30-31	28-30
JW-16	6-11	2.5-11.2	NONE	1-2.5
JW-16B	14.7-19.7	12.4-20.5	11.9-12.4	9.9-11.9
JW-17B	21-26	19.4-26.5	18.5-19.4	14.5-18.5
JW-18	8-13	6.5-13	5.5-6.5	1-5.5
JW-19	12-22	9.8-23	9-9.8	5.3-9.0

[1] Below Grade
* Former Gas Station Monitoring Well

deposits consisted of organic-rich grey silt and clay. Tidal flat deposits were encountered in borings JSB-12B, JSB-13B, JSB-17B, JSB-18, and JSB-19.

Figure 2-3 shows the geologic cross-section profiles for the Phase IV investigation. All of the new monitoring wells are shown on this map and have been used to further define the cross-sections developed in the Phase I and Phase III investigations. The geologic cross-sections are shown in Figures 2-4 through 2-8.

2.4.3 Laboratory Analytical Results

A summary of valid soil sample results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have any published clean-up guidelines for contamination in soils, New Jersey Environmental Clean-up Responsibility Act (ECRA) Guidance Values and proposed Federal Action Levels documented in the Federal Register (55 FR 30865, July 27, 1990) are used for comparison purposes.

TCL Volatiles

There were no volatile concentrations above the proposed Federal Action Levels. Three soil samples [JSB-19(20-22), JSB-16(5-7), and JSB-16(7-9)] had total volatile concentrations (1.74 mg/kg, 2.25 mg/kg, and 21.75 mg/kg, respectively) which exceeded the New Jersey ECRA Guidance Value of 1 ppm for total volatiles in soil. In sample JSB-16(7-9) a freon TIC had an estimated concentration of 20 mg/kg.

TCL Semi-Volatiles

Detectable semi-volatile concentrations were found in all soil samples with the exception of sample JSB-06(14-16). There were no semi-volatile concentrations above the listed proposed Federal Action Levels. Two soil samples [JSB-16(5-7) and JSB-19(20-22)] had total base neutral concentrations of 15.26 mg/kg and 40.07 mg/kg, respectively. These

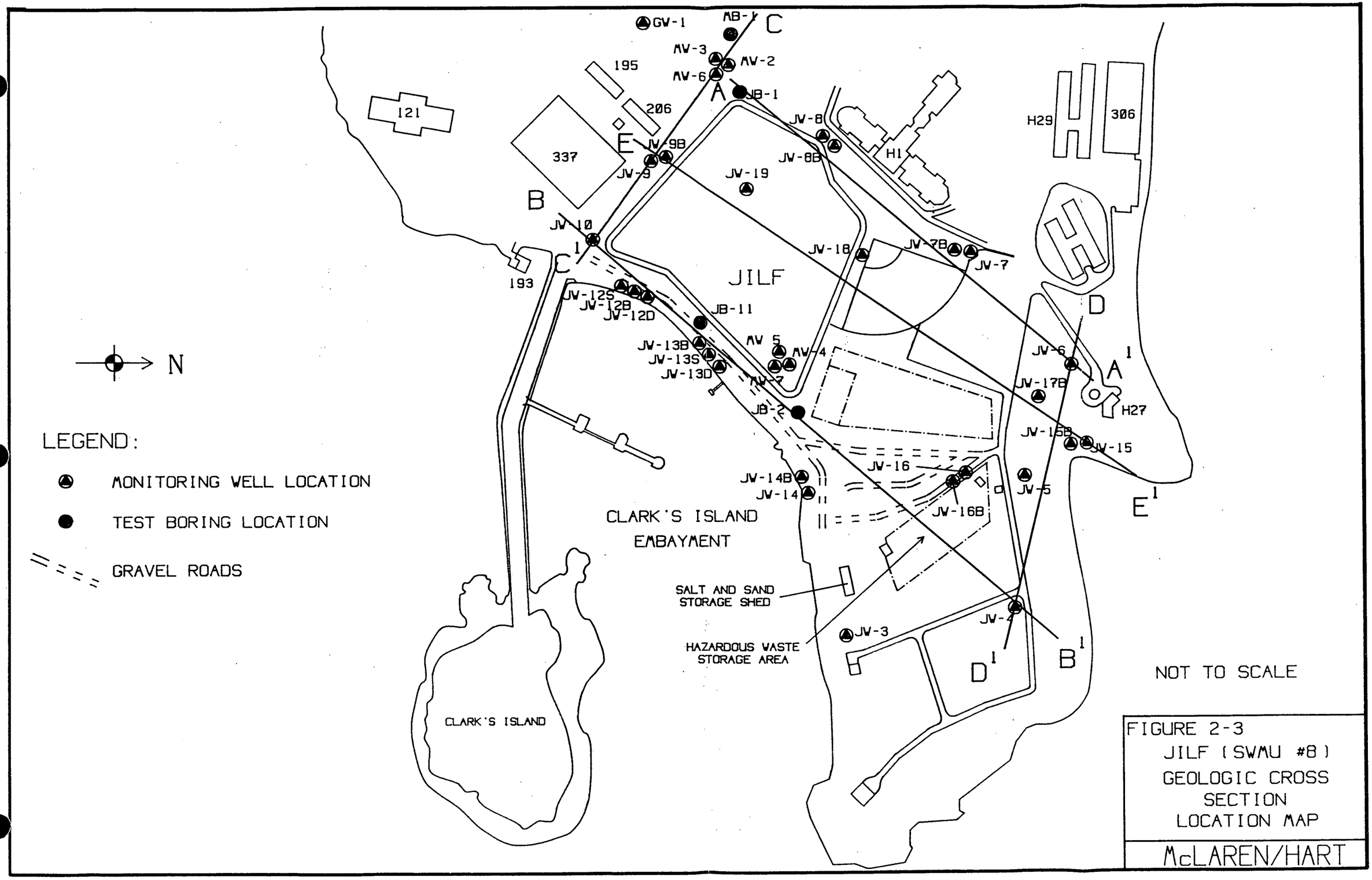
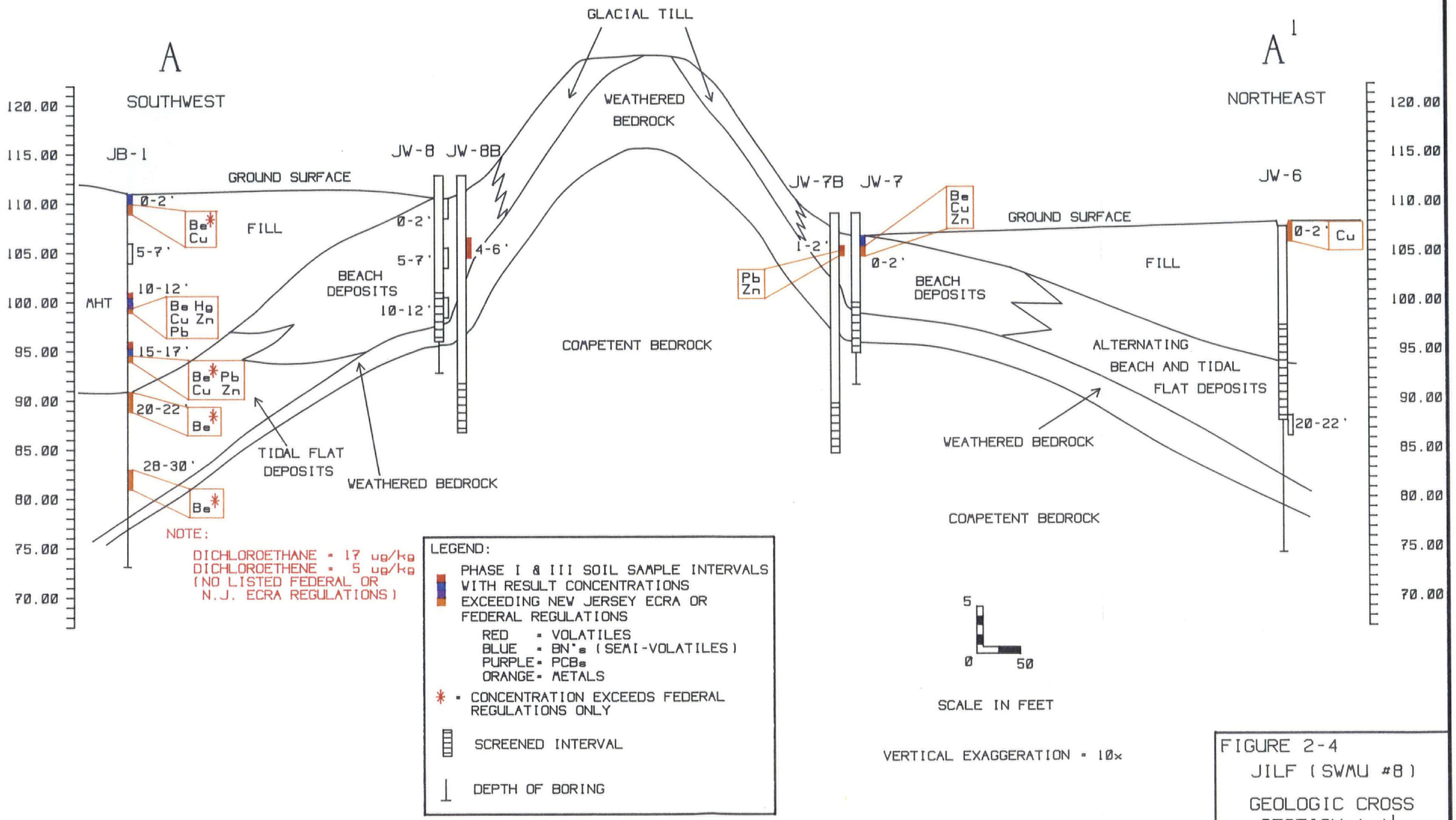


FIGURE 2-3
JILF (SWMU #8)
GEOLOGIC CROSS
SECTION
LOCATION MAP

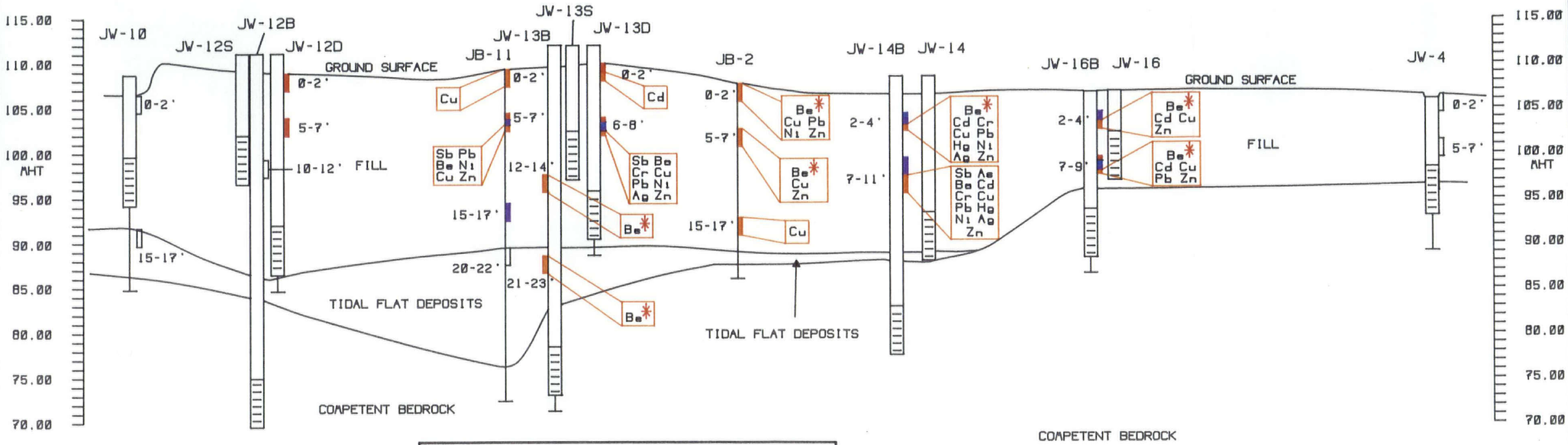
McLAREN/HART



NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' USGS SYSTEM

FIGURE 2-4
JILF (SWMU #8)
GEOLOGIC CROSS SECTION A-A'

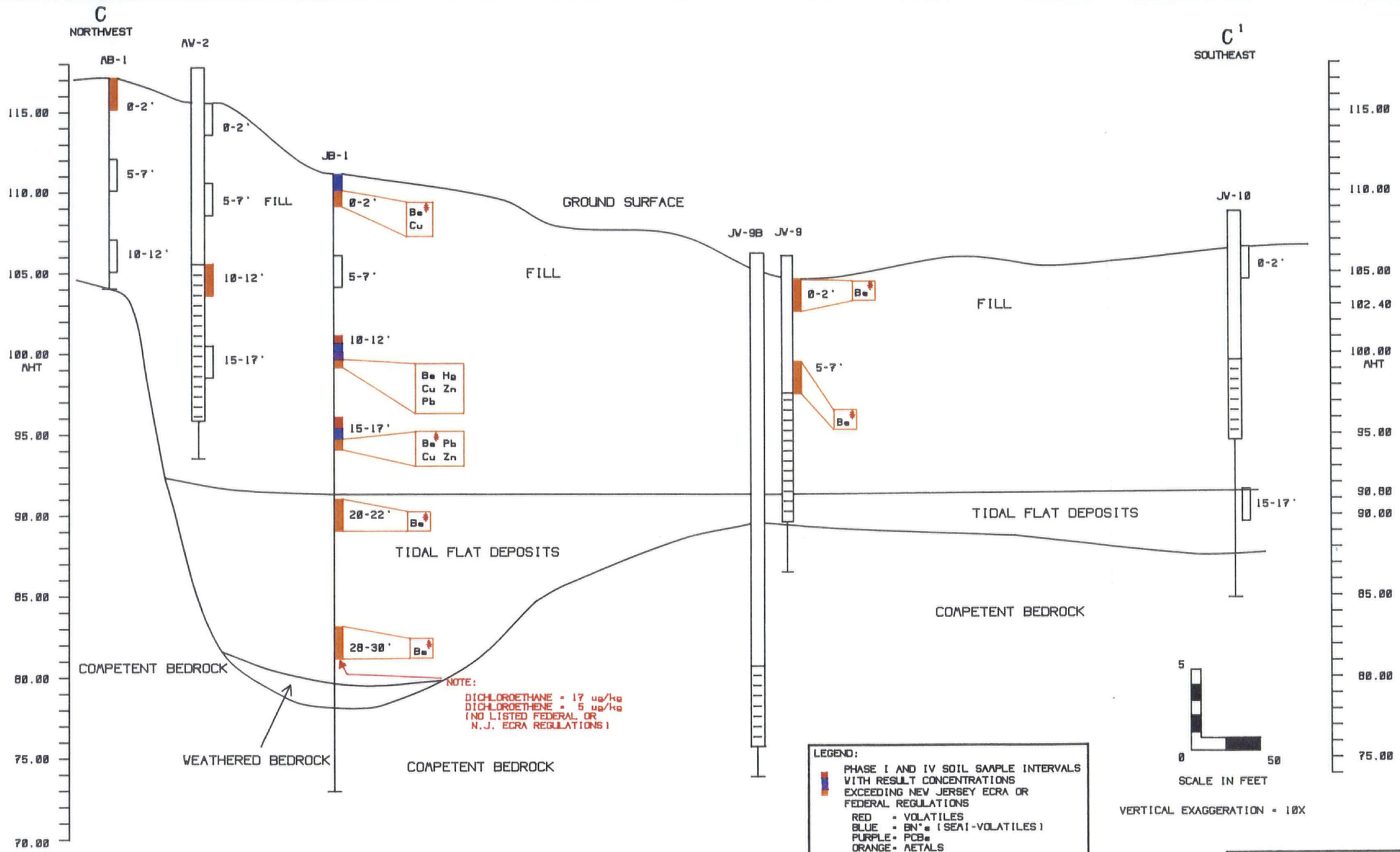
McLAREN/HART



NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' USGS SYSTEM

FIGURE 2-5
JILF (SWMU #8)
GEOLOGIC CROSS SECTION B-B'

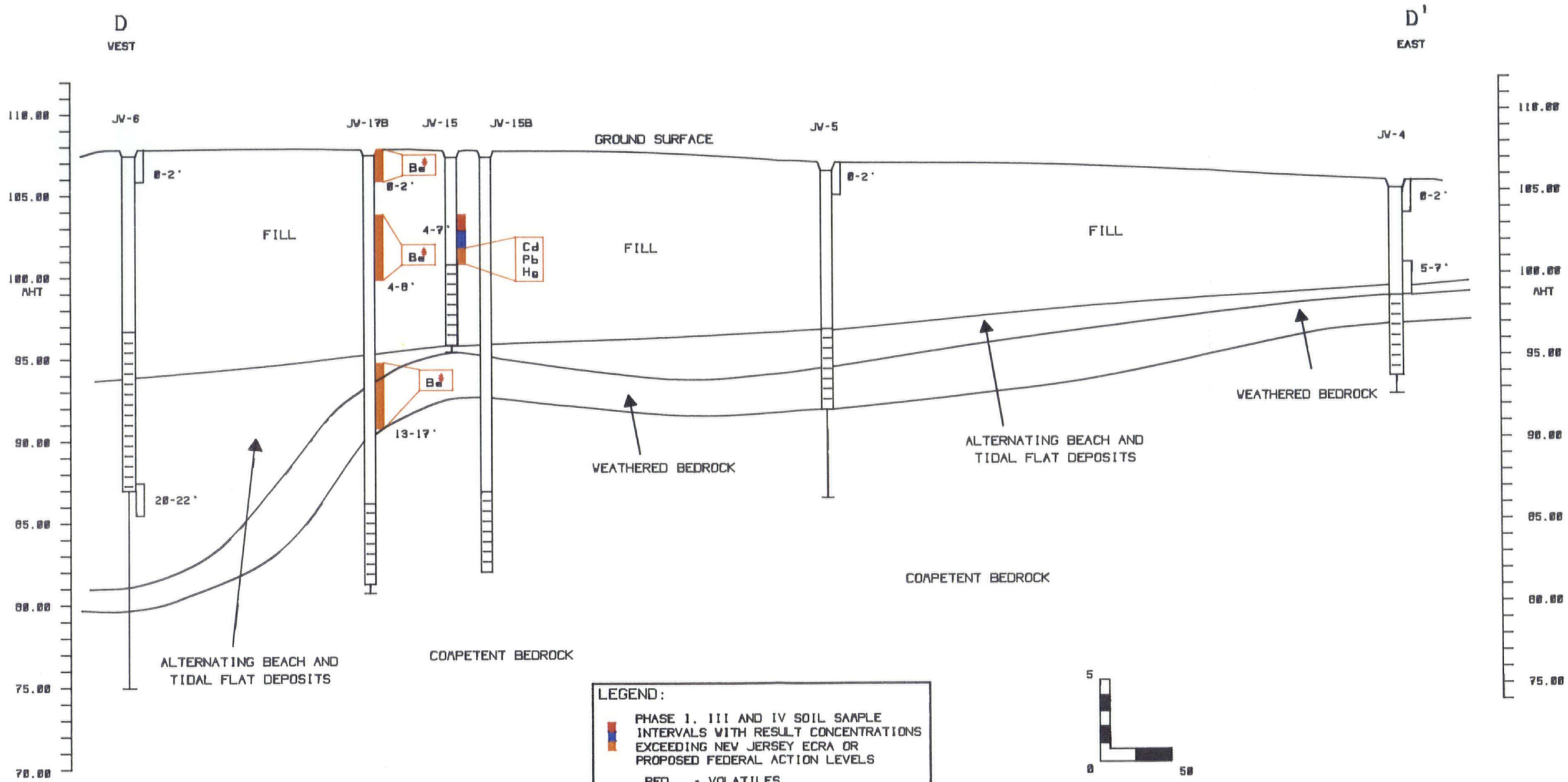
McLAREN/HART



NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' U.S.G.S. SYSTEM

FIGURE 2-6
JILF (SWMU #8)
GEOLOGIC CROSS SECTION C-C'

McLAREN/HART



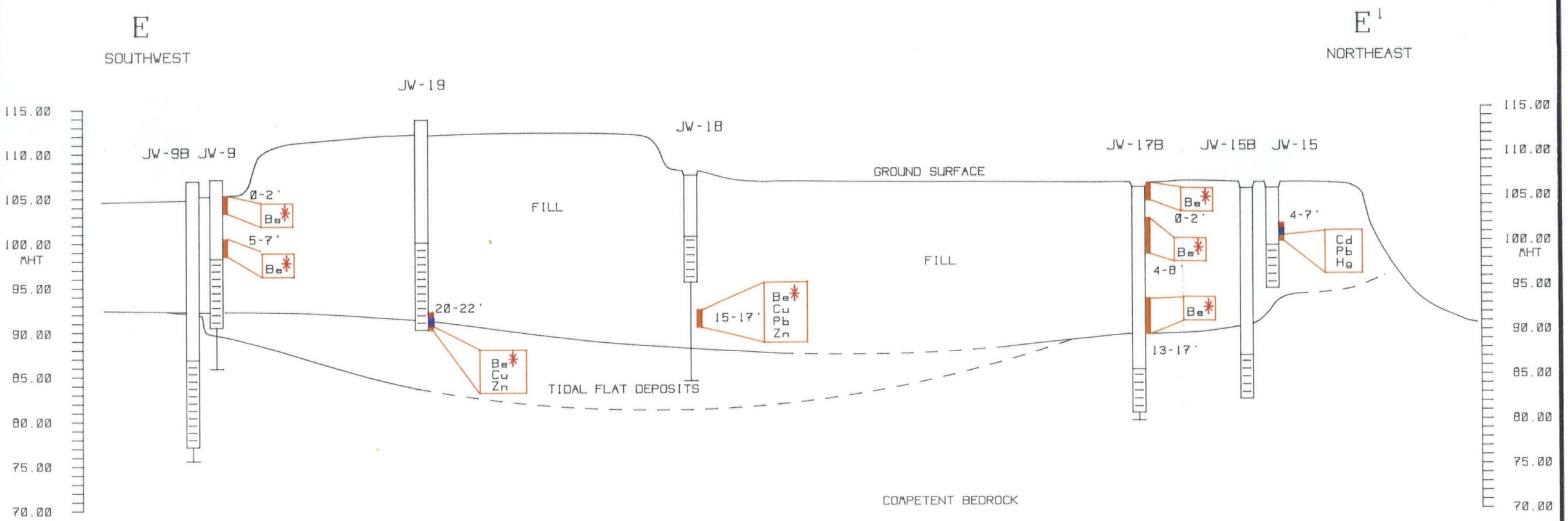
LEGEND:

- PHASE I, III AND IV SOIL SAMPLE INTERVALS WITH RESULT CONCENTRATIONS EXCEEDING NEW JERSEY ECRA OR PROPOSED FEDERAL ACTION LEVELS
  - RED = VOLATILES
  - BLUE = BN'S (SEMI-VOLATILES)
  - ORANGE = METALS
- * CONCENTRATION EXCEEDS PROPOSED FEDERAL ACTION LEVELS ONLY
- SCREENED INTERVAL
- DEPTH OF BORING

NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' U.S.G.S. SYSTEM

FIGURE 2-7
JILF (SWMU #8)
GEOLOGIC CROSS SECTION D-D'

McLAREN/HART



LEGEND:

- PHASE I, III AND IV SOIL SAMPLE INTERVALS WITH RESULT CONCENTRATIONS EXCEEDING NEW JERSEY ECRA OR PROPOSED FEDERAL ACTION LEVELS
  - RED = VOLATILES
  - BLUE = SEMI-VOLATILES
  - PURPLE = PCBs
  - ORANGE = METALS
- * CONCENTRATION EXCEEDS PROPOSED FEDERAL ACTION LEVELS ONLY
- SCREENED INTERVAL
- DEPTH OF BORING

5 0 50

SCALE IN FEET

VERTICAL EXAGGERATION = 10x

NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' USGS SYSTEM

FIGURE 2-8
JILF (SWMU #8)
GEOLOGIC CROSS SECTION E-E'

McLAREN/HART

concentrations exceed the New Jersey ECRA Guidance Value of 10 ppm for total base neutrals in soil. There were no samples exceeding the New Jersey ECRA Guidance Value for total acid extractables.

A review of the chromatograms and listed TICs indicate the presence of a petroleum product in the following samples: JSB-06(12-14), JSB-06(14-16), JSB-06(22-24), JSB-12(10-12), JSB-13B(12-14), JSB-13B(23-25), JSB-16(2-4), JSB-16(5-7), JSB-16(7-9), JSB-17B(0-2), JSB-17B(13-17), JSB-17B(17-19), JSB-17B(4-8), JSB-18(15-17), and JSB-19(20-22). Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum present cannot be made at this time.

TCL Pesticide/PCBs

Five of the fifteen soil samples, plus one duplicate, had detectable pesticide concentrations. There were no pesticide concentrations above proposed Federal Action Levels. Pesticides are not listed under New Jersey ECRA Guidance Values.

Three of the fifteen soil samples, plus one duplicate sample, had detectable PCB concentrations. These detectable concentrations exceed either proposed Federal Action Levels and/or New Jersey ECRA Guidance Values for total PCBs in soil and are summarized in Table 2-8.

TAL Inorganics

There were no detectable cyanide concentrations in any of the soil samples. Detectable metal concentrations were found in all soil samples. Table 2-9 summarizes soil samples which exceed New Jersey ECRA Guidance Values and/or proposed Federal Action Levels for metals in soil.

TABLE 2-8

SUMMARY OF PCB CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 9-30, 1991

McLAREN/HART SAMPLE I.D.	PCB CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
JSB-16(2-4)	0.85	1.0 TO 5.0	0.09
JSB-16(5-7)*	0.65	1.0 TO 5.0	0.09
JSB-16(7-9)	0.44	1.0 TO 5.0	0.09
JSB-19(20-22)	9.68	1.0 TO 5.0	0.09

* = McLAREN/HART Duplicate Sample of JSB-16(7-9)

TABLE 2-9

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 9-30, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
BERYLLIUM	JSB-05(8-10)	0.66Q	1.0	0.2
	JSB-06(4-9)	0.63Q	1.0	0.2
	JSB-06(12-14)	0.41Q	1.0	0.2
	JSB-06(14-16)	1.20	1.0	0.2
	JSB-06(22-24)	0.53Q	1.0	0.2
	JSB-13B(12-14)	1.30J	1.0	0.2
	JSB-13B(21-23)	0.31Q	1.0	0.2
	JSB-13B(23-25)*	0.53Q	1.0	0.2
	JSB-16(2-4)	0.49Q	1.0	0.2
	JSB-16(5-7)**	0.32Q	1.0	0.2
	JSB-16(7-9)	0.83Q	1.0	0.2
	JSB-17B(0-2)	0.60Q	1.0	0.2
	JSB-17B(4-8)	0.98Q	1.0	0.2
	JSB-17B(13-17)	1.20Q	1.0	0.2
	JSB-17B(17-19)***	1.10Q	1.0	0.2
	JSB-18(15-17)	1.80	1.0	0.2
	JSB-19(20-22)	0.96Q	1.0	0.2
CADMIUM	JSB-06(12-14)	6.60	3.0	40.0
	JSB-06(22-24)	9.00	3.0	40.0
	JSB-16(2-4)	4.00	3.0	40.0
	JSB-16(7-9)	5.20	3.0	40.0
	JSB-19(20-22)	4.80	3.0	40.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of JSB-13B(21-23)
** = McLAREN/HART Duplicate Sample of JSB-16(7-9)
*** = McLAREN/HART Duplicate Sample of JSB-17B(13-17)

TABLE 2-9 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 9-30, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
COPPER	JSB-06(12-14)	716.00J	170.0	NA
	JSB-06(22-24)	508.00J	170.0	NA
	JSB-16(2-4)	415.00	170.0	NA
	JSB-16(5-7)**	1,110.00	170.0	NA
	JSB-16(7-9)	550.00	170.0	NA
	JSB-18(15-17)	814.00	170.0	NA
	JSB-19(20-22)	762.00	170.0	NA
LEAD	JSB-16(5-7)**	454.00J	250-1,000	NA
	JSB-16(7-9)	449.00J	250-1,000	NA
	JSB-18(15-17)	523.00J	250-1,000	NA
ZINC	JSB-06(12-14)	1,110.00J	350.0	NA
	JSB-06(22-24)	1,120.00J	350.0	NA
	JSB-16(2-4)	677.00J	350.0	NA
	JSB-16(5-7)**	487.00J	350.0	NA
	JSB-16(7-9)	691.00J	350.0	NA
	JSB-18(15-17)	396.00	350.0	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of JSB-13B(21-23)
** = McLAREN/HART Duplicate Sample of JSB-16(7-9)
*** = McLAREN/HART Duplicate Sample of JSB-17B(13-17)

TOC, pH, Percent Moisture

Table 2-10 shows the results for TOC, pH, and percent moisture analyses. The TOC concentrations ranged from 0.2% to 7.7%, and pH ranged from 7.0 to 10.2. Percent moisture ranged from 7% to 29%.

Particle Size Analysis

A particle size analysis was conducted on soil samples JSB-13B(21-23) and JSB-17B(4-8). The particle size analysis for JSB-13B(21-23) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		6%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		31%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	0%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	2%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	29%	
Silt size, 0.074 to 0.005 mm:		46%
Clay, smaller than 0.005 mm:		7%
Colloids, smaller than 0.001 mm:		10%

The particle size analysis for JSB-17B(4-8) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		6%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		28%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	6%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	14%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	8%	
Silt size, 0.074 to 0.005 mm:		37%
Clay, smaller than 0.005 mm:		14%
Colloids, smaller than 0.001 mm:		15%

TABLE 2-10

SUMMARY OF TOC, pH, AND
PERCENT MOISTURE RESULTS–SOIL

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 9 - 30, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
JSB-05(8-10)	1.2	7.1	21
JSB-06(4-9)	2.6	7.4	10
JSB-06(12-14)	7.4	7.5	19
JSB-06(14-16)	0.3	7.3	23
JSB-06(22-24)	1.7	7.4	29
JSB-12(10-12)	2.3	9.9	13
JSB-13B(12-14)	0.4	10.2	12
JSB-13B(21-23)	1.5	8.2	17
JSB-13B(23-25)*	1.3	8.1	22
JSB-16(2-4)	1.1	8.0	15
JSB-16(5-7)**	2.8	7.9	18
JSB-16(7-9)	7.7	8.0	20
JSB-17B(0-2)	3.5	7.4	7
JSB-17B(4-8)	0.8	7.3	20
JSB-17B(13-17)	0.2	7.0	14
JSB-17B(17-19)***	0.2	7.3	7
JSB-18(15-17)	1.7	7.0	19
JSB-19(20-22)	0.3	7.0	25

* = McLAREN/HART Duplicate Sample of JSB-13B(21-23)
** = McLAREN/HART Duplicate Sample of JSB-16(7-9)
*** = McLAREN/HART Duplicate Sample of JSB-17B(13-17)

Atterberg Limits

Atterberg limits were conducted on soil samples JSB-13B(21-23), JSB-17B(4-8), and JSB-19(20-22). Atterberg limits results are shown in Table 2-11.

2.4.4 Interpretations/Discussion

Soil contaminant concentrations which exceed New Jersey's ECRA Guidance Values and/or proposed Federal Action Levels from Phase I, Phase III, and Phase IV soil sampling activities are illustrated in Figure 2-9. Geologic cross-sections A-A', B-B', C-C', D-D', and E-E', Figures 2-4 through 2-8, show the vertical profile of soil contamination.

Elevated volatile, semi-volatile, and PCB concentrations observed during the Phase IV sampling event were limited to soil samples collected at locations JSB-16 and JSB-19. Elevated concentrations are considered to be concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels. Elevated metal concentrations, not including qualitative results, were observed in soil samples collected at locations JSB-6, JSB-16, JSB-18, and JSB-19.

Analytical results from soil samples collected during Phase I and Phase III show elevated organic and inorganic concentrations at numerous locations. Volatile organic compounds, not including acetone, were present in elevated concentrations in soil samples collected from locations JSB-1, JSB-11, and JSB-13D. Semi-volatile concentrations were elevated in samples collected from locations JSB-1, JSB-7, JSB-13D, JSB-14B, and JSB-15D. PCB concentrations were elevated in samples collected from locations JSB-1, JSB-11, JSB-13D, and JSB-14B. Metal concentrations, not including qualitative results, were elevated in most samples, with beryllium occurring most often. Beryllium was also detected in elevated concentrations in native background soils (see Section 11.1.3). Although elevated concentrations for various parameters were observed at numerous locations, gross

TABLE 2-11

SUMMARY OF ATTERBERG LIMITS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 9-30, 1991

McLAREN/HART SAMPLE I.D.	LIQUID LIMIT(%)	PLASTIC LIMIT(%)	PLASTICITY INDEX(%)
JSB-13B(21-23)	44.9	32.8	12.0
JSB-17B(4-8)	32.0	27.2	4.8
JSB-19(20-22)	44.7	27.5	17.2

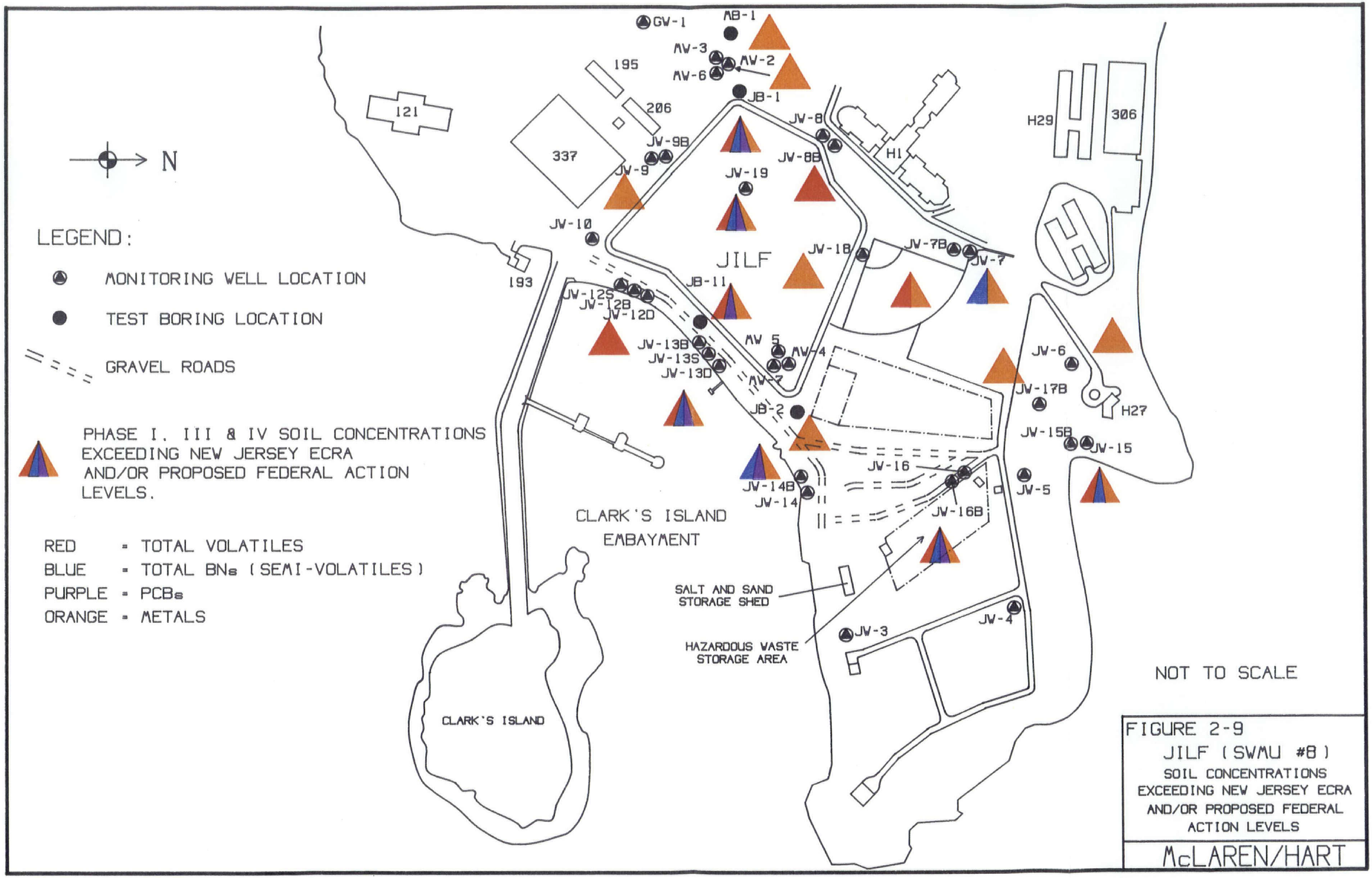


FIGURE 2-9
JILF (SWMU #8)
SOIL CONCENTRATIONS EXCEEDING NEW JERSEY ECRA AND/OR PROPOSED FEDERAL ACTION LEVELS

McLAREN/HART

concentrations were not indicated in the analytical results and a source(s) for the contamination could not be determined.

2.5 Monitoring Well Development

Groundwater monitoring wells installed during Phase IV at the JILF were developed from July 22, 1991 through August 9, 1991. Development began at least forty-eight (48) hours after the monitoring wells were installed and prior to groundwater sampling. Development serves to remove the finer grained material from the well screen and sand pack which may otherwise interfere with water quality analyses, improve the hydraulic connection between the well and the surrounding formation, and to restore the groundwater affected by drilling fluids and other materials introduced during well construction.

2.5.1 Development Procedures

All of the monitoring wells installed during Phase IV at the JILF were developed using the WaTerra inertial pump system. This pump system consists of two downhole components, a self-tapping delrin foot valve and a length of high density polyethylene (HDPE) tubing. Vertical movement of the tubing alternately seats and unseats the foot valve allowing water to accumulate within the tubing. The upward stroke seats the valve, trapping the water in the tubing, while the downward stroke unseats the valve and forces water into the tubing. The vertical motion of the valve and tubing creates sufficient energy to disturb the sand pack, thereby freeing the fines and allowing them to be drawn into the well then up through the tubing and out of the well. Continued development removes the finer grained material from the well and allows representative groundwater, free of drilling fluids and other materials introduced during well construction, to enter the well.

Each well was developed with a dedicated foot valve and length of tubing. Dedicating the development materials eliminated decontamination procedures and the potential for cross contamination between wells. Development was initiated at each well by attaching the tubing to a power pump or by hand pumping. The foot valve was positioned approximately one foot from the bottom of the well. The WaTerra power pump and/or hand pumping systems were used to actuate the tubing, resulting in the development of the wells.

Field parameters including pH, temperature, specific conductance, turbidity, and salinity were measured in the discharge water from each well. No field parameters were obtained from monitoring well JW-16 because of product observed within the groundwater that could contaminate the field parameter equipment. The field parameter measurements were taken at regular intervals for the high yielding wells (after every five gallons of discharge) until development was complete. Measurements for low yielding wells occurred at less regular intervals and development was conducted over several days until the development was complete. The development water from all of the monitoring wells was contained on-site in DOT-approved, 55-gallon drums for later analysis to ensure proper disposal.

Monitoring well development was conducted until all the measured field parameters stabilized. The last parameter to stabilize during development was turbidity. Development was considered complete when three consecutive turbidity measurements were below five nephelometric turbidity units (NTUs) or when three consecutive turbidity measurements were within five percent or less variation.

2.5.2 Development Findings

Table 2-12 contains a summary of the stabilized field parameters for each of the wells and the dates over which each well was developed. Monitoring wells JW-12B, JW-13B, JW-17B, JW-18, and JW-19 recharged quickly and were successfully developed in one or two days. The slower recharging wells, JW-9B, JW-16, and JW-16B were developed over several days.

The salinity and conductivity measurements give an indication of the salt content of the water. The following terms and definitions (Ingmanson and Wallace, 1973) will be used throughout this document to describe the groundwater based on the salinity measurement:

Fresh Water:	Water in which salinity values are below 0.50 parts per thousand (°/∞).
Brackish Water:	Water in which salinity values range from 0.50 to 17.00°/∞.
Seawater:	Water in which salinity values exceed 17.00°/∞. (Note that average salinity in seawater is about 35°/∞ indicating the groundwater on-site that meets this criteria is actually some dilution of seawater).

Based on the salinity and conductivity measurements given in Table 2-12, monitoring well JW-9B contains fresh water and JW-12B, JW-13B, JW-16B, JW-17B, JW-18, and JW-19 contain brackish water.

An HF Scientific, Inc. DRT-15C portable turbidimeter was used to measure relative amounts of suspended solids in the groundwater during development. The turbidimeter projects a light source through the sample and measures the intensity of light rays scattered from particles in suspension. Standard units of measurement are Nephelometric Turbidity Units (NTUs).

TABLE 2-12

STABILIZED FIELD PARAMETERS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

JULY 22–AUGUST 9, 1991

Well N°	Development Date(s)	Total Volume Removed (Gals)	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTUs)	Salinity (°/∞)
JW-9B	7/23-8/9/91	125	7.60	13.5	1,150	3.37	0.2
JW-12B	7/22-7/23/91	180	7.77	10.0	20,500	38.2	16.8
JW-13B	7/23-8/8/91	285	7.54	10.7	16,100	52.3	12.1
JW-16	7/30-8/8/91	150	NA	NA	NA	NA	NA
JW-16B	7/29-8/8/91	121	8.11	15.9	1,390	45.9	1.0
JW-17B	8/5/91	40	7.29	13.0	18,000	29.7	14.2
JW-18	8/5-8/7/91	82.5	7.94	15.4	3,200	7.61	1.9
JW-19	7/29-8/1/91	185	7.23	12.8	2,150	125.2	1.2

NA = Not Available

The turbidity measurement at monitoring well JW-9B stabilized below five NTUs. Turbidity measurements for wells JW-12B, JW-13B, JW-16B, JW-17B, JW-18, and JW-19, did not decrease below five NTUs. Development of these six wells was considered complete after obtaining three consecutive turbidity measurements with five (5) percent or less variation.

2.6 Groundwater Sampling

From August 12 to August 15, 1991, groundwater samples were collected from all twenty-six monitoring wells installed within and around the perimeter of the JILF (Figure 2-2).

One replicate sample labeled JW-16I-04 and two equipment rinseate field blanks (JRB-17-04 and JRB-18-04) were included in this groundwater sampling. Historical information regarding the types of waste disposed of at the JILF suggests the potential for organic and inorganic contaminants to be present in the landfill. The objectives of groundwater sampling at the JILF are summarized as follows:

1) To evaluate the quality of overburden and bedrock groundwater beneath the JILF;

2) To assess whether organic compounds and/or inorganic constituents related to past or current conditions at the JILF have migrated to groundwater;

3) To assess whether any organic compounds and/or inorganic constituents in groundwater samples obtained from the monitoring wells are present in concentrations that exceed applicable groundwater standards; and

4) To provide valid, properly obtained groundwater sampling data for all monitoring wells.

2.6.1 Sampling Procedures

Prior to sampling a monitoring well, a calculated volume of water must be removed to purge the standing column of water in the well or the well must be evacuated and allowed to recover to ensure that formational water is being sampled. EPA guidelines for monitoring well purging stipulate that at least three times the computed well volume is acceptable for assuring that the sample contains groundwater representative of the formation. Also, evacuation of a well to dryness is an acceptable procedure to ensure that the sample contains representative groundwater (EPA 1986). Groundwater samples collected from monitoring wells purged by evacuation to dryness may not be completely representative of formational groundwater if the turbidity is high.

All monitoring wells were first checked for immiscible product phases prior to purging using a precleaned, bottom-filling clear plexiglass bailer with a teflon check valve.

A monitoring well was purged by first obtaining the static water level in the monitoring well and subtracting this level from the total depth of the well. The result is the height of the standing column of water in the monitoring well. The column height is multiplied by a volume-per-foot factor (proportional to well diameter) to obtain the volume of water in the well. All of the monitoring wells at the JILF were purged by removing a minimum of three times the calculated well volume. Monitoring well casing and groundwater elevation information obtained during sampling are summarized in Table 2-13.

All monitoring well purging at the JILF was accomplished using dedicated, pre-cleaned, bottom-filling stainless-steel or teflon bailers with teflon check valves. Exceptions were made at monitoring wells JW-16 and JW-19 where purging and subsequent sampling was accomplished using new lengths of HDPE tubing and new foot valves. HDPE tubing was used in monitoring well JW-16, because of product within the groundwater that would

TABLE 2-13

MONITORING WELL CASING AND GROUNDWATER ELEVATION INFORMATION

JAMAICA ISLAND LANDFILL (SWMU #8) PORTSMOUTH NAVAL SHIPYARD

AUGUST 12-15, 1991

Well N°	Depth to Groundwater From TC (ft.)	Total Depth of Well From TC (ft.)	TC Elevation (ft. MHT)	Groundwater Elevation (ft. MHT)	Bottom of Screen Elevation (ft. MHT)	Well Volume (Gallons)
JW-03	6.73	19.03	110.43	103.70	91.40	2.00
JW-04	3.78	11.83	105.80	102.02	93.97	1.31
JW-05	6.95	14.80	106.74	99.79	91.94	1.28
JW-06	7.12	20.09	107.78	100.66	87.69	2.11
JW-07	6.48	13.67	108.53	102.05	94.86	1.17
JW-07B	6.49	28.09	108.87	102.38	80.78	3.52
JW-08	11.79	16.04	112.73	100.94	96.69	0.69
JW-08B	13.35	28.21	114.00	100.65	85.79	2.42
JW-09	6.51	16.68	106.42	99.91	89.74	1.66
JW-09B	8.96	29.25	106.88	97.92	77.63	3.31
JW-10	11.02	14.38	108.40	97.38	94.02	0.55
JW-12S	7.49	14.99	108.67	101.18	93.68	1.22
JW-12D	7.18	24.87	108.24	101.06	83.37	2.88
JW-12B	6.81	43.09	108.42	101.61	65.33	5.91
JW-13S	9.95	14.86	111.38	101.43	96.52	0.80
JW-13D	16.81	22.26	110.79	93.98	88.53	0.90
JW-13B	13.12	38.87	110.24	97.12	71.37	4.20
JW-14	9.46	16.35	111.13	101.67	94.78	1.12
JW-14B	10.80	27.87	111.00	100.20	83.13	2.78
JW-15	5.90	12.03	107.42	101.52	95.39	1.00
JW-15B	5.50	24.25	107.29	101.79	83.04	3.06
JW-16	4.37	11.06	106.38	102.01	95.32	2.52
JW-16B	4.09	19.57	106.40	102.31	86.83	1.09
JW-17B	6.68	25.55	107.47	100.79	81.92	3.08
JW-18	8.95	12.20	108.29	99.34	96.04	0.53
JW-19	14.11	26.62	114.14	100.03	87.52	2.04

MHT = Mean High Tide (Based on Elevation 100.00', Portsmouth Naval Shipyard System is Equal to 3.804' USGS System)
TC = Top of Casing

make decontaminating a bailer difficult. HDPE tubing was used in JW-19 due to an obstruction within the teflon casing which would not permit the passage of a bailer.

All purge water evacuated was contained in DOT-approved 55-gallon drums, supplied by the PNS. The drums were labeled and later taken to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results to ensure proper disposal.

All wells were sampled immediately following purging. Groundwater samples were collected using the same precleaned, stainless-steel or teflon bailers used for purging (except at JW-16 and JW-19 as previously discussed) and attached to a clean nylon cord. Bailers were decontaminated prior to use according to the protocol listed in Table 2-1. All samples were collected in a manner to minimize agitation and other disturbing conditions which might cause physiochemical changes in the sample which may bring about losses due to volatilization, adsorption, reduction/oxidation reactions or degradation. All groundwater samples from the JILF monitoring wells were analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals). Groundwater from each well was field analyzed for pH, temperature, specific conductivity, turbidity, and salinity prior to sample collection. No field parameters were obtained in groundwater from monitoring well JW-16 due to product observed within the groundwater that could potentially contaminate the field sampling equipment. All of the field parameter measurements (Appendix II) were recorded in field notebooks. A summary of groundwater sampling and field parameter information is contained in Table 2-14.

TABLE 2-14

GROUNDWATER SAMPLING AND FIELD PARAMETER INFORMATION

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 12-15, 1991

Well N°	Sampling Date	Total Volume Removed (Gals)	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTUs)	Salinity (°/∞)
JW-03	8/13/91	6.0	6.58	16.2	290	20.7	0.0
JW-04	8/15/91	4.0	7.10	19.0	350	>200	0.0
JW-05	8/15/91	4.0	7.09	15.5	5,100	>200	3.5
JW-06	8/15/91	7.0	7.48	16.0	550	97.6	0.0
JW-07	8/14/91	3.5	7.35	19.8	1,300	>200	0.6
JW-07B	8/14/91	3.5	6.85	15.5	1,550	52.0	0.8
JW-08	8/14/91	2.5	7.40	22.5	400	>200	0.0
JW-08B	8/14/91	7.5	9.22	15.5	500	>200	0.0
JW-09	8/14/91	5.0	7.16	17.0	32,000	164.8	25.9
JW-09B	8/14/91	4.5	7.82	14.0	1,225	167.6	0.5
JW-10	8/15/91	2.0	6.88	18.0	35,200	>200	26.1
JW-12S	8/12/91	4.0	7.65	18.5	36,200	63.5	28.0
JW-12D	8/12/91	10.0	7.95	16.1	36,000	>200	27.9
JW-12B	8/12/91	20.0	7.60	14.0	18,000	>200	13.9
JW-13S	8/15/91	3.0	7.52	18.0	35,100	78.4	27.5
JW-13D	8/14/91	3.0	6.94	19.0	37,000	48.3	27.0
JW-13B	8/14/91	13.0	7.33	15.5	17,000	>200	11.7
JW-14	8/14/91	4.0	8.03	17.8	6,300	>200	4.2
JW-14B	8/14/91	9.0	8.01	17.5	3,800	15.6	2.1
JW-15	8/13/91	3.0	7.25	19.0	39,500	76.8	31.0
JW-15B	8/13/91	10.0	7.67	16.0	36,000	43.7	28.0
JW-16	8/15/91	4.0	NA	NA	NA	NA	NA
JW-16B	8/15/91	8.0	8.33	16.0	1,310	>200	0.4
JW-17B	8/15/91	10.0	7.42	13.8	19,200	94.1	15.0
JW-18	8/12/91	2.0	8.08	16.1	4,100	>200	2.5
JW-19	8/13/91	7.0	7.20	15.0	2,150	>200	1.0

NA = Not Available

Samples collected for dissolved metal analyses were field filtered through 0.45 micron cellulose prior to collection in pre-preserved, laboratory-supplied bottles. Preservatives provided in the laboratory-supplied bottles, and their associated analyses were as follows:

Metals (both dissolved and total) - Nitric Acid
Cyanide - Sodium Hydroxide
Volatiles - Hydrochloric Acid

Upon collection, samples were placed in coolers which were kept chilled using ice. Groundwater sample coolers were delivered via courier to CEIMIC.

2.6.2 Findings (Groundwater Conditions)

Prior to sampling, turbidity readings in several wells exceeded the maximum reading of the turbidity meter (i.e. greater than 200 NTUs). The lower turbidity readings reached during development suggest that suspended particulates in the groundwater are forming a mud cake on the sand pack during development and are subsequently being resuspended in the water after development ceases. This process may be assisted by the tidal action observed in some wells.

Salinity and specific conductivity readings obtained during sampling of the wells indicate fresh, brackish, and saline water conditions. Table 2-15 summarizes the groundwater conditions during Phase II, III, and IV sampling events.

No apparent immiscible phases were observed in any of the monitoring wells.

2.6.3 Laboratory Analytical Results

Groundwater samples were collected from all twenty-six monitoring wells within and around the perimeter of the JILF. In addition, one replicate sample (JW-16I-04) collected from monitoring well JW-16 and two equipment rinseate field blanks (JRB-17-04 and JRB-18-04) were included in the groundwater sampling program. The sample numbers are followed by "-04"to denote the fourth phase of work. A summary of valid groundwater

TABLE 2-15

SUMMARY OF GROUNDWATER CONDITIONS DURING PHASE II, III, AND IV SAMPLING EVENTS

JAMAICA ISLAND LANDFILL (SWMU #8) PORTSMOUTH NAVAL SHIPYARD

WELL Nº	PHASE II 8/23/90 SALINITY(°/∞)	PHASE III 1/23 - 2/4/91 SALINITY(°/∞)	PHASE IV 8/12 - 8/15/91 SALINITY(°/∞)	GROUNDWATER CONDITION
JW-03	0.0	0.0	0.0	F
JW-04	0.0	0.0	0.0	F
JW-05	4.5	3.1	3.5	B
JW-06	0.0	0.0	0.0	F
JW-07	0.2	0.1	0.6	F-B
JW-07B	NA	0.3	0.8	F-B
JW-08	0.2	0.2	0.0	F
JW-08B	NA	0.0	0.0	F
JW-09	18.5	12.2	25.9	S-B-S
JW-09B	NA	NA	0.5	F-B
JW-10	25.0	20.0	26.1	S
JW-12S	NA	23.0	28.0	S
JW-12D	NA	26.5	27.9	S
JW-12B	NA	NA	13.9	B
JW-13S	NA	*19.1/21.5	27.5	S
JW-13D	NA	24.2	27.0	S
JW-13B	NA	NA	11.7	B
JW-14	NA	0.8	4.2	B
JW-14B	NA	1.5	2.1	B
JW-15	NA	23.9	31.0	S
JW-15B	NA	24.5	28.0	S
JW-16	NA	NA	NA	NA
JW-16B	NA	NA	0.4	F
JW-17B	NA	NA	15.0	B
JW-18	NA	NA	2.5	B
JW-19	NA	NA	1.0	B

NA =Not Available
F =Fresh Water
B =Brackish Water
S =Saline Water
* =JW-13S Was Sampled Over a Two Day Period (Phase III) Because Well Went Dry on the First Day

results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in groundwater, NPDWR and proposed Federal Action Levels are used to evaluate the analytical data.

TCL Volatiles

Detectable volatile concentrations were found in ten of the twenty-six groundwater samples, plus one replicate. Detectable volatile concentrations that exceed NPDWR and/or proposed Federal Action Levels are summarized in Table 2-16. Qualitative concentrations that may exceed NPDWR and/or proposed Federal Action Levels are also shown in Table 2-16.

TCL Semi-Volatiles

Detectable semi-volatile concentrations were found in seventeen of the twenty-six groundwater samples, plus one replicate. Qualitative concentrations of bis(2-Ethylhexyl)phthalate are the only detectable semi-volatiles that may exceed the proposed Federal Action Level of 3.0 ug/L as shown in Table 2-16. Semi-volatiles are not listed as a contaminant under NPDWR.

A review of the chromatograms and the listed TICs indicate the presence of a petroleum product in the following samples: JW-03-04, JW-07B-04, JW-12S-04, JW-13B-04, JW-13D-04, JW-14-04, JW-14B-04, JW-15-04, JW-15B-04, JW-16-04, JW-16I-04, (duplicate of JW-16-04), JW-18-04, and JW-19-04. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum product present cannot be made at this time.

TABLE 2-16

SUMMARY OF ORGANIC CONCENTRATIONS–GROUNDWATER EXCEEDING NATIONAL PRIMARY DRINKING WATER REGULATIONS AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8) PORTSMOUTH NAVAL SHIPYARD

AUGUST 12-15, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVEL (ug/L)
VOLATILES				
BENZENE	JW-16-04	10.0	5.0	5.0
	JW-16I-04*	11.0	5.0	5.0
BROMODICHLOROMETHANE	JW-10-04	2.0Q	NA	5.0
1,2-DICHLOROETHENE	JW-13B-04	73.0	70.0	NA
TRICHLOROETHENE	JW-13B-04	7.0	5.0	5.0
VINYL CHLORIDE	JW-13B-04	4.0Q	2.0	2.0
SEMI-VOLATILES				
BIS(2-ETHYLHEXYL) PHTHALATE	JW-04-04	4.0Q	NA	3.0
	JW-09B-04	4.0Q	NA	3.0
	JW-13B-04	4.0Q	NA	3.0
	JW-16-04	5.0Q	NA	3.0
	JW-16I-04*	7.0Q	NA	3.0
PESTICIDES				
HEPTACHLOR	JW-19-04	0.098	0.400	0.008
4,4'-DDT	JW-19-04	0.120	NA	0.10

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Replicate Sample of JW-16-04

TCL Pesticide/PCBs

Detectable pesticide concentrations were found in eight of the twenty-six groundwater samples. Only sample JW-19-04 had a heptachlor and 4,4'-DDT concentration that exceeded the proposed Federal Action Levels as shown in Table 2-16. The pesticide 4,4'-DDT is not listed as a contaminant under NPDWR.

Rinseate blank JRB-18-04 was contaminated with a detectable pesticide concentration of Endosulfan I. However, associated samples were below five times the rinseate blank level and were evaluated as undetected. There were no detectable PCB concentrations found in any groundwater samples.

TAL Inorganics

Detectable total (unfiltered) and dissolved (filtered) metal concentrations were found in all groundwater samples. Table 2-17 shows the detectable metal concentrations exceeding NPDWR and/or proposed Federal Action Levels. Qualitative metal concentrations that may exceed the NPDWR and/or proposed Federal Action Levels are also summarized in Table 2-17.

2.6.4 Interpretations/Discussion

Volatile concentrations exceeding NPDWR and/or proposed Federal Action Levels were present in Phase IV installed monitoring wells JW-13B and JW-16. Chlorinated solvents 1,2-Dichloroethene (DCE), trichloroethene (TCE), and vinylchloride were detected in bedrock well JW-13B. Lower concentrations of DCE and TCE were detected in the shallow overburden well (JW-13S) of the well cluster in both Phase III and Phase IV. The deep overburden well (JW-13D), which is screened on top of tidal flat deposits, did not have detectable volatile concentrations in either Phase III or Phase IV. Since chlorinated solvents were detected in both shallow overburden and bedrock wells, but not the deep overburden

TABLE 2-17

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER EXCEEDING NATIONAL PRIMARY DRINKING WATER REGULATIONS AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8) PORTSMOUTH NAVAL SHIPYARD

AUGUST 12-15, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
ANTIMONY	JW-05F-04	32.0Q	NA	10.0
	JW-06F-04	32.0Q	NA	10.0
	JW-10F-04	32.0Q	NA	10.0
	JW-12S-04	32.0Q	NA	10.0
	JW-15BF-04	38.0Q	NA	10.0
	JW-17BF-04	39.0Q	NA	10.0
ARSENIC	JW-05-04	76.70	50.0	50.0
	JW-08B-04	93.90J	50.0	50.0
	JW-12D-04	248.00J	50.0	50.0
	JW-12B-04	60.40J	50.0	50.0
	JW-13B-04	375.00J	50.0	50.0
BARIUM	JW-08B-04	1,640.00	1,000.0	1,000.0
BERYLLIUM	JW-05-04	4.40Q	NA	.008
	JW-06-04	1.30Q	NA	.008
	JW-07-04	1.20Q	NA	.008
	JW-08-04	1.20Q	NA	.008
	JW-08B-04	1.40Q	NA	.008
	JW-10-04	2.50Q	NA	.008
	JW-12D-04	13.10	NA	.008
	JW-12B-04	5.70	NA	.008
	JW-13B-04	10.80J	NA	.008

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of JW-16-04
NA = Not Available

TABLE 2-17 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER EXCEEDING NATIONAL PRIMARY DRINKING WATER REGULATIONS AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8) PORTSMOUTH NAVAL SHIPYARD

AUGUST 12-15, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
BERYLLIUM(cont.d)	JW-14-04	1.30Q	NA	.008
	JW-18-04	1.20Q	NA	.008
	JW-19-04	3.70Q	NA	.008
CADMIUM	JW-08B-04	9.0	5.0	10.0
	JW-12D-04	62.0	5.0	10.0
	JW-12B-04	23.00	5.0	10.0
	JW-13B-04	14.00	5.0	10.0
	JW-19-04	28.0	5.0	10.0
CHROMIUM	JW-04-04	250.00	50.0	50.0
	JW-05-04	317.00	50.0	50.0
	JW-06-04	75.00	50.0	50.0
	JW-07-04	145.00	50.0	50.0
	JW-08-04	114.00	50.0	50.0
	JW-08B-04	885.00	50.0	50.0
	JW-10-04	141.00	50.0	50.0
	JW-12D-04	847.00J	50.0	50.0
	JW-12B-04	384.00J	50.0	50.0
	JW-13B-04	249.00	50.0	50.0
	JW-14-04	115.00	50.0	50.0
	JW-15-04	106.00	50.0	50.0
	JW-18-04	130.00	50.0	50.0
	JW-19-04	223.00	50.0	50.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of JW-16-04
NA = Not Available

TABLE 2-17 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER
EXCEEDING NATIONAL PRIMARY
DRINKING WATER REGULATIONS
AND/OR PROPOSED FEDERAL ACTION LEVELS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 12-15, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
LEAD	JW-05-04	81.80	50.0	50.0
	JW-08-04	178.00	50.0	50.0
	JW-08B-04	72.10	50.0	50.0
	JW-09-04	491.00J	50.0	50.0
	JW-10-04	754.00	50.0	50.0
	JW-12S-04	66.00	50.0	50.0
	JW-12D-04	7250.00	50.0	50.0
	JW-12B-04	436.00	50.0	50.0
	JW-13S-04	145.00	50.0	50.0
	JW-13B-04	216.00	50.0	50.0
	JW-14-04	330.00	50.0	50.0
	JW-15-04	926.00	50.0	50.0
	JW-16-04	136.00	50.0	50.0
	JW-16I-04*	134.00	50.0	50.0
	JW-18-04	715.00	50.0	50.0
	JW-19-04	2940.0	50.0	50.0
MERCURY	JW-12D-04	8.10	2.0	2.0
	JW-14-04	2.40	2.0	2.0
	JW-16I-04*	2.40	2.0	2.0
NICKEL	JW-12D-04	929.00	NA	700.0
	JW-19-04	714.00	NA	700.0
SELENIUM	JW-13SF-04	12.60	10.0	10.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of JW-16-04
NA = Not Available

well, two sources for chlorinated solvents are possible for the two wells. The sources of the chlorinated solvents is unknown at this time.

Benzene, a component of gasoline, was detected in monitoring well JW-16. Analytical results from this well cannot be compared to previous phases, as JW-16 was installed during Phase IV field activities. Petroleum contaminated soils were encountered in the test boring prior to installation of JW-16. The source of petroleum contaminated soils and groundwater at this location may be due in part to the former USTs of SWMU #11 and/or to migration of potentially contaminated groundwater. Volatile results from the remaining monitoring wells are comparable to results from previous phases. To date, none of the monitoring wells have detected high concentrations of volatiles in any of the groundwater samples collected.

Qualitative concentrations of bis(2-ethylhexyl)phthalate above proposed Federal Action Levels were present in groundwater samples collected from monitoring wells JW-04, JW-09B, JW-13B, and JW-16. An elevated concentration of bis(2-ethylhexyl)phthalate was present in groundwater collected from JW-05 during Phase II sampling activities. This contaminant was not detected in JW-05 during Phase III or Phase IV sampling. Bis(2-ethylhexyl)phthalate is a common plasticizer and is quite likely present throughout fill material in the JILF.

Monitoring well JW-19 had pesticide concentrations (heptachlor and 4,4'-DDT) exceeding proposed Federal Action Levels. Pesticide concentrations (4,4'-DDD and 4,4'-DDT) exceeding proposed Federal Action Levels were found in a groundwater sample collected from well JW-15 during Phase III sampling activities. Pesticides were not detected in JW-15 in Phase IV. A former PNS controlled spraying program may be the source of the detected pesticides in groundwater. Evidence of a former spraying program is the

widespread detection of pesticides in background soil samples and near surface soil samples at the majority of SWMU locations.

PCBs exceeding NPDWR and proposed Federal Action Levels were present in groundwater collected from monitoring well JW-15 in Phase III. However, there were no detectable PCB concentrations in groundwater collected from JW-15 during Phase IV sampling activities. There were no detectable PCB concentrations in any of the groundwater samples collected during Phase IV or Phase II.

Detectable concentrations of dissolved (filtered) and total (unfiltered) metals were found in all groundwater samples from the JILF monitoring wells in Phase III and Phase IV. Detectable concentrations of dissolved metals (total metals were not collected) were found in all groundwater samples from Phase II. Except for a few isolated and inconsistent occurrences, only total metal results were found to exceed NPDWR and/or proposed Federal Action Levels. Comparing dissolved metal results from Phase III and IV to total metal results from the same phases suggests that metal contamination is associated with suspended particulates in the groundwater. Although total metal concentrations exceed Federal groundwater standards for several metals, there is no evidence of gross metal - contamination in groundwater at the JILF.

2.7 Water-Level Measurements/Hydraulic Conductivity Testing

Groundwater levels in monitoring wells at the JILF and tide levels in Clark's Island Embayment were measured and recorded hourly from September 27 to October 1, 1991. Hydraulic conductivity testing was conducted in the same wells on October 1 and 2, 1991. The objective of such monitoring and testing was to provide data necessary to better characterize the groundwater regime at the JILF and to determine the hydraulic conductivity of the various lithologies underlying the JILF.

2.7.1 Procedures

Water-Level Measurements

Groundwater levels were monitored in 24 of the 26 JILF wells, with JW-16 and JW-16B being the only exclusions. Water levels were not monitored in JW-16 and JW-16B because of significant product in these wells which could have damaged the transducers. Moreover, significant vehicular and heavy machinery traffic near these wells presented significant risks to the integrity of the transducer cables beyond what available cable protection could have reliably mitigated.

Water levels were measured with clean Druck PTX-161D pressure transducers connected to In-Situ Hermit SE2000B dataloggers operating in top of casing mode. In this mode, the datalogger, by means of an internal algorithm, computed the depth to water in the wells from the top of the well casing. The depths to water were later converted to elevations. The pressure transducers were either 10 or 20 PSI scale, depending on the anticipated maximum height of the water column in the wells. For reference, 1 PSI is equivalent to 2.31 feet of fresh water. Thus, 10 and 20 PSI transducers have an operating range of 23.1 and 46.2 feet, respectively. The transducers are reportedly most accurate when operated within 20 and 80 percent of full scale at a constant temperature. This condition was, for the most part, satisfied at the JILF. Therefore, and according to In-Situ specifications, the pressure transducer/datalogger system used for the water-level measurements should have been accurate to 0.05 percent or 0.0005 of full scale of the transducer. Thus, the accuracy of the 10 and 20 PSI transducers should have been 0.01 and 0.02 feet, respectively. To accommodate the 24 transducers, plus two from the Mercury Burial Sites (see Section 3.3), and owing to the necessary layout of the transducer cables around and away from vehicular and machinery traffic, one 8-channel and two 16-channel

dataloggers were used to record water levels. The transducer range, datalogger, and accuracy of each system used for each well and the tide gauge are presented in Table 2-18.

In anticipation of wells potentially going dry at low tide and to monitor the lowest level at which water levels could be measured without potentially clogging the transducer with silt, each transducer was set roughly 0.5 feet to 1.0 feet above the well invert. The vertical placement of each transducer was maintained by a small metal S-hook taped to the transducer cable and secured over and to the well casing. The cable was further secured to the casing with duct tape to minimize any movement in the cable which could have influenced water-level readings. The S-hook could not be used in the tide gauge because of a metal collar over the PVC riser. The transducer cable was, however, securely taped to the side of the PVC riser within which the transducer was placed.

Subsequent to the installation of all transducers, each transducer and its associated datalogger was referenced to the water level in the well within which the transducer was installed. This was accomplished by manually measuring the depth to water from the top of casing and entering that value into the datalogger. When reference water-level measurements were completed, the dataloggers were synchronized to begin hourly water-level measurements at 2300 hours on September 27, 1991. These measurements were continued until 0700 hours on October 1, 1991, at which time the dataloggers were shut off and shortly thereafter disconnected from the transducers. The transducers remained in the wells for use in the subsequent hydraulic conductivity testing. The water-level data were downloaded from the dataloggers to a laptop computer for later analyses and interpretations.

TABLE 2-18

TRANSDUCER, DATALOGGER, AND ASSOCIATED ACCURACY OF WATER–LEVEL MEASUREMENTS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

SEPTEMBER 28 - 30, 1991

WELL Nº	TRANSDUCER RANGE (PSI)	DATALOGGER	ACCURACY (Ft.)
JW-3	10	#2	0.01
JW-4	10	#3	0.01
JW-5	10	#3	0.01
JW-6	20	#3	0.02
JW-7	10	#1	0.01
JW-7B	10	#1	0.01
JW-8	10	#1	0.01
JW-8B	10	#1	0.01
JW-9	10	#1	0.01
JW-9B	20	#1	0.02
JW-10	10	#1	0.01
JW-12S	10	#2	0.01
JW-12D	10	#2	0.01
JW-12B	20	#2	0.02
JW-13S	10	#2	0.01
JW-13D	10	#2	0.01
JW-13B	20	#2	0.02
JW-14	10	#2	0.01
JW-14B	10	#2	0.01
JW-15	10	#3	0.01
JW-15B	10	#3	0.01
JW-17B	20	#3	0.02
JW-18	10	#1	0.01
JW-19	20	#1	0.02
TIDE GAUGE	20	#2	0.02

10 PSI = 23.1 Feet
20 PSI = 46.2 Feet
Dataloggers #1 and #2 = 16 Channel
Datalogger #3 = 8 Channel

Hydraulic Conductivity Testing

Prior to hydraulic conductivity testing, preliminary hydrographs for each well were generated in the field from the above-discussed water-level data. These hydrographs were superimposed upon previously created graphs of the well screen and sandpack depths and reviewed to determine whether and when the well screen and sandpack were saturated in reference to the tide. Ideally, the well screen and preferably the sandpack should be saturated for hydraulic conductivity testing.

Hydraulic conductivity testing was conducted via the slug test method, where a slug, either a solid cylinder or volume of water, is rapidly introduced to or removed from the well and the resulting water-level recovery recorded. In this case, the slug was a clean, solid, stainless steel rod of dimensions 2.53 feet long and 0.11 feet diameter, capable of displacing 0.024 cubic feet of water. In a 2-inch diameter well and accounting for the 0.26-inch diameter transducer cable already in the well, this slug could raise or lower the water level in the well a maximum of 1.12 feet.

Water-level recovery data were recorded by the Hermit SE2000B dataloggers set in the logarithmic data sampling mode, the frequency of which is detailed in Table 2-19. The maximum time step between readings was manually set at one minute.

Falling head (slug inserted) and rising head (slug removed) tests were conducted at each well, with the falling head test generally conducted first. Prior to slug testing at each well, the transducer and associated datalogger was referenced to the water level in the well. This was again necessary since the datalogger had been disconnected from the transducer after the water-level monitoring was completed. Immediately prior to the slug test, the current water level in the well was read from the datalogger and recorded. The slug rod was then inserted rapidly into the well to a depth sufficient to have completely submerged

TABLE 2-19

IN-SITU HERMIT SE2000B LOGARITHMIC SAMPLING SCHEDULE FOR HYDRAULIC CONDUCTIVITY TESTING

PORTSMOUTH NAVAL SHIPYARD

ELAPSED TIME	SAMPLING INTERVAL	Nº POINTS PER INTERVAL
0-5 SEC	0.5 SEC	11
5-20 SEC	1 SEC	15
20-120 SEC	5 SEC	20
2-10 MIN	30 SEC	16
>10MIN	1 MIN	--

the rod, and the datalogger was started simultaneously with the slug insertion. The tests proceeded for a minimum of 2 minutes, at which time recorded water-level recovery data were reviewed on the datalogger's display screen. The slug test proceeded until the water-level data indicated that recovery was sufficiently complete, typically 100 percent. After the falling head test was stopped, the water level in the well was again read from the datalogger and recorded. The slug rod was then removed rapidly from the well, simultaneously with the starting of the datalogger. The rising head test proceeded as described for the falling head test. When slug testing was completed at each well, the transducer was removed and the well closed and, where possible, locked. The slug rod was decontaminated between wells in accordance with the procedures outlined in Table 2-1.

The slug test data were downloaded from the dataloggers to a laptop computer for later analysis and interpretation via the Hvorslev method.

2.7.2 Findings

Water-Level Measurements

Hydrographs generated from the hourly water-level data are provided in Appendix VII. Groundwater elevations are in reference to the mean high tide (MHT) datum used at the shipyard. This datum is equal to 100.00',which is equivalent to 3.804' of the USGS datum. For graphing purposes, the first data point was omitted from each hydrograph, thereby allowing the hydrographs to begin at 0000 hours. To show possible groundwater responses to precipitation, a graph of rainfall data from at least three days prior to and including the days over which water levels were measured is shown on each hydrograph. Rainfall data are for Greenland, New Hampshire, located approximately 6 miles south-southwest of the shipyard.

Groundwater elevations in formations near tidally-fluctuating water bodies can vary in response to such fluctuations. For a given distance from the shoreline in a confined formation, the amplitude of groundwater elevation response relative to the tidal amplitude (called tidal efficiency) increases with increasing transmissivity (hydraulic conductivity times the thickness of a confined formation) and decreasing storage coefficient. The time lag at which peak groundwater elevations occur relative to peak tidal elevations increases with decreasing transmissivity and increasing storage coefficient. Conversely, for given transmissivity and storage coefficient, the tidal efficiency decreases and time lag increases with increasing distance from the shoreline (Ferris, 1951). These relations can, for discussion purposes be applied to unconfined formations as well.

As evident on the hydrographs, tidal fluctuations influence water levels in 14 of the wells monitored at the JILF. Wells located along Clark's Island Embayment and JW-15/15B generally show the greatest tidal response. However, bedrock wells JW-13B and JW-14B, though located as close to the shoreline as the other wells, exhibit dampened and lagged hydrographs relative to the other wells in that area. The lag time in JW-13B and JW-14B is one and two hours, respectively. Though the thickness of the confined bedrock contributing water to JW-13B is not defined, decreased transmissivity does not appear to be the cause of the decreased amplitude and increased lag time in JW-13B: Hydraulic conductivity tests in JW-13B revealed a hydraulic conductivity as high as that in the overburden. Further, the storage coefficient in confined formations is less than that in unconfined formations, which would reduce lag time. The boring log for JW-13B, however, shows 8 to 10 feet of tidal mud deposits overlying the bedrock. As noted by Erskine (1991), such deposits can form an impermeable skin over the contact of the formation with the water body. Thus, the pressure wave induced by the tide is attenuated as it passes through

the impermeable material. Further, the location at which the formation directly contacts (if at all) the water body can be substantially off-shore from the shoreline, due to the impermeable confining layer. This effectively increases the distance the tidal pressure wave must travel through the formation, thereby decreasing tidal efficiency and increasing time lag. One or a combination of the above may be an explanation for the observed hydrograph at JW-13B.

The boring log for JW-14B does not show any significant tidal deposits overlying the bedrock. However, the hydraulic conductivity of the bedrock within which this well is screened is very low. Well development and sampling data confirm this, in that the well was quickly dewatered. Thus, it appears that the hydrograph for this well is a result of very low hydraulic conductivity and poor hydraulic connection with the tide.

The hydrographs for most of the wells on or near Jamaica Island do not show groundwater level responses to the tide. Only JW-5 and JW-15/15B show responses to the tide, with JW-5 responding only at high tide and JW-15/15B responding across the entire tidal cycle. Other than the brief response to the high tide, groundwater elevations in JW-5 slowly decline in a manner typical of gravity drainage in an unconfined formation. This pattern is common to the other wells on or near Jamaica Island, as well as several other JILF wells. As discussed later, the wells on or near Jamaica Island typically exhibit average groundwater elevations higher than the average tide elevation and other JILF wells.

Groundwater level responses to the tide at the JILF are generally seen only in the wells near the shoreline. However, the more inland wells JW-9/9B, JW-17B, and MW-4 also show responses to the tide. The hydrograph for JW-9/9B shows a relatively dampened response to the tide, with a two-hour lag time. The drainage patterns of these hydrographs are characteristic of unconfined formations being watered and dewatered. Knowing that

JW-9 was unsaturated and that the water in JW-9 was saline suggests that a relatively direct hydraulic connection might exist between the embayment and JW-9/9B, thereby allowing saline water to encroach inland.

JW-17B exhibits a typical dampened and sinusoidal hydrograph, with a two-hour lag time. This is likely a combination of decreased transmissivity (as indicated by a relatively lower hydraulic conductivity) and distance inland from the river. Well MW-4, though a Mercury Burial Site well, is located within the groundwater flow regime of the JILF. This well shows a substantially dampened hydrograph, with a three-hour lag time. MW-4 is located inland of a reported clay barrier that separates the landfill proper from the embayment. The hydrograph for MW-4 may, therefore, illustrate dampening and the attenuation of the tidal pressure wave by the barrier.

Though the hydrographs illustrate groundwater responses to the tide and groundwater drainage patterns, they do not provide information necessary to completely evaluate groundwater flow. To that end, average groundwater elevations were computed following the methods described in Serfes (1991). This method employs a filtering mechanism that effectively removed any tidal influence on the groundwater elevations. The resulting average groundwater elevations are presented in Table 2-20.

Several quality control statements need to be mentioned with regard to these averages. First, because the water levels in the wells JW-12S, JW-13S, and JW-15 apparently dropped below the transducer near or at low tide, the recorded water levels were consequently higher than the actual water levels in the screened material. Thus, the computed average groundwater elevations for these wells are too high. This could significantly influence the apparent vertical hydraulic gradients at these locations. Second, the transducers used to measure the water levels were referenced to the density of fresh

TABLE 2-20

AVERAGE GROUNDWATER ELEVATIONS

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

SEPTEMBER 28 - 30, 1991

WELL Nº	AVERAGE GROUNDWATER ELEVATION (Ft. MHT)	MIDPOINT SCREEN ELEVATION (Ft. MHT)
JW-3**	105.97	96.40
JW-4	103.68	96.47
JW-5	100.11	94.44
JW-6	102.01	92.69
JW-7**	103.29	95.36
JW-7B	103.25	83.28
JW-8	101.19	99.19
JW-8B	101.24	88.29
JW-9	99.10	93.74
JW-9B	99.39	82.63
JW-10	97.69	96.52
JW-12S*	96.36	96.18
JW-12D	96.29	85.87
JW-12B	96.64	67.83
JW-13S*	97.53	99.02
JW-13D	96.40	91.03
JW-13B	97.68	73.87
JW-14	101.92	97.28
JW-14B	100.43	85.63
JW-15*	98.26	97.89
JW-15B	97.33	85.54
JW-17B	101.11	84.42
JW-18	100.22	98.54
JW-19	101.22	92.52
TIDE GAUGE	96.03	--

MHT = Mean High Tide = Elevation 100'; Equal to 3.804' USGS System
* = Water Level Dropped Below Transducer Near or at Low Tide
** = Elevations Based on Old Survey of Wells

water. Many of the wells at the JILF contain brackish and/or seawater. Since such water is more dense than fresh water and thus requires less water to exert the same pressure on the transducer, water levels measured in brackish or sea water are higher than the actual water level in the well. For every foot of a column of seawater measured in reference to fresh water, the actual water level should be 0.0244 feet lower. These differences do not significantly affect the horizontal groundwater flow interpretations. Such differences can, however, become important in evaluating vertical gradients in well pairs or clusters.

Consistently higher groundwater elevations are found on or near Jamaica Island. The highest average groundwater elevation, 105.97 feet MHT, was in JW-3. Salinity data acquired during groundwater sampling show the water in JW-3 and several other of these wells to be fresh. Several other wells on and near Jamaica Island were mildly brackish. This information suggests a possible fresh water lens or lenses present on and near Jamaica Island. This fresh water appears to be mounded and sufficiently sustained above high tide. This may explain why JW-14, JW-4, and JW-6 do not show water elevation responses to the tide. The higher elevation of, and lower salinity in, leachate seep JL-01 relative to JL-02 and JL-03, as discussed in Section 2.2.4, also support the possible existence of a fresh water lens. A separate fresh water lens possibly exists near JW-6. Hydrographs and salinity data for JW-15/15B indicate significant seawater influx to the formation in which these wells are screened. Historical information reveals a former tidal channel in this area, which may be separating the fresh water in JW-6 with that on Jamaica Island, though no direct evidence is available to support this. It is not currently known whether the fresh water lens is sustained entirely by precipitation or if it receives some fresh water discharging from the underlying bedrock.

Salinity data for wells within the landfill proper indicate that a fresh water lens may exist within the landfill. Groundwater in JW-19 is mildly brackish and nearly fresh, and groundwater in MW-4 has been fresh to mildly brackish. Hydrographs for both of these wells show a gradual decline in groundwater elevations, similar to that in JW-5. This information, combined with the groundwater elevation data suggests that groundwater within the landfill is flowing toward the embayments, with likely subradial flow towards the landfill perimeter.

Upward vertical hydraulic gradients were observed at the JW-9, JW-12, and JW-13 locations. Salinity measurements collected during groundwater sampling show the water in the overburden wells to be significantly more saline than in the bedrock wells. This would result in the actual water levels in the overburden being lower than those measured, thereby increasing the upward gradient. The sea water in the overburden is likely the result of sea water encroaching inland in the relatively transmissive overburden. The less saline to fresh water in the bedrock plus the upward gradient therefrom is likely indicative of a fresh water lens/saline water transition zone commonly found in island or coastal groundwater flow regimes.

Hydraulic Conductivity

Water-level recovery plots for each slug test are provided in Appendix VII. The water-level recovery plots and associated regression line on the selected data provided the basic time lag, T_o, the variable necessary for estimating hydraulic conductivity via the Hvorslev method. No corrections were made for the effect of tides on the water-level recovery data. Such data were selected from relatively early parts of the slug tests before tide effects apparently became significant. The estimates of hydraulic conductivity at the JILF are presented in Table 2-21.

TABLE 2-21

HYDRAULIC CONDUCTIVITY ESTIMATES

JAMAICA ISLAND LANDFILL (SWMU #8)
PORTSMOUTH NAVAL SHIPYARD

SEPTEMBER 28 - 30, 1991

WELL Nº	HYDRAULIC CONDUCTIVITY (K) Ft/Day	cm/Sec
JW-3	1.16	4.08×10^{-4}
JW-4	12.04	4.25×10^{-3}
JW-5	12.85	4.53×10^{-3}
JW-6	4.68	1.65×10^{-3}
JW-7	38.27	1.35×10^{-2}
JW-7B	6.40	2.26×10^{-3}
JW-8	47.53	1.68×10^{-2}
JW-8B	0.14	4.99×10^{-5}
JW-9	103.77	3.66×10^{-2}
JW-9B	0.17	5.93×10^{-5}
JW-10	88.56	3.12×10^{-2}
JW-12D**	215.49	7.60×10^{-2}
JW-12B	60.69	2.14×10^{-2}
JW-13D*	292.45	1.03×10^{-1}
JW-13B	248.37	8.76×10^{-2}
JW-15	200.80	7.08×10^{-2}
JW-15B	0.33	1.15×10^{-4}
JW-17B	1.16	4.09×10^{-4}
JW-18	15.20	5.36×10^{-3}
JW-19	9.87	3.48×10^{-3}

Unless Otherwise Noted, Hydraulic Conductivity is Average of Falling and Rising Head Tests
* = Falling Head Test Only
** = Rising Head Test Only
JW-12S, 14, and 13S Recovered Too Fast to Estimate K
JW-14B Recovered Imperceptibly Slow; Test Terminated Too Soon

In general the hydraulic conductivity in the bedrock is lower than that in the overburden, except for JW-12B and JW-13B, which exhibited hydraulic conductivities comparable to that in the overburden. Hydraulic conductivity estimates for the bedrock ranged from 4.99×10^{-5} cm/sec in JW-8B to 8.76×10^{-2} cm/sec in JW-13B, with an average value in the 10^{-2} cm/sec range. However, excluding JW-12B and JW-13B, the hydraulic conductivities of the six remaining bedrock wells (including JW-3, which is bedrock) are in the 10^{-4} cm/sec range. Hydraulic conductivity for JW-14B was not estimated, for the water level recovered imperceptibly slow and the slug test was consequently stopped too early. Still, such information indicates that the hydraulic conductivity in JW-14B is extremely low.

The overburden exhibits relatively high hydraulic conductivity, particularly in the wells located along the embayment and the river. Water levels in JW-12S, JW-13S, and JW-14 recovered too quickly to estimate hydraulic conductivity. Hydraulic conductivity ranges from 1.65×10^{-3} cm/sec in JW-5 to 1.26×10^{-1} cm/sec in JW-12D, with values typically in the 10^{-3} to 10^{-2} cm/sec range. Hydraulic conductivities at or above 10^{-2} cm/sec are at or above the limits at which the methods employed can accurately and reliably estimate hydraulic conductivity. This is evident in the water-level recovery data, where rapid water-level recovery coupled with water-level oscillations typical in permeable materials sometimes resulted in little difference between the equilibrium water level (H) and the maximum perturbed water level (H_o). In consequence, few data points were available from which to estimate T_o. Thus, high hydraulic conductivity values should be taken as more qualitative than quantitative.

Wells JW-8, JW-10, JW-15, and JW-18 were not fully saturated during the slug tests, making it difficult to distinguish between sandpack and formation hydraulic conductivity. Water-level recovery curves can show the change from sandpack drainage to formation

drainage. However, none of the water-level recovery curves for the mentioned wells distinctly showed the multiple straight line recovery curve characteristic of sandpack/formation drainage. This suggests that the formation material in which the wells are screened likely is as or more permeable than the sandpack.

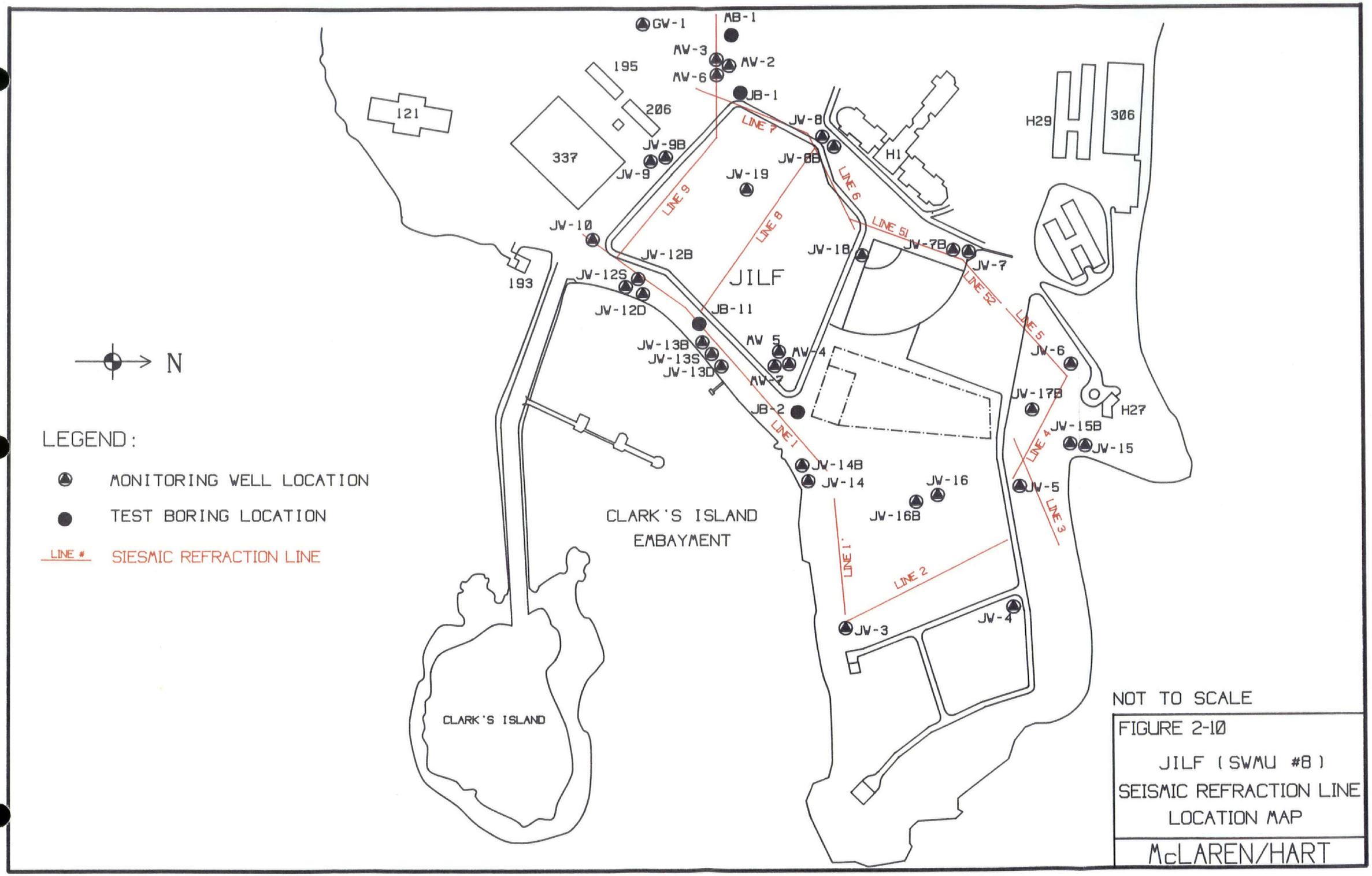
2.8 Seismic Survey

A seismic refraction investigation was conducted by Weston Geophysical Corporation (Weston) for McLaren/Hart at the Portsmouth Naval Shipyard in Kittery, Maine. The purpose of this investigation was to profile the bedrock surface along the lines shown on Figure 2-10. Additional survey objectives included identification of weathered or fractured bedrock and characterization of overburden materials. Field work was accomplished during the period from August 12 to August 16, 1991, by Weston personnel.

2.8.1 Survey Procedures

The seismic refraction survey method is a means of determining the depths to a refracting horizon and the thickness of major seismic discontinuities overlying the high-velocity refracting horizon. The seismic velocities measured by this technique can be used to calculate the mechanical properties of subsurface materials [moduli values], as well as for material identification and stratigraphic correlation.

Interpretations are made from travel time curves showing the measurement of the time required for a compressional seismic wave to travel from the source ["shot"] point to each of a group of vibration sensitive devices [seismometers or geophones]. The geophones are located at known intervals along the ground surface. Various seismic sources may be used, including a drop weight, an air gun, and small explosive charges.



NOT TO SCALE

FIGURE 2-10

JILF (SWMU #8)
SEISMIC REFRACTION LINE
LOCATION MAP

McLAREN/HART

Weston uses a seismic recording technique of continuous profiling and overlapping spreads for engineering and groundwater investigations. The seismic refraction equipment consists of a Weston Geophysical trace amplifier, Model USA780, with either a WesComp™ [a field computer system developed by Weston Geophysical], or a recording oscillograph.

Continuous profiling is accomplished by having the end shot-point of one spread coincident with the end or intermediate position shot-point of the succeeding spread. The spread length used in a refraction survey is determined by the required depth of penetration to the refracting horizon. It is generally possible to obtain adequate penetration when the depth to the refracting horizon is approximately one-third to one-quarter of the spread length.

In general, "shots" are located at each end and at the center of the seismic spread. The configuration of the geophone array and the shot point positions are dependent upon the objectives of the seismic array.

The seismometer or geophone is in direct contact with the earth and converts the earth motion resulting from the shot energy into electrical signals. A moving coil electromagnetic geophone is generally used. This type of detector consists of a magnet permanently attached to a spiked base which can be rigidly fixed to the earth's surface. Suspended within the magnet is a coil-wrapped mass. Relative motion between the magnet and coil produces an electric current, with a voltage proportional to the particle velocity of the ground motion.

The electric current is carried by cable to the recording device which provides simultaneous monitoring of each of the individual geophones. The operator can amplify and filter the seismic signals to minimize background interference. For each shot, the seismic signals detected by a series of geophones are recorded on either photographic paper or

magnetic tape, depending on job requirements. Included on each shot record is a "time break" representing the instant at which the shot was detonated.

The elastic wave measured in the seismic refraction method, the "P" or compressional wave, is the first arrival of energy from the source at the detector. This elastic wave travels from the energy source in a path causing adjacent solid particles to oscillate in the direction of wave propagation. At smaller distances between the source and the detector, the first arriving waves will be direct waves that travel near the ground surface through the lower velocity material. At greater distance, the first arrival at the detector will be a refracted wave that has taken an indirect path through the two layers. The refracted wave will arrive before the direct wave at a greater distance along the spread because the time gained in travel through the higher-speed material compensates for the longer path. Depth computations are based on the ratio of the layer velocities and the horizontal distance from the energy source to the point at which the refracted wave overtakes the direct wave.

Generally the interpretation is by one or more of several methods [W.M. Telford, et al., 1976] including ray-tracing, wave front methods, delay times, critical distances, etc.. In addition, either a forward or inverse interpretation can be performed using Weston's computer. Since successful refraction interpretation is based on experience, all interpretation of refraction data is performed or thoroughly reviewed by a senior staff geophysicist.

The locations for the seismic profile lines are shown on Figure 2-10. Refraction survey coverage was staked in the field at selected seismic source locations. Ground surface topography along the seismic profiles was estimated by Weston's field crew and is approximate. In general, seismic survey lines were located by taped measurements from borings and other structural features such as buildings, roadways, fences, etc..

Seismic refraction data were obtained with a 24-channel, digital seismic acquisition system. Spread lengths were 250 feet with geophone spacings of 10 feet. In some instances, 12-channel, 130 foot spreads were utilized where logistical limits affected coverage. An explosive source was used to generate seismic energy except in the parking lot area of seismic Line 5 where hammer blows were utilized to generate energy. Data were recorded on magnetic media for playback and processing, and hard copy records were printed in the field to assure duplicate, permanent storage of seismograms.

2.8.2 Survey Results

Seismic refraction profiles presented in Enclosure B show the thicknesses and compressional seismic velocity values of layers identified along each refraction traverse. Based on Weston's experience with seismic refraction profiling in numerous geologic settings, the seismic velocities shown in Enclosure B are likely to represent the geologic materials listed in the table below:

Velocity (ft/sec)	Material Correlation
1,000-2,000	Loose, unconsolidated, and unsaturated overburden and fill. May include sand, gravel, silt, and organic matter.
2,000-3,500	Unsaturated overburden, possibly fill or sandy glacial till with cobbles. This velocity range in most cases appears to represent the engineered fill material found to exist throughout the site.
4,800-5,300	Water-saturated overburden materials as listed above, or possibly compact glacial till with some clay.
9,000-13,000	Bedrock, possibly partly weathered or fractured, especially at the low end of this velocity range.
13,000-17,000	Bedrock exhibiting only limited weathering or fracturing.

The results of the seismic refraction investigation are presented in profile form in Enclosure B. The profiles show the depths to bedrock and interfaces of various overburden layers detected, as well as their characteristic seismic velocity values.

Key information obtained by this investigation is summarized below.

Bedrock Depth: Bedrock depth ranged from five feet or less to more than sixty feet throughout the area profiled. Shallow rock of 20 foot depth or less was identified along Line 1 from Stations 0+0 to 0+30 and 9+80 to 10+40; Line 1' from Station 0+0 to 2+50; Line 2 from Stations 0+0 to 3+10 and 3+80 to 5+20; Line 3 from Station 0+0 to 2+50; Line 4 from Stations 0+0 to 1+50 and 2+0 to 3+60; Line 5 from Station 0+25 to 2+50; Line 52 from Station 2+35 to 2+50; Line 51 from Station 0+0 to 3+80; Line 6 from Station 0+0 to 2+50; Line 7 from Station 0+0 to 0+25; Line 8 from Station 5+60 to 5+75; and Line 9 from Station 3+35 to 5+00.

Areas of deeper rock, 50 feet or greater, were identified along Line 1 from Stations 0+85 to 2+30 and 6+90 to 7+20; and Line 8 from Station 0+60 to 3+60. In addition, relatively deep "pockets" of overburden that may represent filled tidal inlets were identified between Stations 1+00 to 2+00, 6+50 to 8+00, and 11+00 to 12+50 along Line 1; between Station 3+00 to 4+20 along Line 2; between Station 1+60 to 2+60 along Line 4; between Station 0+0 to 2+0 along Line 52; between Station 2+40 to 3+10 along Line 51; between Station 1+00 and 3+40 along Line 8 and between Stations 1+60 to 2+80 and 5+60 to 7+00 along Line 9.

- Bedrock Seismic Velocity: Generally high velocity (greater than 14,000 ft/sec) with zones of suspected weathered bedrock encountered throughout Line 4, Line 5 and Line 52.

- Overburden Material: The velocities and materials correlation of the overburden layers are discussed in the above table. Most of the fill material is in the 1,500-3,500 foot per second velocity range.

To the extent possible, the seismic interpretation has been correlated to existing boring logs in the vicinity of the geophysical coverage. There was good correlation between these two data sets with respect to bedrock depth, as shown in Enclosure B. It is important to note, however, that specific features of interest (e.g. the possible filled tidal inlets) may contain highly irregular rock surface elevations and may warrant further investigation by test pits or borings.

2.8.3 Interpretations/Discussion

Based on the correlation between the seismic refraction profiles and existing boring data, there is a high degree of confidence in the interpreted seismic data. It is important to note, however, that there is likely to be more localized variability in the bedrock surface than is shown in the refraction profiles. Locally erratic bedrock will tend to be "smoothed" in the seismic profiles due to the averaging processes used in the interpretation. This likelihood notwithstanding, significant bedrock trends including "depressions" and "highs" are well documented by the seismic technique.

It was somewhat surprising that the "disposal" area exhibited seismic velocity values in the 2,500-3,500 ft/second range which indicates relatively compact material. There appears to be a "transition" zone along Line 8 (3+50 to 4+00) which may mark the boundary of differing fill materials.

Any additional detail of fill characteristics or bedrock profiles may be accomplished by implementing additional seismic refraction investigation using gridded coverage with closely spaced lines.

2.9 Conclusions/Recommendations

Soil samples collected during the four phases of investigation reveal low to moderate soil contamination across the landfill. Based on the low concentrations of contaminants detected, specific source areas cannot be determined.

Groundwater samples collected from the monitoring wells during Phase III and Phase IV were generally "clean" with the exception of total metal results. A comparison of dissolved metal results from Phase III and Phase IV groundwater sampling with total metal results from the same phases suggests that metal contamination is associated with suspended particulates in the groundwater. Total metals were not analyzed for during the Phase II investigation. Comparable concentrations were observed between Phase III and Phase IV groundwater results.

Two areas of potential concern that may warrant further groundwater monitoring and investigation is the area in the vicinity of SWMU #11 and monitoring wells JW-16 and JW-16B, and monitoring well JW-13B. Visual petroleum contamination was observed in the soils at location JW-16 during test boring activities. Groundwater results from JW-16 indicate low concentrations of a petroleum product. The source of petroleum contaminated soils and groundwater at this location may be due in part to the former USTs of SWMU #11 and/or to the migration of potentially contaminated groundwater.

Low concentrations of chlorinated organic compounds (DCE, TCE, and vinyl chloride) were detected in bedrock monitoring well JW-13B. Lower concentrations of DCE and TCE were detected in the shallow overburden well (JW-13S) during Phase III and Phase IV. However, there were no detectable volatile concentrations in the deep overburden well (JW-13D), screened on top of tidal flat deposits, in either Phase III or Phase IV. This indicates that the chlorinated organic compounds are present in bedrock

below the tidal flat deposits. A deeper bedrock monitoring well may need to be installed in this area to determine the presence of chlorinated organic compounds at depth within bedrock.

Continued sampling of the JILF monitoring wells should be undertaken to further monitor groundwater quality around the perimeter of the landfill. Groundwater samples should be analyzed for TCL Organics and TAL Inorganics (total metals).

Hydrographs generated from the hourly water-level data show that groundwater levels in 14 of the JILF wells respond to tidal fluctuations. Of these wells, those nearest the embayment or river typically show the greatest and quickest response to the tide. However, wells JW-13B and JW-14B, owing to an impermeable confining layer and low hydraulic conductivity, respectively, exhibit dampened and lagged hydrographs. Hydrographs, groundwater elevations, and salinity data suggest that saline water is encroaching into and/or around the landfill, particularly at and near JW-9. Such data for wells in and near the landfill proper also indicate a possible fresh water lens in the landfill. Groundwater in this area appears to be flowing toward the embayment, with likely subradial flow toward the landfill perimeter. Hydrographs, groundwater elevations, and salinity data for wells on and near Jamaica Island suggest the presence of a fresh water lens in this area. Groundwater in this area may be flowing radially to subradially away from Jamaica Island. Additional salinity data, collected at high and low tide in existing and proposed wells, may be needed to better define the presence of fresh water lenses and the inland movement of saline water. Several strategically located wells may be required to confirm groundwater flow systems at the JILF. Also, information regarding the source and construction of the fresh water ponds may prove valuable in better understanding the groundwater flow regime at the JILF. Further, physical structures such as old seawalls or utility lines, may be influencing water

level responses in some wells and should therefore be located and evaluated for such potential influence.

Hydraulic conductivity is generally several orders of magnitude lower in the bedrock than in the overburden; however, some bedrock wells exhibited hydraulic conductivities comparable to that in the overburden. Hydraulic conductivity in the overburden was typically in the 10^{-2} cm/sec range, with the overburden wells along the embayment generally exhibiting the higher values. Hydraulic conductivities in and above the 10^{-2} cm/sec range are at or above the limits of the methods employed to accurately and reliably estimate hydraulic conductivity. Additional testing using methods designed for highly permeable material may be necessary to provide more accurate and reliable estimates of hydraulic conductivity.

3.0 MERCURY BURIAL SITES (SWMU #9)

The purpose of this phase of work at the Mercury Burial Sites was as follows:

-- Locate the buried mercury cells by conducting exploratory excavations within the two Mercury Burial Sites;

-- Further define fill thickness, depth to native soils, and soil quality at the Mercury Burial Sites;

-- Continue monitoring shallow groundwater quality at the Mercury Burial Sites; and

-- Determine hydraulic conductivity and effects of the tides on representative monitoring wells at both Mercury Burial Sites.

The following tasks were performed as part of the Phase IV field investigation at the Mercury Burial Sites:

- Exploratory Excavations and Soil Sampling
- Groundwater Sampling
- Hydraulic Conductivity Testing and Water Level Measurements

The information obtained from these investigations will be incorporated into the final RCRA Facility Investigation Report.

3.1 Exploratory Excavations/Soil Sampling

Exploratory excavations were conducted from July 9 - July 15, 1991 and July 23 - July 26, 1991 at Mercury Burial Site II (Western site) and Mercury Burial Site I (Eastern site), respectively. Exploratory excavation locations and dimensions are shown on the enclosed survey map of the JILF (Enclosure A) and Appendix VI.

Exploratory test pits were excavated in the vicinity of Mercury Burial Sites I and II to locate any existing cells containing mercury contaminated material. The excavation locations were based on existing concrete plaques that marked the presumed locations of Mercury Burial Sites I & II.

A total of six (6) subsurface soil samples, plus one equipment rinseate field blank, were collected from Mercury Burial Sites I and II. All soil samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. In addition, particle size and Atterberg limit samples were collected from Mercury Burial Site I.

3.1.1 Procedures

Excavating was performed with a 235 CAT backhoe and a 936 CAT front end loader operated by William A. Renaud, Jr., Trucking, Inc.. All excavation work was supervised by McLaren/Hart's geologists and engineers. An HNU photoionization detector or OVA, Geiger counter, Dräger pump with chlorine gas tubes, Jerome Mercury Vapor Analyzer, and a PDM-3 Miniram Aerosol Monitor were used to constantly monitor the excavating for organic vapors, radiation, chlorine gas, mercury vapors, and airborne particulates, respectively.

Prior to excavating, the backhoe bucket was steam-cleaned to remove possible contaminants. The bucket was decontaminated between excavations by scrubbing with Alconox(TM) and water to eliminate any gross contamination that may have been encountered and to reduce the possibility of cross-contamination. The backhoe bucket was decontaminated over a portable decontamination pad.

Excavations were terminated when either native soils and/or groundwater was encountered. As nearly as possible, using the above documented excavation equipment, soil samples were collected from approximately five foot intervals. The samples collected were labeled MTP-01 (Mercury Burial Site II) and MTP-02 (Mercury Burial Site I) followed by the footage interval from which the sample was obtained. Soil samples were obtained from within the backhoe bucket using a precleaned stainless-steel trowel. The sample was placed in a stainless-steel mixing bowl, homogenized and transferred to the appropriate laboratory-

supplied container. TCL volatile samples were collected prior to homogenizing so as to preserve the integrity of this parameter. The sampling equipment was decontaminated prior to use at each location to prevent cross-contamination according to the protocol described in Table 2-1. All samples were stored on ice in a field cooler and delivered via courier to CEIMIC for laboratory analysis.

3.1.2 Findings

Mercury Burial Site II was excavated to a depth of approximately 15.5 feet below grade where saturated native soils were encountered. Fill material, consisting of construction and demolition debris including concrete, brick, scrap metal, wood fragments, Herculite(TM), plastic, and black sandblast grit, were encountered from approximately 5.0 feet to 15.0 feet below grade. Several bags of asbestos containing material (ACM) was uncovered within the fill material. A total of four bulk ACM samples were collected by PNS Occupational Safety and Health (OSH) - PNS Code 106.3 that verified amosite and chrysotile asbestos in the samples collected. There was no evidence of any type of container or mercury contaminated soils. Soil samples MTP-01(2-4), MTP-01(5-7), and MTP-01(12-14) were collected from three separate intervals within the excavation. The excavation was then backfilled with the original soil and fill material.

Mercury Burial Site I was excavated to a depth of approximately 16.5 feet below grade where native soils were encountered. The upper 2.5 feet of soil consisted of fine to coarse sand and gravel. A silty clay layer, presumably a landfill cap, was encountered from 2.5 feet to 4.5 feet below grade. Fill material encountered from 4.5 feet to 16.5 feet consisted of scrap metal, wood fragments, plastic, and red fine to medium sand lenses. Three separate concrete cells and one vertical section of a concrete sewer pipe, all presumed to contain mercury contaminated material were encountered approximately 7.5

feet below grade. The dimensions of each concrete cell and the concrete pipe are summarized below as they were aligned from east to west:

I.D. N°	Length	Width	Height
Vertical Sewer Pipe (East End)	4.5 feet in diameter		4.0 feet - 4 inches
Cell N° 1	4.0 feet	5.0 feet	2.0 feet - 11 inches
Cell N° 2	8.0 feet - 7 inches	7.0 feet	2.0 feet - 11 inches
Cell N° 3 (West End)	4.0 feet	5.0 feet	2.0 feet - 11 inches

Each concrete cell was supported by a one foot thick concrete pad except for the section of concrete sewer pipe. The hollow section of concrete sewer pipe appeared to be filled with soil at the surface and was not capped. All of the concrete cells appeared to be intact. Soil samples MTP-02(5-7), MTP-02(10-12), and MTP-02(15-17) were collected from three separate intervals within the excavation. After checking the integrity of each cell and obtaining dimensions, the concrete cells and concrete sewer pipe were left in place and backfilled with the original soil and fill material. The concrete cell and sewer pipe locations were measured from monitoring wells MW-04 and MW-05 and are described in the field notebook (Appendix II).

3.1.3 Laboratory Analytical Results

A total of six (6) subsurface soil samples, plus one equipment rinseate field blank, were collected from Mercury Burial Sites I and II. These samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Two of the samples MTP-02(10-12) and MTP-02(15-17) were also submitted for particle size and Atterberg limit analysis, respectively. A summary of valid soil sample results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

The State of Maine does not have published clean-up guidelines for contamination in soils, therefore, New Jersey ECRA Guidance Values and proposed Federal Action Levels are used for comparison purposes.

TCL Volatiles

There were no volatile organic compound concentrations above New Jersey ECRA Guidance Values or proposed Federal Action Levels.

TCL Semi-Volatiles

Soil samples MTP-01(2-4) and MTP-01(5-7) had total base neutral concentrations of 176 mg/kg and 119 mg/kg, respectively. These concentrations exceed the New Jersey ECRA Guidance Value of 10 ppm for total base neutrals in soil.

Soil samples MTP-01(2-4) and MTP-01(5-7) also had total polynuclear aromatic hydrocarbon (PAH) concentrations that exceeded the New Jersey ECRA Guidance Value of 10 ppm for total PAHs in soil. These samples had concentrations of 174 mg/kg and 118 mg/kg, respectively. No proposed Federal Action Levels are available for total base neutrals or PAH's.

A review of chromatograms and listed TICs indicate petroleum in all soil samples. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum cannot be made at this time.

There were no acid extractable concentrations exceeding New Jersey ECRA Guidance Values or proposed Federal Action Levels.

TCL Pesticide/PCBs

There were no pesticide concentrations exceeding proposed Federal Action Levels. Pesticides are not listed under New Jersey ECRA Guidance Values. Soil sample MTP-02(5-7) had a PCB concentration of 2.2 mg/kg. This concentration exceeds the New Jersey ECRA Guidance Value of 1.0 ppm and the proposed Federal Action Level of .09 mg/kg for PCBs in soil.

TAL Inorganics

Detectable metal concentrations were found in all subsurface soil samples. Metal concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels are shown in Table 3-1. Qualitative concentrations that may exceed proposed Federal Action Levels are also shown in Table 3-1. There were no detectable cyanide concentrations in any of the soil samples.

TOC, pH, and Percent Moisture

Table 3-2 shows the results for TOC, pH, and percent moisture analyses. TOC ranged from 0.2% to 4.2%. pH ranged from 7.5% to 7.8%. Percent moisture ranged from 4% to 25%.

Particle Size Analysis

A particle size analysis was conducted on subsurface soil sample MTP-02(10-12). The particle size analysis results for MTP-02(10-12) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		15%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		71%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	6%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	42%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	23%	
Silt size, 0.074 to 0.005 mm:		13%
Clay, smaller than 0.005 mm:		1%
Colloids, smaller than 0.001 mm:		0%

TABLE 3-1

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

MERCURY BURIAL SITES (SWMU #9) PORTSMOUTH NAVAL SHIPYARD

JULY 12, 1991 AND JULY 24, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
ANTIMONY	MTP-02(5-7)	12.50J	10.0	30.0
BERYLLIUM	MTP-01(2-4)	1.10	1.0	0.2
	MTP-01(5-7)	0.73Q	1.0	0.2
	MTP-01(12-14)	0.31Q	1.0	0.2
	MTP-02(5-7)	0.61Q	1.0	0.2
	MTP-02(10-12)	0.92Q	1.0	0.2
	MTP-02(15-17)	1.70	1.0	0.2
CADMIUM	MTP-01(5-7)	3.30	3.0	40.0
CHROMIUM	MTP-02(15-17)	116.00	100.0	400.0
COPPER	MTP-01(2-4)	296.00J	170.0	NA
	MTP-01(5-7)	254.00	170.0	NA
	MTP-02(5-7)	4,210.00	170.0	NA
	MTP-02(10-12)	2,020.00	170.0	NA
	MTP-02(15-17)	414.00	170.0	NA
LEAD	MTP-02(10-12)	541.00J	250.0 - 1,000.0	NA
	MTP-02(15-17)	301.00J	250.0 - 1,000.0	NA
NICKEL	MTP-02(5-7)	488.00	100.0	2,000.0
	MTP-02(10-12)	171.00	100.0	2,000.0
SILVER	MTP-02(15-17)	5.10	5.0	200.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available

TABLE 3-1 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

MERCURY BURIAL SITES (SWMU #9)
PORTSMOUTH NAVAL SHIPYARD

JULY 12, 1991 AND JULY 24, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
ZINC	MTP-02(5-7)	627.00	350.0	NA
	MTP-02(10-12)	452.00	350.0	NA
	MTP-02(15-17)	786.00	350.0	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available

TABLE 3-2

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS

MERCURY BURIAL SITES (SWMU #9) PORTSMOUTH NAVAL SHIPYARD

JULY 12, 1991 AND JULY 24, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
MTP-01(2-4)	2.7	7.8	4
MTP-01(5-7)	1.7	7.7	5
MTP-01(12-14)	0.2	7.7	4
MTP-02(5-7)	4.2	7.8	6
MTP-02(10-12)	0.3	7.5	9
MTP-02(15-17)	0.5	7.8	25

Atterberg Limits Analysis

An Atterberg limit analysis was performed on subsurface soil sample MTP-02(15-17). The Atterberg limit analysis results for MTP-02(15-17) is as follows:

Parameter	Sample Result (%)
Liquid Limit (LL)	39.5
Plastic Limit (PL)	22.1
Plasticity Index (PI)	17.4

3.1.4 Interpretations/Discussion

Concentrations of TCL Volatiles, TCL Semi-volatiles, and a review of chromatograms and listed TICs (Appendix III and IV) indicate a light petroleum product (i.e. gasoline) and a heavier petroleum product are present in subsurface soil samples MTP-01 (5-7) and MTP-01 (10-12) at Mercury Burial Site II. Chromatograms and TICs also indicate a heavier petroleum product in the remaining subsurface soil samples MTP-01 (2-4), MTP-02 (5-7), MTP-02 (10-12), and MTP-02 (15-17). Total base neutrals and total PAH concentrations were above New Jersey ECRA Guidance Values in subsurface soil samples MTP-01 (2-4) and MTP-01 (5-7) at Mercury Burial Site II.

The source of petroleum contamination is unknown at this time, but sources could be related to past disposal practices (i.e. contaminated soil, drums, etc.), surficial spills, proximity to USTs, etc.

A PCB concentration of 2.2 mg/kg was detected in subsurface soil sample MTP-02 (5-7) exceeding the New Jersey ECRA Guidance Value of 1.0 ppm.

Most of the metal concentrations detected above proposed Federal Action levels and/or New Jersey ECRA Guidance Values were comparable to metal concentrations in background soil samples listed on Table 11-1. However, copper concentrations of 4,210 mg/kg and 2,020 mg/kg detected in subsurface soil samples MTP-02 (5-7) and MTP-

02 (10-12), respectively, were significantly higher than other samples. It appears that most of the elevated metal concentrations were detected in the shallow surface samples with decreasing concentrations at depth.

The excavation program revealed three concrete mercury cells and one vertical section of a concrete sewer pipe at Mercury Burial Site I, all presumed to contain mercury contaminated material. All of the mercury burial cells appeared to be in reasonably good condition. No mercury burial cells were located as a result of excavations at what had been identified as Mercury Burial Site II. On-site PNS personnel indicated that the cells may be located north of the excavation area, under the black top parking lot. Additional research and interviews should be conducted in order to definitively locate Mercury Burial Site II.

3.2 Groundwater Sampling

On August 13, 1991, groundwater samples were collected from monitoring wells MW-2, MW-3, and MW-6. On August 14, 1991, groundwater samples were collected from monitoring wells MW-4, MW-5, and MW-7.

One replicate sample, labeled MW-02I-04, collected from MW-02 was included in this groundwater sampling.

The objectives of the groundwater sampling and analysis at the two Mercury Burial Sites are summarized as follows:

1) To provide valid groundwater data for all monitoring wells;
2) To evaluate the quality of groundwater in the vicinity of the Mercury Burial Sites;
3) To assess whether any potential contaminants related to the buried vaults have migrated to the groundwater. This assessment will also give an indication of the integrity of the vaults; and
4) To assess whether contaminants, if present, exceed applicable groundwater standards.

3.2.1 Sampling Procedures

Prior to collecting groundwater samples, the static water level in each monitoring well was measured, and the volume of water in each well was calculated. Monitoring well casing and groundwater elevation information during sampling are summarized in Table 3-3. All wells were first checked for immiscible product phases prior to purging using a precleaned, bottom-filling clear plexiglass bailer with a teflon check valve. The wells were then purged, as described in Section 2.6.1, using separate, dedicated, precleaned bottom-filling stainless-steel bailers or teflon bailers with teflon check valves. The wells were purged until at least three well volumes were removed. All purge water was contained in DOT-approved, 55-gallon drums supplied by PNS. The drums were labeled with the well locations from which the purge water was generated and later transported to and stored temporarily at the PNS Hazardous Waste Storage Area while awaiting sample analysis to ensure proper disposal.

Groundwater samples were collected as previously described in Section 2.6.1. All wells were sampled immediately after purging. All samples were collected in a manner to minimize agitation and other conditions which might disturb the sample and thus cause physicochemical changes (volatilization, adsorption, redox changes or degradation) in the sample.

At the time of sample collection, groundwater from the well being sampled was analyzed in the field for pH, temperature, specific conductance, turbidity, and salinity; results were recorded in the field notebook (see Appendix II). A summary of groundwater sampling and field parameter information is contained in Table 3-4.

All well samples were analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals). Samples collected for metal analyses were filtered in the field through 0.45 micron cellulose filters prior to being preserved in laboratory-supplied bottles. Preservatives provided in the laboratory-supplied bottles, and their associated analyses were as follows:

TABLE 3-3

MONITORING WELL CASING AND GROUNDWATER ELEVATION INFORMATION DURING SAMPLING

MERCURY BURIAL SITES (SWMU #9) PORTSMOUTH NAVAL SHIPYARD

AUGUST 13-14, 1991

Well N°	Depth to Groundwater From TC (ft.)	Total Depth of Well From TC (ft.)	TC Elevation (ft. MHT)	Groundwater Elevation (ft. MHT)	Bottom of Screen Elevation (ft. MHT)	Well Volume (Gallons)
MW-02	17.42	21.82	118.15	100.73	96.33	0.72
MW-03	15.61	19.34	116.14	100.53	96.80	0.61
MW-04	14.38	20.55	113.08	98.70	92.53	1.00
MW-05	15.08	22.14	113.45	98.37	91.31	1.15
MW-06	15.60	25.34	116.17	100.57	90.83	1.59
MW-07	15.51	25.07	113.86	98.35	88.79	1.56

MHT = Mean High Tide (Based on Elevation 100.00', Portsmouth Naval Shipyard System is Equal to 3.804' USGS System)
TC = Top of Casing

TABLE 3-4

GROUNDWATER SAMPLING AND FIELD PARAMETER INFORMATION

MERCURY BURIAL SITES (SWMU #9)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 13-14, 1991

Well N°	Sampling Date	Total Well Volumes Removed (Gallons)	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTUs)	Salinity (°/∞)
MW-02	8/13/91	4.0	6.97	16.0	480	82.9	0.0
MW-03	8/13/91	2.0	6.56	15.6	710	29.5	0.0
MW-04	8/14/91	3.5	7.49	16.2	1,420	>200	0.5
MW-05	8/14/91	3.75	7.44	13.9	5,900	>200	4.2
MW-06	8/13/91	5.0	7.15	15.1	5,800	>200	4.0
MW-07	8/14/91	5.0	7.16	14.0	9,500	>200	7.0

Metals (both dissolved and total)-Nitric Acid
Cyanide-Sodium Hydroxide
Volatiles-Hydrochloric Acid.

Upon collection, all samples were placed in coolers, packed in ice, and delivered via courier to CEIMIC.

3.2.2 Findings (Groundwater Conditions)

Turbidity in groundwater samples collected from four of the six monitoring wells, prior to sampling, exceeded the maximum reading (200 NTUs) of the turbidity meter.

Measured salinity and specific conductivity of groundwater samples collected from monitoring wells MW-02 and MW-03 indicate the presence of fresh water and wells MW-04, MW-05, MW-06, and MW-07 indicate the presence of brackish water conditions at the time of sampling. Table 3-5 summarizes the groundwater conditions during Phase II, III, and IV sampling events.

No immiscible product phases were observed in any of the monitoring wells.

3.2.3 Laboratory Analytical Results

Groundwater samples were collected from the six monitoring wells around the Mercury Burial Sites. In addition, one replicate sample (MW-02I-04) collected from monitoring well MW-02 was included in this groundwater sampling program. The sample numbers are followed by "-04" to denote the fourth phase of work. A summary of valid groundwater analytical results is provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

The State of Maine does not have published cleanup guidelines for contamination in water; therefore, NPDWR and proposed Federal Action Levels are used to evaluate the analytical data.

TABLE 3-5

SUMMARY OF GROUNDWATER CONDITIONS DURING PHASE II, III, AND IV SAMPLING EVENTS

MERCURY BURIAL SITES (SWMU #9) PORTSMOUTH NAVAL SHIPYARD

WELL Nº	PHASE II 8/22/90 SALINITY(°/∞)	PHASE III 2/7 - 2/12/91 SALINITY(°/∞)	PHASE IV 8/13 - 8/14/91 SALINITY(°/∞)	GROUNDWATER CONDITION
MW-02	0.0	0.1	0.0	F
MW-03	0.0	0.2	0.0	F
MW-04	0.6	0.2	0.5	B-F-B
MW-05	5.0	0.09	4.2	B-F-B
MW-06	NA	0.0	4.0	F-B
MW-07	NA	0.2	7.0	F-B

NA =Not Available
F =Fresh Water
B =Brackish Water
S =Saline Water

TCL Volatiles

Detectable volatile concentrations (Appendix III) were found in groundwater samples MW-02-04, MW-02I-04 (replicate sample of MW-02-04), MW-03-04, and MW-06-04. The compounds typically detected were benzene, toluene, ethylbenzene, and xylene (BTEX), however, no volatile concentrations were above NPDWR or proposed Federal Action Levels. No other groundwater samples had detectable volatile concentrations.

TCL Semi-Volatiles

Detectable semi-volatile concentrations (Appendix III) were found in all groundwater samples with the exception of MW-04-04. There were no quantitative-qualitative semi-volatile concentrations above the proposed Federal Action Levels, however, groundwater sample MW-03-04 had a qualitative concentration of bis(2-Ethylhexyl)phthalate (9 ug/L) that may be above the proposed Federal Action Level of 3 ug/L. Semi-volatiles are not a listed contaminant under NPDWR.

A review of chromatograms and listed TICs (Appendix IV) indicate petroleum in all groundwater samples except for MW-04-04. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum cannot be made at this time.

Pesticide/PCBs

There were no detectable pesticide or PCB concentrations found in any of the groundwater samples.

TAL Inorganics

Detectable total (unfiltered) and dissolved (filtered) metal concentrations were found in all groundwater samples. Table 3-6 shows the total metal concentrations which exceed NPDWR and/or proposed Federal Action Levels. Qualitative metal concentrations that may exceed NPDWR and/or proposed Federal Action Levels are also summarized in Table 3-6. There were no dissolved metal concentrations exceeding NPDWR or proposed Federal Action Levels.

TABLE 3-6

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER EXCEEDING NATIONAL PRIMARY DRINKING WATER REGULATIONS AND/OR PROPOSED FEDERAL ACTION LEVELS

MERCURY BURIAL SITES (SWMU #9) PORTSMOUTH NAVAL SHIPYARD

AUGUST 13-14, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
ANTIMONY	MW-02-04	34.00Q	NA	10.0
	MW-02I-04*	55.00Q	NA	10.0
	MW-04-04	32.00J	NA	10.0
	MW-06-04	41.00Q	NA	10.0
ARSENIC	MW-05-04	95.60Q	50.0	50.0
	MW-06-04	343.00J	50.0	50.0
	MW-07-04	106.00Q	50.0	50.0
BARIUM	MW-06-04	1560.00	1000.0	1000.0
BERYLLIUM	MW-04-04	1.00Q	NA	0.008
	MW-05-04	3.60Q	NA	0.008
	MW-06-04	13.30	NA	0.008
	MW-07-04	4.70Q	NA	0.008
CADMIUM	MW-02-04	12.00	5.0	10.0
	MW-02I-04*	17.00	5.0	10.0
	MW-03-04	6.00	5.0	10.0
	MW-05-04	6.00	5.0	10.0
	MW-06-04	157.00	5.0	10.0
	MW-07-04	13.00	5.0	10.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of MW-02-04
NA = Not Available

TABLE 3-6 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER
EXCEEDING NATIONAL PRIMARY
DRINKING WATER REGULATIONS
AND/OR PROPOSED FEDERAL ACTION LEVELS

MERCURY BURIAL SITES (SWMU #9)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 13-14, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
CHROMIUM	MW-04-04	60.00	50.0	50.0
	MW-05-04	176.00	50.0	50.0
	MW-06-04	636.00J	50.0	50.0
	MW-07-04	258.00	50.0	50.0
LEAD	MW-02-04	297.00	50.0	50.0
	MW-O2I-04*	392.00	50.0	50.0
	MW-03-04	72.10J	50.0	50.0
	MW-04-04	98.00	50.0	50.0
	MW-05-04	252.00	50.0	50.0
	MW-06-04	4760.00	50.0	50.0
	MW-07-04	246.00	50.0	50.0
NICKEL	MW-06-04	1930.00	NA	700.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of MW-02-04
NA = Not Available

There were no detectable cyanide concentrations in any of the groundwater samples.

3.2.4 Interpretations/Discussion

Concentrations of TCL Volatiles, TCL Semi-volatiles, and a review of chromatograms and listed TICs (Appendix IV) indicate a light petroleum product (i.e. gasoline) and a heavier petroleum product are present in groundwater from monitoring wells MW-02, MW-03, and MW-06 (Mercury Burial Site II). Low concentrations of BTEX detected in monitoring wells MW-02, MW-03, and MW-06 were relatively comparable to Phase II and III sampling results. Monitoring well MW-03 showed higher concentrations of ethylbenzene and total xylenes compared to previous sampling events. Chromatograms and TICs also indicate a heavier petroleum product is present in the groundwater from monitoring wells MW-05 and MW-07 (Mercury Burial Site I). There was no indication of petroleum in groundwater from MW-04 (Mercury Burial Site I). In any future sampling of the Mercury Burial Site wells, a petroleum identification should be requested as part of the analyses to determine the type of petroleum present in groundwater.

Detectable semi-volatile concentrations were found in all groundwater monitoring wells with the exception of MW-04. A qualitative concentration of bis(2-Ethylhexyl) phthalate in well MW-03 may be above the proposed Federal Action Level.

The source of petroleum product may be due to previous disposal practices or from the former gasoline station and the USTs located approximately 200 feet southwest of monitoring well MW-03. However, as discussed in Section 5.0, there was no indication of petroleum contamination in monitoring well GW-01 which is presumed to be downgradient of the USTs.

PCB concentrations detected during Phase III groundwater sampling of monitoring wells MW-02 and MW-06 were not detected in the Phase IV sampling results. Also, pesticides detected in monitoring well MW-02 during the Phase III sampling were not detected in the Phase IV sample results.

Phase IV metal concentrations were consistently lower than the Phase II and Phase III sampling results except for monitoring well MW-06. Groundwater in MW-06 continued to exhibit the highest metal concentrations. Elevated metal concentrations may be attributed to previous disposal practices in the vicinity of the Mercury Burial Sites. Based on analytical results, there does not appear to be any mercury in the groundwater attributed to potential releases from either Mercury Burial Site. However, subsurface vaults were not located at Mercury Burial Site II during the excavation program as discussed in Section 3.1.

Salinity and conductivity measurements collected during Phase II, III, and IV sampling events indicate a fluctuation between fresh and brackish water in monitoring wells MW-04 through MW-07. This may be an indication of a rise in brackish water and a decreasing fresh water lens in the summer months. Monitoring wells MW-02 and MW-03 are continually fresh water wells.

3.3 Water-Level Measurements/Hydraulic Conductivity Testing

Groundwater levels in monitoring wells MW-2 and MW-4 were measured and recorded hourly from September 27 to October 1, 1991, concurrent with water-level monitoring in the JILF wells. Hydraulic conductivity testing was conducted in the same wells on October 2, 1991. Since the three wells at each Mercury Burial Site are screened in the same material and at similar depth, only wells MW-2 and MW-4 were monitored and tested. Though located at separate SWMUs, these wells are located within the JILF

groundwater system. As such, the objective of the water-level monitoring and hydraulic conductivity testing at the Mercury Burial Sites was to provide hydrologic and hydraulic conductivity data for each site, as well as to compliment such data for the JILF.

3.3.1 Procedures

Water-level measurements and hydraulic conductivity tests were conducted as described in Section 2.7.1. Transducers used in both MW-2 and MW-4 were 10 PSI range, with an associated accuracy of 0.01 feet. During water-level measurements, the transducers from these wells were connected to Datalogger #1 of Table 2-18.

3.3.2 Findings

Water-Level Measurements

Hydrographs generated from the hourly water-level data are provided at the end of Appendix VII. Groundwater elevations are in reference to the mean high tide (MHT) datum used at the shipyard. For graphing purposes, the first data point was omitted from each hydrograph, thereby allowing the hydrographs to begin at 0000 hours. A graph of rainfall data, as described in Section 2.7.2,is included on each hydrograph. As evident on the hydrograph, water levels in MW-2 do not respond to tidal fluctuations. The hydrograph shows a gradual decline in water levels, characteristic of gravity drainage in an unconfined formation. Water-levels in MW-4, conversely, show a response to tidal fluctuations, superimposed upon a gradual decline in water levels. The tidal response is significantly dampened and lags the tidal fluctuations by three hours. The dampening and attenuation of the tidal pressure wave in MW-4 is likely an expression of the low permeable clay barrier reported to be in place between MW-4 and the embayment. MW-4 behaves similar to JW-5, where a minimum groundwater elevation is sustained by a water table, above which tidal effects are apparent.

Average groundwater elevations were computed for MW-2 and MW-4, as discussed in Section 2.7.2. Average groundwater elevations in MW-2 and MW-4 are 102.23 and 98.96 MHT, respectively. These elevations combined with groundwater elevations in the JILF wells suggest that groundwater in the unconsolidated materials is flowing from MW-2 toward the landfill. Within the landfill, groundwater appears to be flowing towards MW-4 and the embayment, with likely subradial and, near the reported clay barrier, possible lateral flow toward the landfill perimeter.

Hydraulic Conductivity Testing

Water-level recovery plots for each slug test are provided at the end of Appendix VII. The water-level recovery plots and associated regression line on the selected data provided the basic time lag, T_0, the variable necessary for estimating hydraulic conductivity via the Hvorslev method. Neither MW-2 nor MW-4 were saturated during the slug tests, thereby making it necessary to distinguish between sand pack and formation drainage. The water-level recovery plots for MW-4 appear to show distinct drainage curves indicative of formation drainage subsequent to sand pack drainage; that is, an initial straight line recovery followed by a second straight line recovery of different slope. However, such drainage is not as distinct in MW-2. The resulting hydraulic conductivities for MW-2 and MW-4 are 9.28×10^{-3} cm/day (26.3 ft/day) and 2.12×10^{-3} cm/sec (6.01 ft/day), respectively. The result for MW-2 is for the falling head test only, whereas the result for MW-4 represents the average of the falling and rising head tests.

3.4 Conclusions/Recommendations

McLaren/Hart completed field investigations at the Mercury Burial Site II (western site) and Mercury Burial Site I (eastern site) during Phases I through IV. Groundwater monitoring wells MW-02 and MW-03 (Mercury Burial Site II) and monitoring wells MW-04

and MW-05 (Mercury Burial Site I) were installed during the Phase I field investigation. Additional monitoring wells MW-06 and MW-07 were installed at Mercury Burial Sites II and I, respectively, during the Phase III field investigation. Subsurface soil samples were collected from the Phase I soil boring program (RCRA metal analyses only) and the Phase IV excavation program.

The BTEX detected during Phase II through Phase IV sampling events and the petroleum signatures indicated on chromatograms (Phase IV) suggests the presence of a lighter petroleum product such as gasoline in groundwater monitoring wells MW-02, MW-03, and MW-06. Subsurface soils collected from Mercury Burial Site II also revealed the presence of a lighter petroleum product such as gasoline.

Detected semi-volatile concentrations, chromatograms, and listed TICs (Phase IV) suggest the presence of a heavier petroleum product in all wells except for MW-04. Phase IV subsurface soils revealed the presence of a heavier petroleum in all soil samples from Mercury Burial Sites I and II.

The source of petroleum in the groundwater and subsurface soil is unknown, but might be attributed to the former gasoline station and associated USTs (located approximately 200 feet southwest of MW-03), previous disposal practices (i.e., petroleum contaminated soils, drums, etc.), surficial spillage, and use of petroleum-based products for dust suppression on roadways.

In any future sampling of subsurface soils and groundwater at Mercury Burial Sites I and II, a petroleum identification should be requested as part of the analyses to determine the type of petroleum present.

Low levels of pesticides and PCBs detected during Phase III in monitoring wells MW-02 and MW-06 were not detected in the Phase IV sampling results. However, a PCB concentration of 2.2 mg/kg, which is above the New Jersey ECRA Guidance Value, was present in Phase IV subsurface soil sample MTP-02(5-7) at Mercury Burial Site I.

Elevated levels of some metals were detected in the Phase II through Phase IV groundwater sampling program; however, analytical data did not reveal any significant releases of mercury. Also, subsurface soil samples (Phase I and IV) did not reveal any significant releases of mercury. Elevated metals may be attributed to previous disposal practices (i.e., scrap metal, sandblast grit, etc.) in the vicinity of the Mercury Burial Sites.

The concrete mercury disposal cells at Mercury Burial Site I were excavated and inspected for integrity. All of the concrete mercury cells appeared to be in reasonably good condition. Concrete mercury cells were not located during excavation activities at Mercury Burial Site II. Additional research and interviews are required in order to locate Mercury Burial Site II. PNS personnel knowledgeable in the possible location of Mercury Burial Site II should be contacted prior to any additional excavations. A contingency plan for encountering asbestos should be developed prior to any further excavations.

Groundwater elevation data suggest that groundwater is likely flowing from MW-2 towards the landfill. The hydrograph for MW-4 shows significantly dampened and lagged water-levels in response to the tide, likely on expression of the reported clay barrier. Groundwater elevation data for MW-4 and surrounding wells indicate that groundwater is flowing toward the embayment, with possible lateral flow toward the landfill perimeter.

A Corrective Measures Overview report was submitted as a separate document. The Corrective Measures Overview report discusses alternative site remediation for the Mercury Burial Sites.

4.0 DEFENSE REUTILIZATION MANAGEMENT OFFICE--DRMO (SWMU #6)

The purpose of this phase of work at the DRMO was as follows:

-- Establish an initial database regarding subsurface and bedrock groundwater quality in the area of Building 298;

-- Continue monitoring shallow and bedrock groundwater quality;

-- Evaluate surface soil contamination at the DRMO; and

-- Further evaluate soil contamination at Quarters "S"and "N".

Specific tasks of the Phase IV field program relating to the DRMO were as follows:

- DRMO Surface Soil Sampling
- Quarters "S"and "N"Soil Sampling
- Drilling, Soil Sampling, and Monitoring Well Installation
- Monitoring Well Development
- Groundwater Sampling
- Hydraulic Conductivity Testing/Water Level Measurements

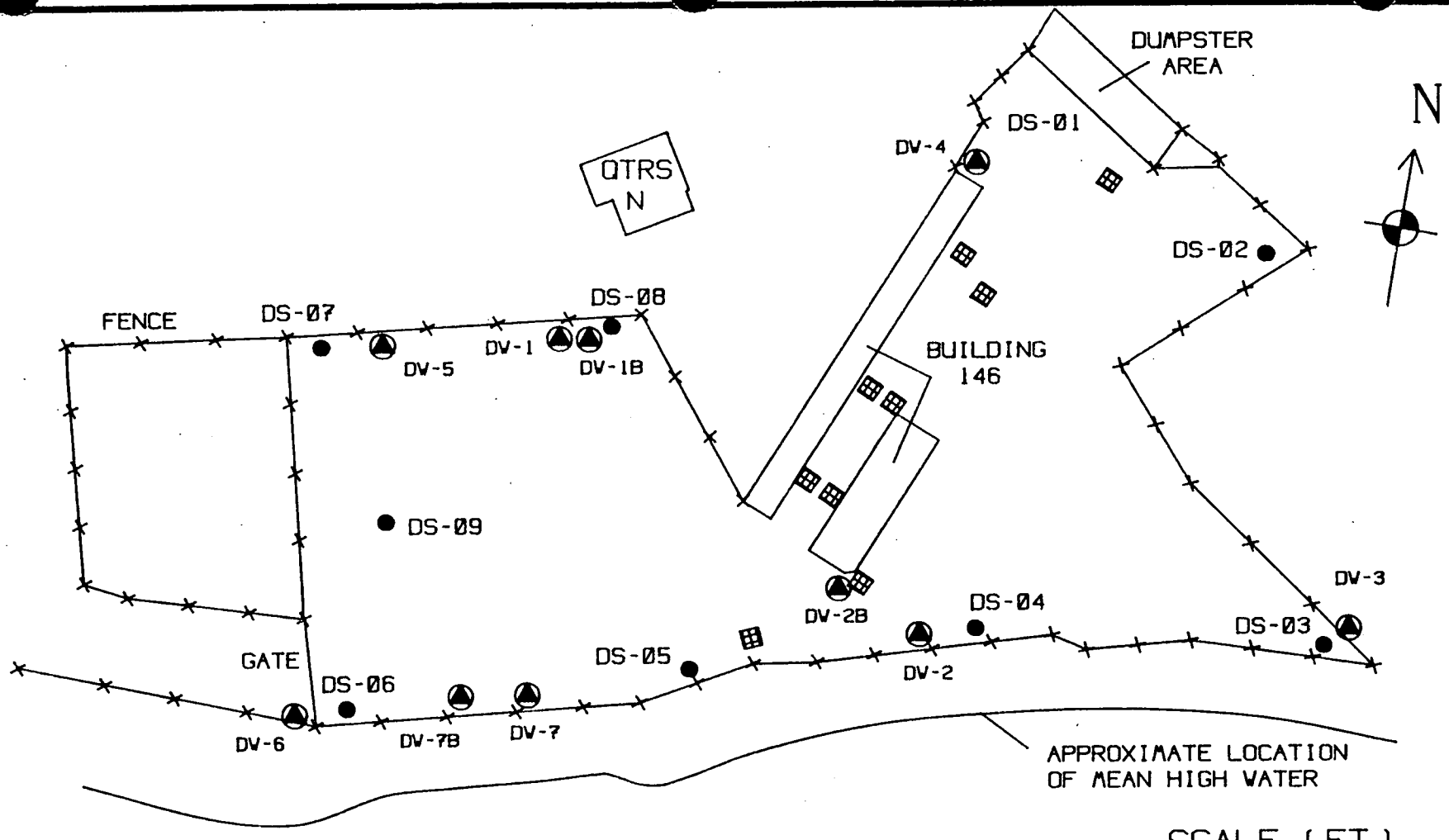
The information collected from this field work will help to evaluate future courses of action for the DRMO Storage Facility.

4.1 DRMO Surface Soil Sampling

On July 16 and 17, 1991, nine surface soil samples, plus one duplicate sample and equipment rinseate field blank, were collected within the fenced area of the DRMO as shown in Figure 4-1. These samples were collected at the request of EPA and for risk assessment purposes.

4.1.1 Sampling Procedures

Surface soil samples were obtained from the upper twelve inches of the soil column or until refusal at each location. The samples collected were labeled DS-01 through DS-09 followed by the footage interval from which the sample was obtained. A duplicate sample, labeled DS-02(1-2), was collected at location DS-02(0-1). An equipment rinseate field blank, DRB-08-04, was also included in the soil sampling.



SCALE (FT)

0 10 20 50 90 140

LEGEND:

SURFACE SOIL SAMPLE LOCATION

CATCH BASIN LOCATION

TEST BORING/MONITORING WELL LOCATIONS

FIGURE 4-1

DRMO (SWMU #6)

SURFACE SOIL SAMPLE LOCATION MAP

McLAREN/HART

Each sample was collected using a properly decontaminated hand auger and a stainless-steel trowel. The sample was placed in a precleaned stainless-steel mixing bowl, homogenized and transferred to the appropriate laboratory-supplied sample bottles. The sampling equipment was decontaminated prior to use at each location to prevent cross-contamination according to the protocol described in Table 2-1. All samples were stored on ice in a field cooler and delivered via courier to CEIMIC to be analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Two soil samples DS-05(0-0.5) and DS-06(0-1) were also selected for particle size analysis. All soil sample locations were measured from fixed points.

4.1.2 Findings

All soil samples collected were obtained by hand augering the upper twelve inches of the soil column or until refusal. The description of soil varies slightly, but in general, most soil samples consisted of brown fine to medium grained sand and silt, with a trace of fine to medium grained gravel. Noticeable exceptions occurred at the following sample locations:

- DS-01(0-1): Tan loamy silt (organic rich) with some fine to medium grained sand.
- DS-02(0-1): Brown to black, appears slightly stained, and trace of metal debris.
- DS-03(0-0.5): Reddish-brown silt and fine grained sand, coarse gravel, and trace of wood fragments.
- DS-06(0-1): Top six inches of soil column contains a trace of metal debris. Bottom six inches of soil column appears slightly stained.
- DS-07(0-1): Brown fine to medium grained sand, trace of metal debris.
- DS-08(0-1): Brown to black, organic rich (roots), trace of metal slag.
- DS-09(0-0.2): Brown fine grained sand with some fine grained gravel, stained with grease or oil, slight odor. Refusal due to asphalt.

4.1.3 Laboratory Analytical Results

A total of nine surface soil samples were collected within the fenced area of the DRMO, plus one duplicate sample and one equipment rinseate field blank (Figure 4-1). These samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Two of the samples DS-05(0-0.5) and DS-06(0-1) were also submitted for particle size analysis. A summary of valid surface soil sample results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in soils, New Jersey ECRA Guidance Values and proposed Federal Action Levels are used for comparison purposes.

TCL Volatiles

Qualitative volatile concentrations were detected in some of the surface soil samples collected at the DRMO. There were no volatile concentrations above the New Jersey ECRA Guidance Values or proposed Federal Action Levels.

TCL Semi-Volatiles

Detectable concentrations of TCL Semi-Volatiles were found in all surface soil samples, with the exception of DS-07(0-1). The bis(2-ethylhexyl)phthalate concentration of 110 mg/kg in sample DS-09(0-0.2) exceeded the proposed Federal Action Level of 50 mg/kg. There is no applicable New Jersey ECRA Guidance Value for bis(2-ethylhexyl)phthalate in soil. No other individual analytes exceeded New Jersey ECRA Guidance Values and/or proposed Federal Action Levels.

Three of the surface soil samples had total base neutral concentrations above the New Jersey ECRA Guidance Value of 10 ppm for total base neutrals in soil. These sample results are summarized in Table 4-1 and are shown on Figure 4-2. None of these samples had total acid extractable concentrations exceeding the New Jersey ECRA Guidance Value of 10 ppm.

A review of the chromatograms and listed TICs contained in the laboratory data package indicate the presence of a heavy petroleum product in all of the surface soil samples. The specific petroleum product could not be positively identified since a petroleum ID was not one of the parameters analyzed.

TCL Pesticide/PCBs

Valid detectable concentrations of TCL pesticides were found in all of the surface soil samples, with the exception of DS-02(0-1), DS-02(1-2) (duplicate of DS-02(0-1)) and the equipment rinseate field blank, DRB-08-04. Only four of these surface soil samples had detectable concentrations above proposed Federal Action Levels for pesticides in soil. Pesticides are not listed under New Jersey ECRA Guidance Values. There were five surface soil samples exceeding the New Jersey ECRA Guidance Value and/or proposed Federal Action Level for PCBs in soil. Pesticide and PCB sample results are summarized in Table 4-1 and are shown in Figure 4-2.

TABLE 4-1

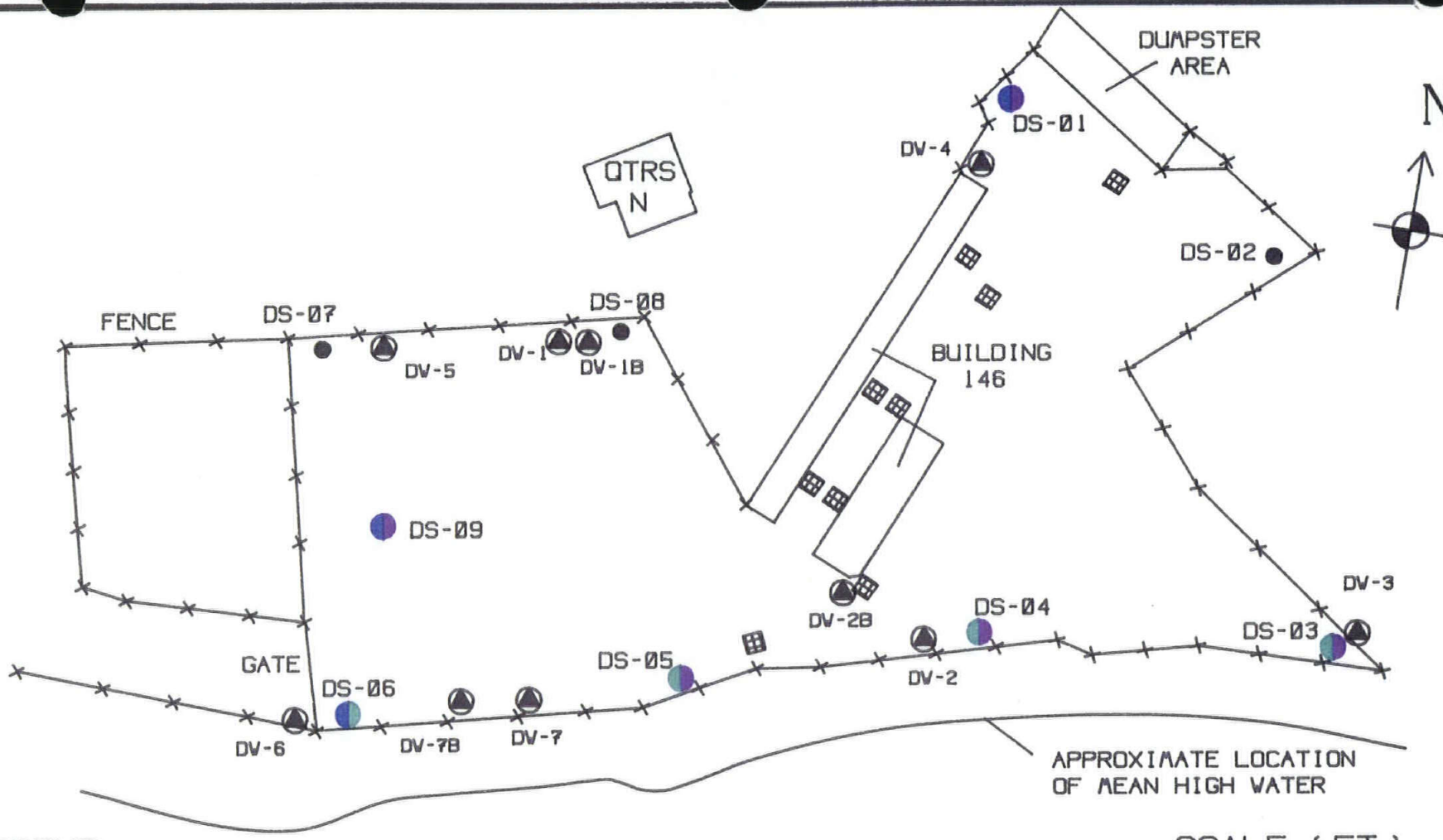
SUMMARY OF SEMI-VOLATILE AND PESTICIDE/PCB CONCENTRATIONS – SURFACE SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 16-17, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
TOTAL BASE NEUTRALS	DS-01(0-1)	25.82	10.0	NA
	DS-06(0-1)	106.90	10.0	NA
	DS-09(0-0.2)	127.00	10.0	NA
PESTICIDES				
DIELDRIN	DS-03	0.17	NA	0.04
	DS-04	0.20	NA	0.04
	DS-05	0.28	NA	0.04
ALDRIN	DS-06	0.11	NA	0.04
PCBs	DS-01(0-1)	0.69	1.0-5.0	0.09
	DS-03(0-0.5)	5.40*	1.0-5.0	0.09
	DS-04(0-0.5)	7.00*	1.0-5.0	0.09
	DS-05(0-0.5)	6.00*	1.0-5.0	0.09
	DS-09(0-0.2)	5.20	1.0-5.0	0.09

NA =Not Available
* =Valve Reported From the Diluted Samples



LEGEND:

- SURFACE SOIL SAMPLE LOCATION
  - TOTAL BASE NEUTRALS
  - PESTICIDES
  - PCBs
  - SOIL CONCENTRATIONS EXCEEDING PROPOSED FEDERAL ACTION LEVELS AND/OR NEW JERSEY ECRA GUIDANCE VALUES
- OTHER PHASE IV SURFACE SOIL SAMPLING LOCATIONS
- CATCH BASIN LOCATION
- TEST BORING/MONITORING WELL LOCATIONS

SCALE (FT)

0 10 20 50 90 140

FIGURE 4-2

DRMO (SWMU #6)

SURFACE SOIL SAMPLING RESULTS

McLAREN/HART

TAL Inorganics

There were no detectable cyanide concentrations in any of the surface soil samples. Metal concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels were found in all surface soil samples as shown in Table 4-2.

TOC, pH, and Percent Moisture

Table 4-3 shows the results for TOC, pH, and percent moisture analyses. The TOC analyses results ranged from 1.3% to 44.0%. The pH results ranged from 6.4 to 7.8. The percent moisture results ranged from 2% to 16%.

Particle Size Analysis

A particle size analysis was conducted on surface soil samples DS-05(0-0.5) and DS-06(0-1). The particle size analysis results for DS-05(0-0.5) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		32%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		53%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	14%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	31%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	8%	
Silt size, 0.074 to 0.005 mm:		14%
Clay, smaller than 0.005 mm:		1%
Colloids, smaller than 0.001 mm:		0%

TABLE 4-2

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 16-17, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
ANTIMONY	DS-02(1-2)*	17.10J	10.0	30.0
	DS-03(0-0.5)	580.00J	10.0	30.0
ARSENIC	DS-03(0-0.5)	20.60J	20.0	80.0
BARIUM	DS-06(0-1)	592.00	400.0	NA
BERYLLIUM	DS-01(0-1)	3.60J	1.0	0.2
	DS-02(0-1)	1.00Q	1.0	0.2
	DS-02(1-2)*	0.81Q	1.0	0.2
	DS-03(0-0.5)	0.45Q	1.0	0.2
	DS-04(0-0.5)	1.20J	1.0	0.2
	DS-05(0-0.5)	2.40J	1.0	0.2
	DS-06(0-1)	0.49Q	1.0	0.2
	DS-08(0-1)	1.70Q	1.0	0.2
	DS-09(0-0.2)	1.70Q	1.0	0.2
CADMIUM	DS-01(0-1)	4.30	3.0	40.0
	DS-02(0-1)	6.70	3.0	40.0
	DS-02(1-2)*	4.90	3.0	40.0
	DS-03(0-0.5)	4.30	3.0	40.0
	DS-04(0-0.5)	6.50	3.0	40.0
	DS-05(0-0.5)	11.20	3.0	40.0
	DS-06(0-1)	13.30	3.0	40.0
	DS-08(0-1)	3.80	3.0	40.0
	DS-09(0-0.2)	8.30	3.0	40.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of DS-02(0-1)

TABLE (Continued)

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 16-17, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
CHROMIUM	DS-01(0-1)	102.00J	100.0	400.0
	DS-04(0-0.5)	127.00J	100.0	400.0
COPPER	DS-01(0-1)	539.00	170.0	NA
	DS-02(0-1)	278.00	170.0	NA
	DS-03(0-0.5)	568.00	170.0	NA
	DS-04(0-0.5)	1,840.00	170.0	NA
	DS-05(0-0.5)	1,580.00	170.0	NA
	DS-06(0-1)	246.00	170.0	NA
	DS-08(0-1)	329.00	170.0	NA
	DS-09(0-0.2)	466.00	170.0	NA
LEAD	DS-01(0-1)	371.00J	250-1,000	NA
	DS-02(0-1)	786.00J	250-1,000	NA
	DS-02(1-2)*	2,870.00J	250-1,000	NA
	DS-03(0-0.5)	255,000.00J	250-1,000	NA
	DS-04(0-0.5)	6,130.00J	250-1,000	NA
	DS-05(0-0.5)	3,070.00J	250-1,000	NA
	DS-06(0-1)	7,700.00J	250-1,000	NA
	DS-07(0-1)	74,600.00J	250-1,000	NA
	DS-08(0-1)	1,260.00J	250-1,000	NA
	DS-09(0-0.2)	25,700.00J	250-1,000	NA
MERCURY	DS-05(0-0.5)	1.20	1.0	20.0
	DS-06(0-1)	13.80	1.0	20.0
	DS-08(0-1)	1.90	1.0	20.0
NICKEL	DS-01(0-1)	153.00	100.0	2,000.0
	DS-02(0-1)	120.00	100.0	2,000.0
	DS-03(0-0.5)	235.00	100.0	2,000.0
	DS-04(0-0.5)	2,670.00	100.0	2,000.0
	DS-05(0-0.5)	250.00	100.0	2,000.0
	DS-09(0-0.2)	201.00	100.0	2,000.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of DS-02(0-1)

TABLE 4-2 (C ntinued)

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 16-17, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
SILVER	DS-03(0-0.5)	6.70J	5.0	200.0
ZINC	DS-01(0-1)	1,070.00J	350.0	NA
	DS-02(0-1)	741.00J	350.0	NA
	DS-02(1-2)*	434.00J	350.0	NA
	DS-03(0-0.5)	972.00J	350.0	NA
	DS-04(0-0.5)	627.00J	350.0	NA
	DS-05(0-0.5)	1,990.00J	350.0	NA
	DS-06(0-1)	2,090.00J	350.0	NA
	DS-09(0-0.2)	911.00J	350.0	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of DS-02(0-1)

TABLE 4-3

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 16-17, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
DS-01(0-1)	2.3	7.6	10
DS-02(0-1)	31.0	7.8	14
DS-02(1-2)*	44.0	7.4	13
DS-03(0-0.5)	1.6	7.4	8
DS-04(0-0.5)	1.9	6.5	6
DS-05(0-0.5)	4.1	7.6	8
DS-06(0-1)	4.5	7.1	16
DS-07(0-1)	1.3	6.4	5
DS-08(0-1)	7.8	6.8	12
DS-09(0-0.2)	6.5	6.5	2

* = McLAREN/HART Duplicate Sample of DS-02(0-1)

The particle size analysis for DS-06(0-1) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		13%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		63%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	8%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	30%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	25%	
Silt size, 0.074 to 0.005 mm:		24%
Clay, smaller than 0.005 mm:		0%
Colloids, smaller than 0.001 mm:		0%

4.1.4 Interpretations/Discussion

Surface soil samples were collected inside the fence at the DRMO to characterize the surface soil for risk assessment purposes. A total of ten surface soil samples, including one duplicate, were collected inside the fence at the DRMO (Figure 4-1). In addition to these samples, an equipment rinseate field blank, DRB-08-04, was also collected.

The chromatograms for TCL Semi-Volatiles indicate the presence of a heavier weight, higher boiling point petroleum product in all of the surface soil samples at the DRMO. The chromatograms also indicate that the petroleum product is weathered at every location, except for DS-03(0-0.5), based on the lack of well defined peaks along the chromatogram. The peaks along the chromatogram for sample DS-03(0-0.5) are well defined indicating relatively fresh petroleum product. This sample was collected in close proximity to current scrap metal storage operations. The freshness of the petroleum product in sample DS-03(0-0.5) may be the result of precipitation/runoff across the metal pile which could mobilize any petroleum product on the metal. The specific source and type of the petroleum product in the surface soils at the DRMO is unknown at this time.

TCL pesticides were found in every soil sample, with the exception of location DS-02. One sample, DS-06(0-1), had a detectable concentration of Aldrin above the proposed Federal Action Level of 0.04 mg/kg. In addition, three samples, DS-03(0-0.5), DS-04(0-0.5), DS-05(0-0.5), had concentrations of Dieldrin above the proposed Federal Action Level of 0.04 mg/kg. Aldrin is primarily used as an insecticide for soil dwelling pests. The manufacture and usage of Aldrin has ceased in the United States. Once released to the environment, Aldrin will degrade to Dieldrin. The primary use for Dieldrin was as an insecticide on corn which doesn't apply to PNS, therefore, the probable source of the Dieldrin is the environmental degradation of Aldrin. Given the low levels found, the source of the Aldrin may be a former PNS spraying program and/or storage practices at the DRMO.

Detectable concentrations of PCBs were found in five of the surface soil samples collected within the DRMO. All of the detected concentrations were for Aroclor-1254 only and all exceeded the proposed Federal Action Level of 0.09 mg/kg. Additionally, all of detected concentrations exceeded the New Jersey ECRA Guidance Value range of 1-5 ppm, with the exception of sample DS-01(0-1). The presence of the PCBs can be attributed to the storage practices of PCB transformers within the DRMO.

TAL metal concentrations exceeding the New Jersey ECRA Guidance Values and/or proposed Federal Action Levels were detected in all of the surface soil samples (Table 4-2). In general, these detected concentrations are consistently higher than the concentrations detected in the background soil samples (Section 11.0). The presence of the metals in the surface soil can be attributed to the metal storage practices within the DRMO.

The TOC, pH and percent moisture results were within expected ranges with the exception of the TOC result at sample location DS-02. The TOC results for the two

samples collected at this location, sample (DS-02(0-1)) and duplicate (DS-02(1-2)), were 31 percent and 44 percent, respectively. The similarity in these two results indicate that the results are probably valid as reported. Sources for the elevated concentrations of TOC are unknown at this time.

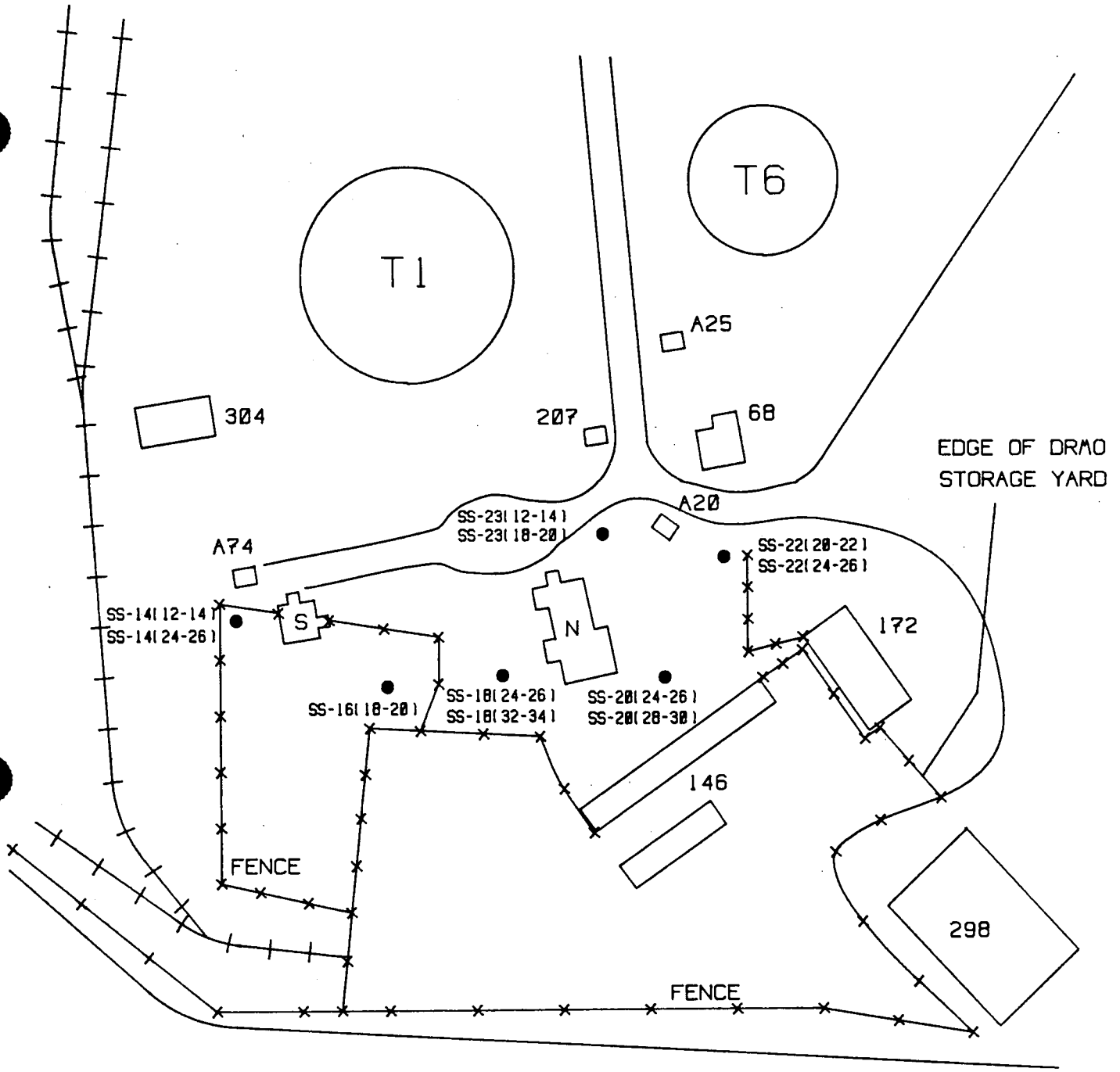
4.2 Quarters "S" & "N" Soil Sampling

On July 10 and 11, 1991, eleven soil samples, plus one duplicate sample and one equipment rinseate field blank, were collected in the vicinity of Quarters "S" and "N" as shown in Figure 4-3. The analytical results for soil samples collected in the vicinity of Quarters "S" and "N" on August 7 and 8, 1990 showed detectable concentrations of priority pollutant metals, total petroleum hydrocarbons (TPH), and TCL pesticides. The objective of this soil sampling program was to further assess the potential for contamination at depth at those locations where elevated concentrations were previously detected. The field notebook (Appendix II) identifies the exact sample locations measured from fixed points.

4.2.1 Sampling Procedures

Soil borings were drilled to the desired sampling depth using a two person power auger with a four inch, outside diameter, solid stem auger. A power auger was used because of the frequent refusals encountered with the hand auger during previous sampling events. The sampling intervals at each location are shown in Figure 4-3. A duplicate sample, labeled SS-18(26-28), was collected at SS-18(24-26) to monitor laboratory performance.

Once the desired sampling depth was reached with the power auger, an attempt was made to clean out soil which fell in from the surface. This soil was removed with a clean stainless-steel trowel or a clean hand auger. The method used depended on whether the sampling personnel could physically reach the sample interval. Soil samples were collected using a properly cleaned stainless-steel trowel or hand auger, depending on the reach of the



N

PISCATAQUA RIVER

NOT TO SCALE

LEGEND:

● PHASE IV SOIL SAMPLING LOCATIONS

FIGURE 4-3

DRMO (SWMU #6)
QUARTERS "S" AND "N"
SAMPLING LOCATIONS

McLAREN/HART

sampling personnel. Because of the nature of the sampling methods used, any sample collected may be affected by surficial material falling into the bore hole even though precautions were made to clean out the bore hole prior to sampling. Each sample was placed in a stainless-steel mixing bowl, homogenized and transferred to laboratory-supplied sample bottles. All samples were stored on ice in a field cooler and hand delivered to CEIMIC.

The power auger flights, hand augers, stainless-steel trowels and mixing bowls were decontaminated prior to use according to the protocol described in Table 2-1.

4.2.2 Findings

All soil samples collected from Quarters "S"and "N"were obtained from the upper three feet of the soil column. In general, the soil consisted of brown, fine to coarse grained sand and silt with varying amounts of fine to medium grained gravel. Organic matter (roots) and rock fragments were also observed in some of the samples. No soil discoloration, staining or unnatural odors were observed in any of the soil samples.

4.2.3 Laboratory Analytical Results

A total of eleven soil samples were collected in the vicinity of Quarters "S"and "N", plus one duplicate sample and one equipment rinseate field blank. These samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. In addition, a particle size analysis was conducted on soil samples SS-18(24-26) and SS-23(18-20). A summary of the valid analytical results of the soil samples collected during the Phase IV sampling event are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in soils, New Jersey's Environmental Cleanup Responsibility Act (ECRA) Guidance Values and proposed Federal Action Levels documented in the Federal Register (55FR30865, July 27, 1990) are used for comparison purposes.

TCL Volatiles

Detectable volatile concentrations were found in some of the soil samples around Quarters "S" and "N". All of these concentrations were qualitative only with the exception of a qualitative and semi-quantitative concentration of acetone (4300 ug/mg) in sample SS-18(22-34). There were no volatile concentrations above New Jersey ECRA Guidance Values or proposed Federal Action Levels.

TCL Semi-Volatiles

Qualitative semi-volatile concentrations were detected in all soil samples with the exception of samples SS-18(24-26), SS-22(20-22) and the equipment rinseate field blank, DRB-04-04. There were no semi-volatile concentrations exceeding New Jersey ECRA Guidance Values or proposed Federal Action Levels for any individual analyte, total base neutrals, or total acid extractables.

A review of chromatograms and listed TICs indicate the presence of a heavier petroleum product in the following samples: SS-14(12-14), SS-18(24-26), SS-18(26-28), SS-18(32-34), SS-20(24-26), SS-20(28-30), SS-22(20-22), SS-22(24-26), SS-23(12-14), SS-23(18-20). Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum cannot be accomplished at this time.

TCL Pesticide/PCBs

Valid concentrations of TCL Pesticides were detected in seven of the eleven soil sampling intervals around Quarters "S" and "N". There were no pesticide concentrations

above proposed Federal Action Levels. Pesticides are not listed under New Jersey ECRA Guidance Values. There were no detectable PCB concentrations in any of the soil samples.

TAL Inorganics

There were no detectable cyanide concentrations in any of the soil samples. Detectable metal concentrations were found in all of the soil samples above New Jersey ECRA Guidance Values and/or proposed Federal Action Levels. Table 4-4 summarizes soil samples which exceed New Jersey ECRA Guidance Values and/or proposed Federal Action Levels for metals in soil.

TOC, pH, Percent Moisture

Table 4-5 shows the results for TOC, pH, and percent moisture analyses. The TOC results ranged from 1.1% to 4.7%. The pH results ranged from 5.4 to 7.8. The percent moisture results ranged from 3% to 17%.

Particle Size Analysis

A particle size analysis was conducted on soil samples SS-18(24-26) and SS-23(18-20). The particle size analysis for SS-18(24-26) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		14%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		43%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	8%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	19%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	16%	
Silt size, 0.074 to 0.005 mm:		43%
Clay, smaller than 0.005 mm:		0%
Colloids, smaller than 0.001 mm:		0%

TABLE 4-4

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
QUARTERS "S" AND "N"
PORTSMOUTH NAVAL SHIPYARD

JULY 10 - 11, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
ARSENIC	SS-14(24-26)	26.80J	20.0	80.0
	SS-18(24-26)	28.20J	20.0	80.0
	SS-18(26-28)*	27.70J	20.0	80.0
	SS-22(20-22)	51.60J	20.0	80.0
	SS-22(24-26)	47.30J	20.0	80.0
BERYLLIUM	SS-14(12-14)	1.10J	1.0	0.2
	SS-14(24-26)	1.10Q	1.0	0.2
	SS-16(18-20)	0.69Q	1.0	0.2
	SS-18(24-26)	0.97Q	1.0	0.2
	SS-18(26-28)*	0.94J	1.0	0.2
	SS-18(32-34)	1.00Q	1.0	0.2
	SS-20(24-26)	1.10J	1.0	0.2
	SS-20(28-30)	0.93Q	1.0	0.2
	SS-22(20-22)	1.00Q	1.0	0.2
	SS-22(24-26)	1.40J	1.0	0.2
	SS-23(12-14)	2.00	1.0	0.2
	SS-23(18-20)	1.50	1.0	0.2
CADMIUM	SS-23(12-14)	4.60	3.0	40.0
	SS-23(18-20)	3.70	3.0	40.0
CHROMIUM	SS-14(24-26)	103.00	100.0	400.0
	SS-22(20-22)	169.00	100.0	400.0
	SS-22(24-26)	154.00	100.0	400.0
	SS-23(12-14)	226.00	100.0	400.0
	SS-23(18-20)	188.00	100.0	400.0

Q = Quaitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of SS-18(24-26)

TABLE 4-4 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
QUARTERS "S" AND "N"
PORTSMOUTH NAVAL SHIPYARD

JULY 10 - 11, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
LEAD	SS-14(12-14)	262.00	250-1,000	NA
	SS-23(12-14)	472.00J	250-1,000	NA
NICKEL	SS-22(24-26)	107.00	100.0	2,000.0
	SS-23(12-14)	156.00J	100.0	2,000.0
	SS-23(18-20)	127.00J	100.0	2,000.0

Q = Quaitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of SS-18(24-26)

TABLE 4-5

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS

DRMO (SWMU #6)
QUARTERS "S" AND "N"
PORTSMOUTH NAVAL SHIPYARD

JULY 10 - 11, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
SS-14(12-14)	2.8	7.7	12
SS-14(26-28)	2.2	7.8	12
SS-16(18-20)	1.1	7.7	3
SS-18(24-26)	3.3	7.1	12
SS-18(26-28)*	2.2	7.0	10
SS-18(32-34)	3.9	6.1	17
SS-20(24-26)	2.8	6.4	15
SS-20(28-30)	2.6	6.6	12
SS-22(20-22)	2.1	6.8	11
SS-22(24-26)	1.8	6.1	14
SS-23(12-14)	4.7	5.4	7
SS-23(18-20)	4.5	6.1	10

* = McLAREN/HART Duplicate Sample of SS-18(24-26)

The particle size analysis for SS-23(18-20) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		47%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		20%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	6%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	8%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	6%	
Silt size, 0.074 to 0.005 mm:		32%
Clay, smaller than 0.005 mm:		1%
Colloids, smaller than 0.001 mm:		0%

4.2.4 Interpretations/Discussion

A total of twelve soil samples, including a duplicate, were collected from around Quarters "S" and "N" to assess the vertical extent of contamination detected in previous phases of the investigation. In addition to these soil samples, an equipment rinseate field blank, DRB-04-04, was also collected.

There were no TCL volatile or semi-volatile concentrations detected above New Jersey ECRA Guidance Values and/or proposed Federal Action Levels. The chromatograms for TCL semi-volatiles indicate the presence of a weathered, heavier weight, higher boiling point petroleum product in all of the soil samples with the exception of SS-18(24-26) and SS-22(20-22). The specific type and source of the petroleum product is unknown at this time.

TCL pesticides were detected in seven of the eleven soil sampling intervals. Five of these samples had concentrations of both 4,4'-DDT and 4,4'-DDE, one sample had concentrations 4,4'-DDT, 4,4'-DDE and 4,4'-DDD and the last sample had concentrations

of 4,4'-DDE only. Some of the background soil samples contained detectable concentrations of 4,4'-DDT and 4,4'-DDE at similar concentrations. Both 4,4'-DDE and 4,4'-DDD are environmental degradation products of 4,4'-DDT. The concentrations detected for these analytes are within the expected ranges based on the results of previous sampling events around Quarters "S" and "N". A potential source for these pesticides in the soil may be a former PNS spraying program.

Eight out of eleven soil samples collected from the Phase IV sampling event had metal concentrations above New Jersey ECRA Guidance Values and/or proposed Federal Action Levels as shown in Table 4-4. The concentrations of the metals detected in these soil samples are comparable with the results for the background soil samples (Section 11.0). In addition, the results for these samples are generally comparable with or are less than the results for the same metals detected in the DRMO surface soil samples. The presence of TAL metals in the soil around Quarters "S" and "N" may be attributed to either background conditions and/or wind dispersion from the DRMO.

Comparing metal results from Phase II soil sampling activities to results from Phase IV indicate lead concentrations decreasing with depth. Higher lead concentrations, evident in the shallow near surface samples collected in Phase II, may be the direct result of air dispersion of lead contamination from the DRMO. The only other comparable metal concentrations from Phase II and Phase IV are the results for arsenic. Arsenic concentrations remained relatively constant in the two sampling events and do not appear to change with depth.

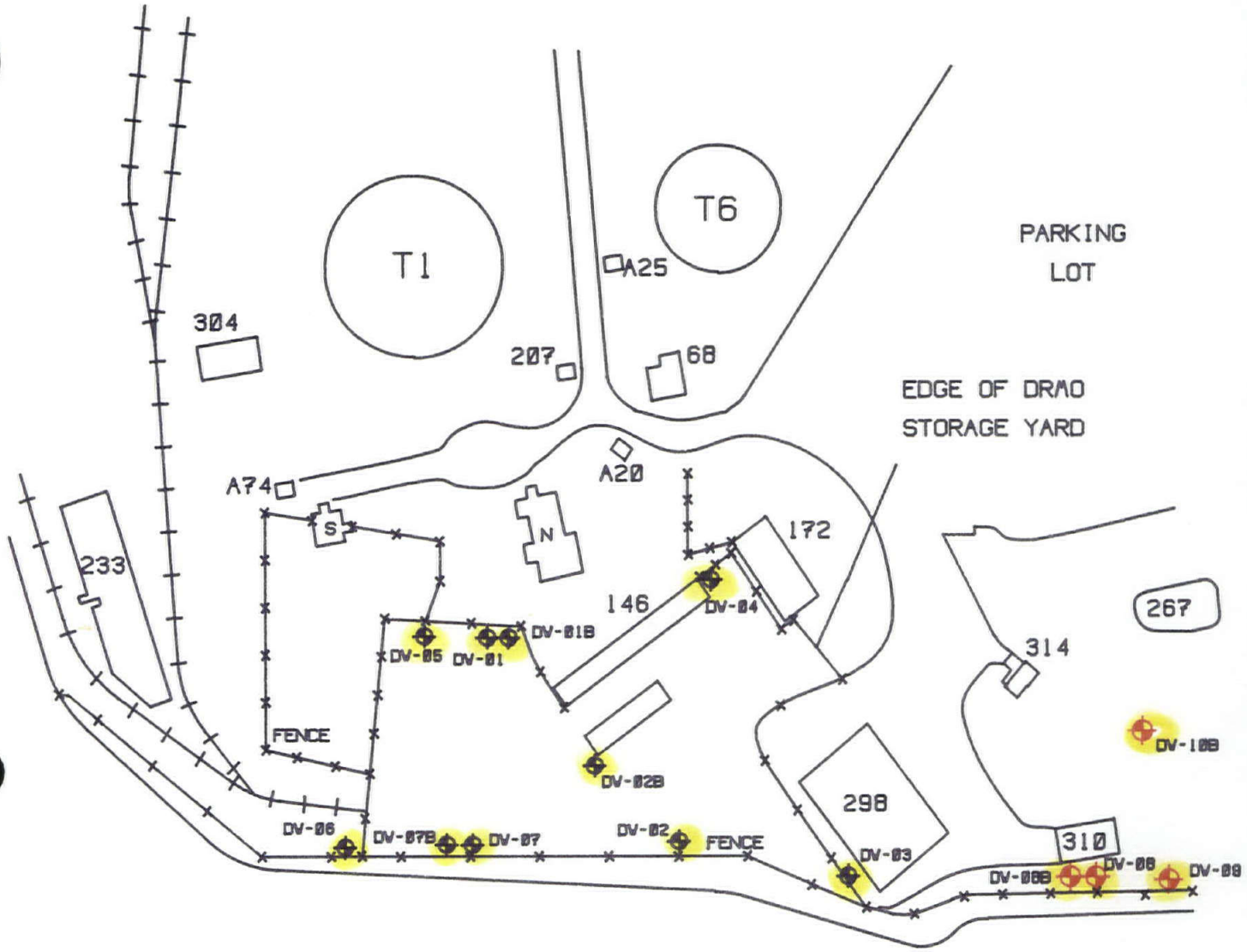
4.3 Drilling/Monitoring Well Installation

Drilling and monitoring well installation at the DRMO was conducted from July 11, 1991 through July 26, 1991. Four test borings were drilled and completed as monitoring wells east of the DRMO storage yard at the locations shown on Figure 4-4. Two monitoring wells were constructed in the shallow unconsolidated material and two wells were completed in bedrock. This test boring/monitoring well installation program was designed to provide physical and chemical information regarding the unconsolidated materials (fill and indigenous) and groundwater east of the DRMO, and thus to better define the hydrogeochemical regime at the DRMO.

4.3.1 Procedures

All test borings/monitoring wells were drilled and installed by CDS of North Chelmsford, Massachusetts, under the supervision of a McLaren/Hart geologist. A truck-mounted, Mobile B-57 rig, utilizing 4¼-inch ID hollow-stem augers, was used for drilling. Cuttings produced by the drilling of the test borings were contained in DOT-approved 55 gallon drums supplied by PNS. The drums were labeled and later transported to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results.

Where auger refusal or bedrock was encountered, a nominal 2⅞-inch OD roller bit or an HQ (3⅞-inch OD) core barrel (bedrock) was advanced concurrently with 4-inch ID casing. Water used in the coring/casing advance process was drawn from fire hydrants located near buildings 314 and 337. Each drilling location was monitored for organic vapors and radiation with an HNU photoionization detector (PID) and a Geiger Counter, respectively.



NOT TO SCALE

LEGEND:

- PHASE IV GROUNDWATER MONITORING WELL LOCATIONS
- PREVIOUSLY INSTALLED GROUNDWATER MONITORING WELL LOCATIONS

N

FIGURE 4-4

DRMO (SWMU #6)

PHASE IV GROUNDWATER MONITORING WELL LOCATIONS MAP

McLAREN/HART

Prior to drilling the first test boring, the drill rig and equipment used in the drilling process underwent steam cleaning to remove any potential contaminants. Such cleaning was additionally performed subsequent to the completion of each boring/well to prevent possible cross-contamination. Where soil samples were collected for chemical analyses via split-spoon samplers, as described below, the split-spoon samplers were subject to decontamination in accordance with the protocol outlined in Table 2-1.

Soil samples were collected ahead of the advancing borehole using standard, 2-foot long, 2-inch OD, steel, split-spoon samplers. The hammer lift system on the Mobile B-57 consisted of a hydraulic hammer, which delivered a blow equivalent to a 140-pound weight dropping 30 inches.

Soil samples were collected on a continuous sampling frequency. Each soil sample was screened with an HNU PID and a Geiger Counter immediately after the split-spoon was opened. The sample was subsequently described by a McLaren/Hart geologist and then either archived in soil jars or, where analytical samples were called for, transferred to labeled, laboratory-supplied sample containers. Such analytical soil samples were stored on ice in field coolers for transport via courier to CEIMIC. Where bedrock was cored, the recovered rock core was described and archived in labeled core boxes. Detailed physical descriptions of the soil samples and bedrock are included in the test boring logs in Appendix I.

Attempts were made to collect analytical soil samples on a standard sampling frequency (every 5 feet). However, owing to poor to no sample recoveries at some standard sampling depths, as a result of coarse material and obstructions, the frequency and thus number of analytical samples collected was less than anticipated. In one instance, where subsurface conditions warranted, an analytical soil sample was collected at an interval other

than the standard sampling depth. Where this occurred, the split-spoon was not decontaminated in accordance with Table 2-1. The soil constituting the sample thus was taken from the center of the recovered sample, where contact with the inner walls of the split-spoon was negligible.

Eleven soil samples plus one duplicate were submitted to CEIMIC for TCL Organic, TAL Inorganic, TOC, pH, and percent moisture analyses. Two of the eleven samples were additionally analyzed for particle size analysis. One equipment rinseate field blank was submitted for TCL Organic and TAL Inorganic analyses.

A monitoring well was constructed within the casing at each test boring. Each well consists of 2-inch diameter, threaded, flush-joint, schedule 40 teflon riser pipe and 10-slot (0.010-inch) manufactured teflon well screen. Wells DW-8 and DW-9 are screened over a 10-foot interval, which brackets the tidally-varying water table in the unconsolidated fill material. Wells DW-8B and DW-10B are screened over 5-foot intervals in bedrock. Bedrock at DW-10B is found near the ground surface, and DW-10B is screened across the tidally-varying water table. Bedrock at DW-8B is found at a much greater depth and thus monitors a much deeper groundwater flow regime.

Table 4-6 summarizes the well construction details for each well. Each well was constructed following procedures similar to those described in Section 2.4.1. The exception to such procedures was the use of bentonite pellets from the top of the sand choker to within two feet of the ground surface; that is, the cement/bentonite grout was not used. This was done in wells DW-8, DW-8B, and DW-9 in response to large voids in the subsurface which likely would have allowed the grout to flow into and possibly throughout interconnected voids, with the potential for compromising adjacent wells.

TABLE 4-6

MONITORING WELL DETAILS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

WELL Nº	SCREEN SETTING (FT.)[1]	SAND PACK (FT.)[1]	SAND CHOKER COLLAR (FT.)[1]	BENTONITE SEAL (FT.)[1]
DW-8	10.0 - 20.0	7.7 - 20.5	6.7 - 7.7	2.0 - 6.7
DW-8B	48.7 - 53.7	46.4 - 54.5	45.4 - 46.4	2.0 - 45.4
DW-9	10.0 - 20.0	7.9 - 20.5	6.9 - 7.9	2.0 - 6.9
DW-10B	13.0 - 18.0	11.0 - 18.5	9.6 - 11.0	7.6 - 9.6

[1] Below Grade

The last two feet of all boreholes were filled with concrete. A lockable, protective steel casing was placed over each well and cemented in place to prevent unauthorized access to, and provide protection for, the wells. A concrete collar was placed around the protective casing and sloped so as to divert surface runoff away from the well.

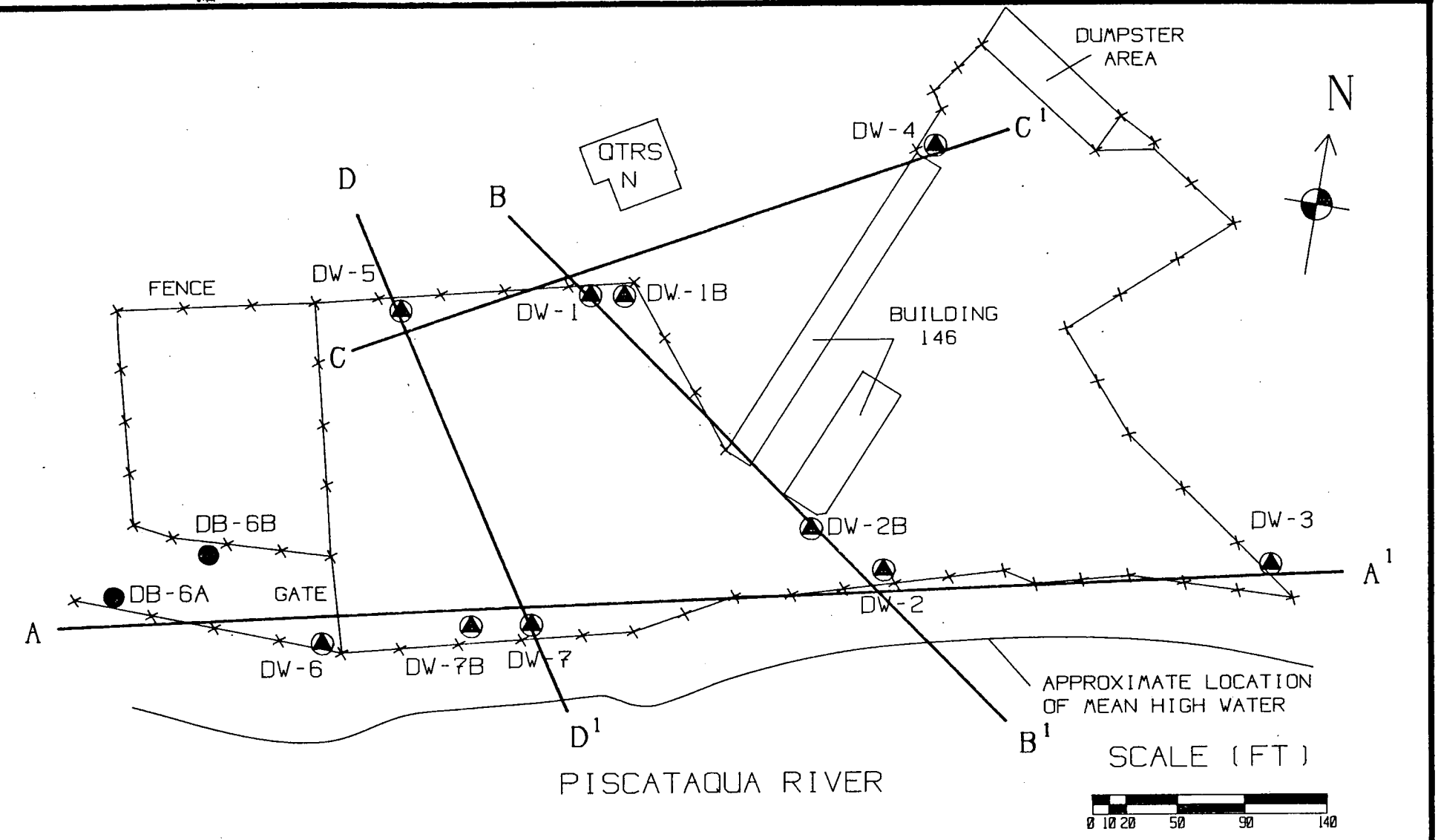
4.3.2 Findings

Information from the subsurface boring investigation east of the DRMO shows the same overburden materials found beneath the DRMO as encountered during the Phase I and Phase III investigations. The overburden consists of fill, which is composed of blasted rock, metal, wood, cinders, ash, and fine to coarse sand. Relatively large void spaces were observed during drilling operations because of the coarse material encountered.

The bedrock consists primarily of fractured gray metamorphosed sedimentary rock. Some of these fractures have been healed by calcite, pyrite and quartzite. Depth of bedrock ranged from as shallow as four feet in DSB-10 to approximately forty-three feet in boring DSB-8.

An approximately eight foot thick layer of beach deposits was found overlying the bedrock at boring DSB-8. This unit was composed of light brown, coarse to fine sand with trace clay silt and gravel and minor shell fragments. These beach deposits appear to be the indigenous material on which the fill material was deposited.

Figure 4-5 shows the geologic cross-section profiles for the Phase III investigation. All of the new monitoring wells are shown on this map and have been used to further define the cross-sections developed in the Phase I and Phase III investigations. The geologic cross-sections are shown in Figure 4-6, 4-7, 4-8, and 4-9.



LEGEND:

▲ PHASE I AND PHASE III TEST BORING/MONITORING WELL LOCATIONS

PHASE I TEST BORING LOCATIONS

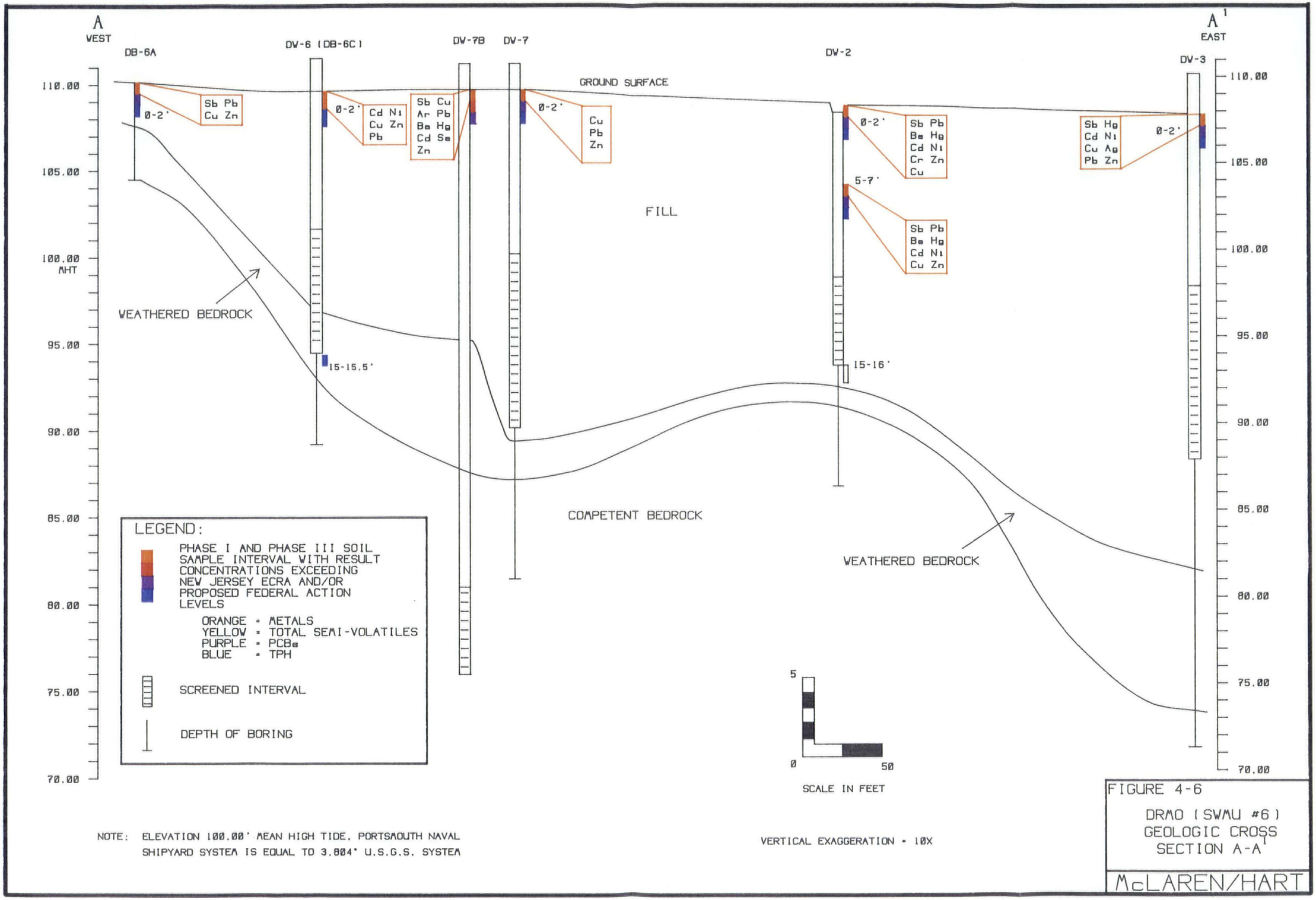
A — A¹ GEOLOGIC CROSS SECTION

FIGURE 4-5

DRMO (SWMU #6)

CROSS SECTION LOCATION MAP

McLAREN/HART



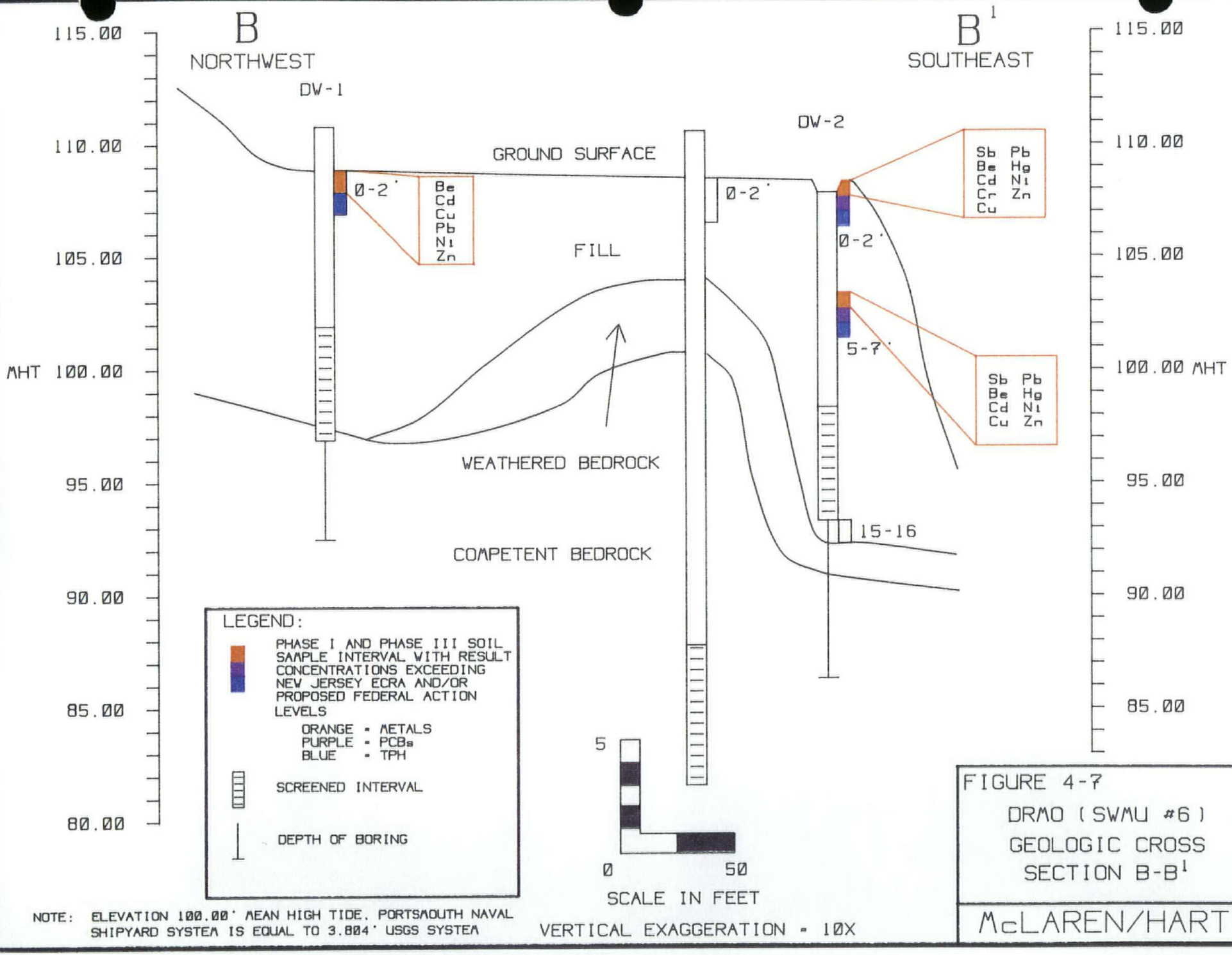
NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' U.S.G.S. SYSTEM

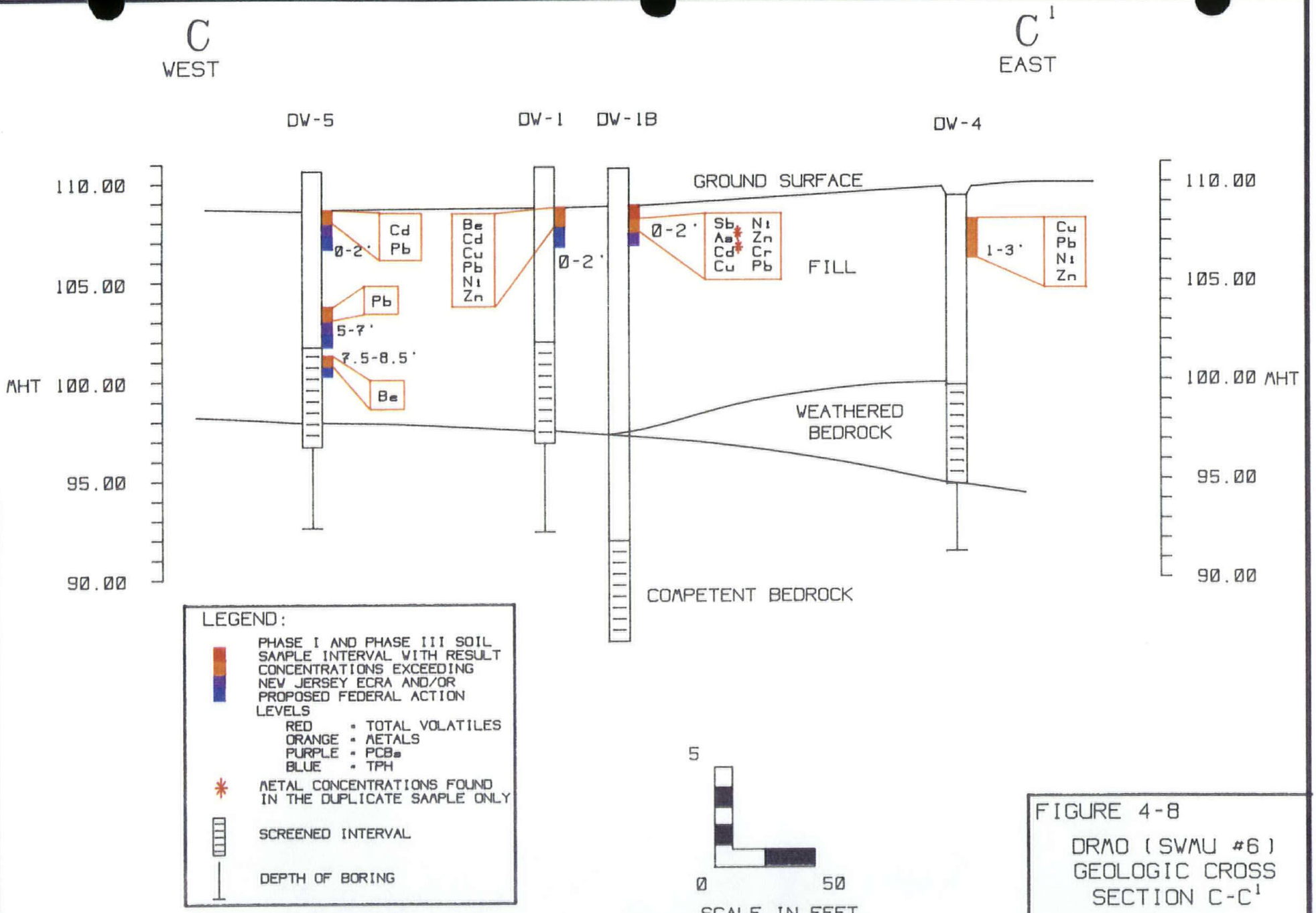
VERTICAL EXAGGERATION = 10X

FIGURE 4-6

DRMO (SWMU #6) GEOLOGIC CROSS SECTION A-A'

McLAREN/HART


B
NORTHWEST
B1
SOUTHEAST
115.00
110.00
105.00
MHT 100.00
95.00
90.00
85.00
80.00
DW-1
DW-2
GROUND SURFACE
FILL
WEATHERED BEDROCK
COMPETENT BEDROCK
0-2'
Be
Cd
Cu
Pb
Ni
Zn
Sb Pb
Be Hg
Cd Ni
Cr Zn
Cu
5-7'
15-16
LEGEND:
PHASE I AND PHASE III SOIL SAMPLE INTERVAL WITH RESULT CONCENTRATIONS EXCEEDING NEW JERSEY ECRA AND/OR PROPOSED FEDERAL ACTION LEVELS
ORANGE - METALS
PURPLE - PCBs
BLUE - TPH
SCREENED INTERVAL
DEPTH OF BORING
5
0
50
SCALE IN FEET
VERTICAL EXAGGERATION - 10X
NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' USGS SYSTEM
FIGURE 4-7
DRMO (SWMU #6)
GEOLOGIC CROSS SECTION B-B1
McLAREN/HART

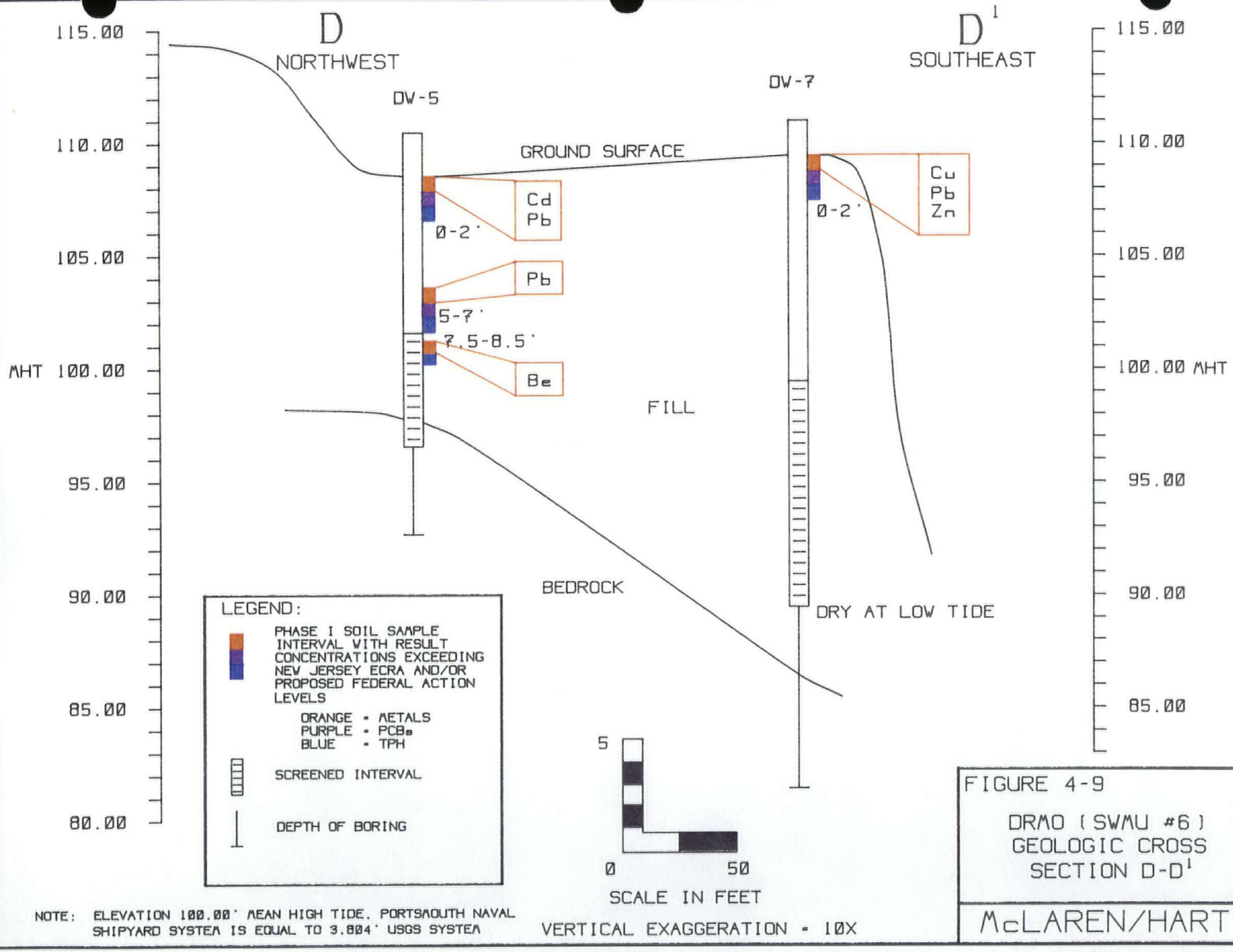


NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' USGS SYSTEM

FIGURE 4-8

DRMO (SWMU #6) GEOLOGIC CROSS SECTION C-C'

McLAREN/HART


D
NORTHWEST
D'
SOUTHEAST
115.00
110.00
105.00
MHT 100.00
95.00
90.00
85.00
80.00
DW-5
DW-7
GROUND SURFACE
Cd
Pb
0-2'
Pb
5-7'
7.5-8.5'
Be
Cu
Pb
Zn
0-2'
FILL
BEDROCK
DRY AT LOW TIDE
LEGEND:
PHASE I SOIL SAMPLE INTERVAL WITH RESULT CONCENTRATIONS EXCEEDING NEW JERSEY ECRA AND/OR PROPOSED FEDERAL ACTION LEVELS
ORANGE - METALS
PURPLE - PCBs
BLUE - TPH
SCREENED INTERVAL
DEPTH OF BORING
5
0
50
SCALE IN FEET
VERTICAL EXAGGERATION - 10X
NOTE: ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' USGS SYSTEM
FIGURE 4-9
DRMO (SWMU #6)
GEOLOGIC CROSS
SECTION D-D'
McLAREN/HART

4.3.3 Laboratory Analytical Results

A summary of valid soil results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have any published clean up guidelines for contamination in soils, New Jersey ECRA Guidance Values and proposed Federal Action Levels documented in the Federal Register (55 FR 30865, July 27, 1990) are used for comparison purposes.

TCL Volatiles

TCL volatiles were analyzed on a total of twelve soil samples, including one duplicate, from three of the four test borings drilled east of the DRMO plus one equipment rinseate field blank. No soil samples were submitted to CEIMIC from test boring DSB-10B due to shallow bedrock at approximately four feet. One of the soil samples, DSB-08B(6-8), was analyzed for TCL volatiles only based on appearance, HNU readings and lack of recovery in the split-spoon.

Detectable TCL volatile concentrations were found in only four of the twelve soil samples, including the duplicate, and the equipment rinseate field blank. The majority of these detectable concentrations were qualitative only. There were no detectable volatile concentrations above the proposed Federal Action Levels. There were also no detectable volatile concentrations above New Jersey ECRA Guidance Values either for an individual analyte or for total volatiles.

A review of the chromatograms and listed TICs contained in the laboratory data package indicated the presence of a light weight petroleum product in four of the twelve soil samples. The specific petroleum product could not be positively identified since petroleum identification analysis was not one of the analytical parameters.

TCL Semi-Volatiles

TCL semi-volatile analysis was conducted on eleven soil samples, including the duplicate, and the equipment rinseate field blank. Seven of these eleven soil samples had detectable semi-volatile concentrations. Semi-volatile concentrations were not detected in the equipment rinseate field blank. None of these samples had total acid extractable concentrations exceeding the New Jersey ECRA Guidance Value of 10 ppm in soil. Two of the samples, DSB-09(6-8) and DSB-09(11-13), had total base neutral concentrations exceeding the New Jersey ECRA Guidance Value of 10 ppm. One of the samples, DSB-09(6-8), also had a total PAH concentration that exceeded the New Jersey ECRA Guidance Value of 10 ppm. These results are summarized on Table 4-7. There were no other detected concentrations above New Jersey ECRA Guidance Values or proposed Federal Action Levels.

A review of the chromatograms and listed TICs contained in the laboratory data package indicated the presence of a heavier weight petroleum product in seven of the eleven soil samples. The specific petroleum product could not be positively identified since petroleum ID analysis was not one of the analytical parameters.

TCL Pesticide/PCBs

TCL pesticide/PCBs were analyzed on eleven soil samples, including the duplicate, and the equipment rinseate field blank. There were no detectable concentrations of TCL pesticides in any of these samples. There were detectable concentrations of PCBs in four of the eleven soil samples. No detectable concentrations of PCBs were found in the equipment rinseate field blank.

TABLE 4-7

SUMMARY OF TOTAL BASE NEUTRAL AND PAH CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 11 - 26, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)
TOTAL BASE NEUTRALS	DSB-09(6-8)	31.91	10.0
	DSB-09(11-13)	10.26	10.0
TOTAL PAHs	DSB-09(6-8)	23.27	10.0

Three of the four samples (DSB-08(0-2), DSB-08B(4-6) and DSB-09(6-8)) that had detectable concentrations of PCBs, had concentrations of both Aroclor-1248 and Aroclor-1254 whereas the fourth sample (DSB-09(11-13)) had a concentration of Aroclor-1260 only. In all of these samples, the detectable concentration of each analyte alone exceeded the New Jersey ECRA Guidance Value and proposed Federal Action Level for total PCBs in soil. Table 4-8 summarizes the PCB concentrations that exceeded the given standards for PCBs in soil.

TAL Inorganics

TAL Inorganics were analyzed on eleven soil samples, including the duplicate, and the equipment rinseate field blank. There were no detectable concentrations of cyanide in any of the soil samples or the equipment rinseate field blank. Detectable metals concentrations were found in all soil samples. Detectable metals concentrations were not found in the equipment rinseate field blank. Table 4-9 summarizes the metals concentrations that exceed New Jersey ECRA Guidance Values and/or proposed Federal Action Levels in each of the samples.

TOC, pH and Percent Moisture

TOC, pH and percent moisture analyses were conducted on eleven soil samples including the duplicate. Table 4-10 summarizes the results for TOC, pH and percent moisture analyses. TOC results ranged from non-detectable to 14.0 percent on a day weight basis. The pH results ranged from 6.9 to 8.8 standard units. The percent moisture results ranged from 4 to 44 percent.

TABLE 4-8

SUMMARY OF TCL PCB CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 11 - 26, 1991

McLAREN/HART SAMPLE I.D.	PARAMETER	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
DSB-08(0-2)	AROCLOR 1248	1.1	--	--
	AROCLOR 1254	1.6	--	--
	TOTAL PCBs	2.7	1.0	0.09
DSB-08B(4-6)	AROCLOR 1248	1.0	--	--
	AROCLOR 1254	6.6	--	--
	TOTAL PCBs	7.6	1.0	0.09
DSB-09(6-8)	AROCLOR 1248	7.3	--	--
	AROCLOR 1254	3.6	--	--
	TOTAL PCBs	10.9	1.0	0.09
DSB-09(11-13)	AROCLOR 1260	3.0	--	--
	TOTAL PCBs	3.0	1.0	0.09

-- There is no Guidance Value or Action Level for a Single PCB Aroclor

TABLE 4-9

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6) PORTSMOUTH NAVAL SHIPYARD

JULY 11 - 26, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
ANTIMONY	DSB-08B(4-6)	87.10J	10.0	30.0
	DSB-08(0-2)	49.10J	10.0	30.0
	DSB-08(15-17)	213.00J	10.0	30.0
	DSB-08(22-24)	317.00J	10.0	30.0
	DSB-08(27.5-29.5)	300.00J	10.0	30.0
	DSB-09(11-13)	44.50J	10.0	30.0
	DSB-09(6-8)	293.00J	10.0	30.0
ARSENIC	DSB-08(15-17)	31.40J	20.0	80.0
	DSB-08(22-24)	21.40J	20.0	80.0
	DSB-09(11-13)	46.30J	20.0	80.0
	DSB-09(6-8)	22.20	20.0	80.0
BARIUM	DSB-08(15-17)	563.00	400.0	4000.0
	DSB-08(22-24)	914.00	400.0	4000.0
	DSB-08(27.5-29.5)	989.00	400.0	4000.0
	DSB-09(6-8)	710.00	400.0	4000.0
BERYLLIUM	DSB-08B(4-6)	1.80	1.0	0.2
	DSB-08(15-17)	0.29Q	1.0	0.2
	DSB-08(22-24)	0.32Q	1.0	0.2
	DSB-08(27.5-29.5)	0.24Q	1.0	0.2
	DSB-08(37-39)	0.60Q	1.0	0.2
	DSB-09(0-2)	0.56Q	1.0	0.2
	DSB-09(11-13)	0.99Q	1.0	0.2
	DSB-09(6-8)	1.50	1.0	0.2
	DSB-11(0-2)*	0.49Q	1.0	0.2

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of DSB-09(0-2)

TABLE 4-9 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 11 - 26, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
CADMIUM	DSB-08B(0-2)	3.20	3.0	40.0
	DSB-08B(4-6)	18.50	3.0	40.0
	DSB-08(0-2)	11.10	3.0	40.0
	DSB-08(15-17)	32.70	3.0	40.0
	DSB-08(22-24)	33.40	3.0	40.0
	DSB-08(27.5-29.5)	29.40	3.0	40.0
	DSB-08(37-39)	5.20	3.0	40.0
	DSB-09(11-13)	8.90	3.0	40.0
	DSB-09(6-8)	52.70	3.0	40.0
CHROMIUM	DSB-08B(4-6)	527.00	100.0	400.0
	DSB-08(0-2)	128.00	100.0	400.0
	DSB-08(15-17)	167.00J	100.0	400.0
	DSB-08(22-24)	354.00J	100.0	400.0
	DSB-08(27.5-29.5)	199.00J	100.0	400.0
	DSB-09(11-13)	160.00	100.0	400.0
	DSB-09(6-8)	266.00	100.0	400.0
COPPER	DSB-08B(0-2)	491.00J	170.0	0.0
	DSB-08B(4-6)	5990.00J	170.0	0.0
	DSB-08(0-2)	3430.00J	170.0	0.0
	DSB-08(15-17)	3650.00	170.0	0.0
	DSB-08(22-24)	22400.00	170.0	0.0
	DSB-08(27.5-29.5)	23300.00	170.0	0.0
	DSB-09(11-13)	1960.00	170.0	0.0
	DSB-09(6-8)	8730.00J	170.0	0.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of DSB-09(0-2)

TABLE 4-9 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 11 - 26, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
LEAD	DSB-08B(0-2)	726.00J	250.0	0.0
	DSB-08B(4-6)	5650.00	250.0	0.0
	DSB-08(0-2)	3320.00	250.0	0.0
	DSB-08(15-17)	3260.00	250.0	0.0
	DSB-08(22-24)	19700.00	250.0	0.0
	DSB-08(27.5-29.5)	4300.00	250.0	0.0
	DSB-08(37-39)	7300.00	250.0	0.0
	DSB-09(11-13)	1990.00J	250.0	0.0
	DSB-09(6-8)	4720.00J	250.0	0.0
MERCURY	DSB-08(15-17)	1.80	1.0	20.0
	DSB-08(22-24)	3.50	1.0	20.0
	DSB-08(27.5-29.5)	4.70	1.0	20.0
	DSB-09(11-13)	22.60	1.0	20.0
	DSB-09(6-8)	2.30	1.0	20.0
NICKEL	DSB-08B(4-6)	4220.00J	100.0	2000.0
	DSB-08(0-2)	847.00J	100.0	2000.0
	DSB-08(15-17)	431.00	100.0	2000.0
	DSB-08(22-24)	1010.00	100.0	2000.0
	DSB-08(27.5-29.5)	733.00	100.0	2000.0
	DSB-09(11-13)	159.00	100.0	2000.0
	DSB-09(6-8)	1250.00J	100.0	2000.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of DSB-09(0-2)

TABLE 4-9 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–SOIL
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 11 - 26, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
SILVER	DSB-08B(4-6)	8.80	5.0	200.0
	DSB-08(0-2)	12.60	5.0	200.0
	DSB-08(15-17)	9.50	5.0	200.0
	DSB-08(22-24)	174.00	5.0	200.0
	DSB-08(27.5-29.5)	65.10	5.0	200.0
	DSB-09(6-8)	60.00	5.0	200.0
ZINC	DSB-08B(4-6)	3220.00J	350.0	0.0
	DSB-08(0-2)	2900.00J	350.0	0.0
	DSB-08(15-17)	4930.00J	350.0	0.0
	DSB-08(22-24)	13700.00J	350.0	0.0
	DSB-08(27.5-29.5)	5740.00J	350.0	0.0
	DSB-09(6-8)	10600.00J	350.0	0.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of DSB-09(0-2)

TABLE 4-10

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS–SOIL

DRMO (SWMU #6) PORTSMOUTH NAVAL SHIPYARD

JULY 11 - 26, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)*	TOC METHOD REPORTING LIMIT(%)	pH	PERCENT MOISTURE
DSB-08(0-2)	5.0	0.1	6.9	9
DSB-08(15-17)	3.9	0.1	8.6	33
DSB-08(22-24)	5.0	0.1	8.8	44
DSB-08(27.5-29.5)	3.8	0.1	8.8	32
DSB-08(37-39)	ND	0.1	8.8	20
DSB-08B(0-2)	1.2	0.1	6.9	4
DSB-08B(4-6)	1.5	0.1	7.5	12
DSB-09(0-2)	0.9	0.1	8.0	8
DSB-11(0-2)**	0.4	0.1	8.4	9
DSB-09(6-8)	14.0	0.1	7.5	20
DSB-09(11-13)	2.9	0.1	7.1	22

* =Result is a Percent on a Dry Weight Basis
** =McLAREN/HART Duplicate of Sample DSB-09(0-2)
ND =Non-Detectable

Particle Size Analysis

Particle size analysis was conducted on two soil samples, DSB-09(0-2) and DSB-09(9-11). The results of these analyses are given below:

Sample DSB-09(0-2)

Gravel, passing 3-inch and retained on No. 4 sieve:		33%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		52%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	9%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	31%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	12%	
Silt size, 0.074 to 0.005 mm:		14%
Clay, smaller than 0.005 mm:		0%
Colloids, smaller than 0.001 mm:		1%

Sample DSB-09(9-11)

Gravel, passing 3-inch and retained on No. 4 sieve:		33%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		45%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	13%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	24%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	8%	
Silt size, 0.074 to 0.005 mm:		20%
Clay, smaller than 0.005 mm:		2%
Colloids, smaller than 0.001 mm:		0%

4.3.4 Interpretations/Discussion

A total of twelve soil samples, including one duplicate, were analyzed for TCL Volatiles. Detectable concentrations of TCL Volatiles were found in only four of the twelve soil samples. The majority of the detectable concentrations were qualitative only, however, qualitative and semi-quantitative concentrations of 2-butanone (16 ppb) and acetone (150 ppb) were noted in samples DSB-09(6-8) and DSB-09(11-13), respectively. In addition, valid concentrations (qualitative and quantitative) of ethylbenzene (40 ppb) and total xylenes (120 ppb) were found in sample DSB-09(11-13). Valid volatile concentrations were also discovered in the rinseate blank for methylene chloride (7 ppb) and acetone (14 ppb). These volatiles have generally not been detected in previous soil sampling tasks within the DRMO. None of the detected concentrations exceeded New Jersey ECRA Guidance Values and/or proposed Federal Action Levels.

The chromatograms and listed TICs for TCL Volatiles indicated the presence of a relatively light weight petroleum product in four of the twelve soil samples submitted for volatile analysis. Sample DSB-9(11-13) had detectable concentrations of toluene, ethylbenzene and xylene suggesting that the petroleum product in this sample may be gasoline. The other samples with petroleum product did not have detectable toluene, ethylbenzene or xylene. In any case, the petroleum product could not be positively identified without a petroleum identification analysis. Sources for the petroleum product and/or volatiles are unknown at this time.

TCL semi-volatile analysis was conducted on a total of eleven soil samples including the duplicate. Detectable concentrations of semi-volatiles were found in most of the samples, however, only two samples had total base neutral concentrations exceeding the New Jersey ECRA Guidance Value of 10 ppm. The TCL semi-volatile chromatograms

indicated the presence of a heavier weight, higher boiling point petroleum product. This product was relatively fresh when compared with chromatograms for samples elsewhere at PNS. The specific petroleum product could not be identified without a petroleum identification analysis. Sources for the petroleum product are unknown at this time.

There were no detectable concentrations of TCL pesticides in any of the soil samples. There were detectable concentrations of PCBs in four of the soil samples. Three of the soil samples, DSB-08(0-2), DSB-08B(4-6) and DSB-09(6-8), had concentrations of both aroclor-1248 and aroclor-1254 whereas the fourth sample, DSB-09(11-13) had a concentration of aroclor-1260 only. Sources for these PCBs are unknown at this time.

Detectable concentrations of TAL metals were found in all of the soil samples. In general, the concentrations of most metals tend to be higher at depth than at the surface. For example, the lead concentration in sample DSB-08(0-2) is 55600 mg/kg. The concentrations of the next three intervals, DSB-08(15-17), DSB-08(22-24) and DSB-08(27.5-29.5) are 254000 mg/kg, 206000 mg/kg and 177000 mg/kg, respectively. The concentration then decreases to 47200 mg/kg in sample DSB-08(37-39). The lead concentration in DSB-08(37-39) is comparable to the lead concentration in DSB-08(0-2). The lead concentrations in the middle three intervals are significantly higher than the surface and deep samples and are comparable to each other. This may be due to the sea water infiltration and flushing action within the water table above bedrock. Sources for these metals are unknown at this time.

The TOC, pH and percent moisture analysis results were within expected ranges with a few minor exceptions. The TOC result in sample DSB-09(6-8) of 14 percent is higher than expected. The source of the TOC is unknown. The pH results for samples DSB-08(15-17), DSB-08(22-24), DSB-08(27.5-29.5) and DSB-08(37-39) are 8.6, 8.8, 8.8 and 8.8, respectively.

These results are slightly higher than expected and are probably due to the presence of sea water.

4.4 Monitoring Well Development

Groundwater monitoring wells DW-08, DW-08B, DW-09, and DW-10B, installed during Phase IV at the DRMO were developed from July 24-31, 1991. Development began at least forty-eight (48) hours after the monitoring wells were installed and prior to groundwater sampling. Development serves to remove the finer grained material from the well screen and sand pack that may otherwise interfere with water quality analyses, improve the hydraulic connection between the well and the surrounding formation, and to restore the groundwater from drilling fluids and other materials introduced during well construction.

4.4.1 Development Procedures

All of the monitoring wells installed during Phase IV at the DRMO were developed according to the development procedures discussed in Section 2.5.1.

4.4.2 Development Findings

Table 4-11 contains a summary of the stabilized field parameters for each of the wells and the dates over which each well was developed. Monitoring well DW-9 recharged quickly and was successfully developed in one day. The slower recharging wells, DW-08, DW-08B, and DW-10B were developed over two or more days.

Based on the salinity and specific conductivity measurements given in Table 4-11, monitoring wells DW-08B and DW-10B contain brackish water conditions and wells DW-08 and DW-09 contain saline water conditions.

The turbidity measurements at monitoring wells DW-08, DW-08B, and DW-10B stabilized below five NTUs. The turbidity measurements for well DW-09 stabilized slightly above five NTUs. Development of DW-09 was considered complete after obtaining three consecutive turbidity measurements with five (5) percent or less variation.

TABLE 4-11

STABILIZED FIELD PARAMETERS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

JULY 24-31, 1991

Well N°	Development Date(s)	Total Volume Removed (Gals)	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTUs)	Salinity (°/∞)
DW-08	7/26-7/31/91	130	7.78	17.0	32,000	4.10	24.9
DW-08B	7/26-7/31/91	70.5	7.79	13.3	17,200	3.60	12.9
DW-09	7/31/91	45	8.26	16.2	37,000	6.40	29.0
DW-10B	7/24-7/25/91	77.5	7.10	14.2	16,000	3.05	12.0

4.5 Groundwater Sampling

From August 2 to August 6, 1991, groundwater samples were collected from all fourteen monitoring wells installed around the perimeter of the DRMO (Figure 4-5).

One replicate sample, labeled DW-11-04, collected from well DW-09 and one equipment rinseate field blank DRB-15-04 were included in this groundwater sampling.

The objectives of groundwater sampling at the DRMO are summarized as follows:

1) To provide valid, properly obtained groundwater sampling data for all monitoring wells;
2) To evaluate the quality of both overburden and bedrock groundwater beneath the DRMO;
3) To assess whether organic compounds and/or inorganic constituents related to past or current conditions at the DRMO have migrated to groundwater and potentially off-site.
4) To assess whether any organic compounds and/or inorganic constituents in groundwater samples obtained from the monitoring wells at the DRMO are present in concentrations that exceed applicable groundwater standards.

4.5.1 Sampling Procedures

Prior to collecting groundwater samples, static water levels in each of the monitoring wells were measured, and the volume of water in the well was calculated. Monitoring well casing and groundwater elevation product information during sampling are summarized in Table 4-12. All wells were first checked for immiscible phases prior to purging using a precleaned, bottom-filling clear plexiglass bailer with a teflon check valve.

TABLE 4-12

MONITORING WELL CASING AND GROUNDWATER ELEVATION INFORMATION DURING SAMPLING

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 2-6, 1991

Well N°	Depth to Groundwater From TC (ft.)	Total Depth of Well From TC (ft.)	TC Elevation (ft. MHT)	Groundwater Elevation (ft. MHT)	Bottom of Screen Elevation (ft. MHT)	Well Volume (Gallons)
DW-01	12.93	14.08	111.44	98.51	97.36	0.19
DW-01B	12.87	23.91	111.36	98.49	87.45	1.80
DW-02	9.43	14.43	107.94	98.51	93.51	0.82
DW-02B	17.63	27.79	111.77	94.14	83.98	1.66
DW-03	14.34	22.37	110.69	96.35	88.32	1.31
DW-04	12.22	14.88	109.69	97.47	94.81	0.43
DW-05	11.41	13.37	111.14	99.73	97.77	0.32
DW-06	14.94	17.00	112.06	97.12	95.06	0.34
DW-07	18.18	21.65	111.52	93.34	89.87	0.57
DW-07B	18.02	35.33	112.33	94.31	77.00	2.82
DW-08	15.06	21.90	109.86	94.80	87.96	1.11
DW-08B	14.07	54.71	109.03	94.96	54.32	6.62
DW-09	15.15	22.04	110.14	94.99	88.10	1.12
DW-10B	14.54	19.41	112.83	98.29	93.42	0.79

MHT = Mean High Tide (Based on Elevation 100.00', Portsmouth Naval Shipyard System is Equal to 3.804' USGS System)
TC = Top of Casing

The wells were then purged as described in Section 2.6.1 using separate, dedicated, precleaned bottom-filling stainless-steel and teflon bailers with teflon check valves. The wells were purged until at least three well volumes were removed. All purge water was contained in DOT-approved 55-gallon drums, supplied by the PNS. The drums were labeled and later taken to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results to ensure proper disposal.

All wells were sampled immediately following purging as previously described in Section 2.6.1. Bailers were decontaminated prior to use according to the protocol listed in Table 2-1.

All groundwater samples from the DRMO monitoring wells were analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals). Groundwater from each well was field analyzed for pH, temperature, specific conductivity, turbidity and salinity prior to sample collection. All of the field parameter measurements were recorded in field notebooks (Appendix II). A summary of groundwater sampling and field parameter information is contained in Table 4-13.

Samples collected for dissolved metal analyses were field filtered through 0.45 micron cellulose prior to collection in pre-preserved, laboratory-supplied bottles. Preservatives provided in the laboratory-supplied bottles, and their associated analyses were as follows:

Metals (both dissolved and total) - Nitric Acid
Cyanide - Sodium Hydroxide
Volatiles - Hydrochloric Acid

Upon collection, samples were placed in coolers which were kept chilled using ice. Groundwater sample coolers were delivered via courier to CEIMIC.

TABLE 4-13

GROUNDWATER SAMPLING AND FIELD PARAMETER INFORMATION

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 2-6, 1991

Well N°	Sampling Date	Total Volume Removed (Gals)	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTUs)	Salinity (°/∞)
DW-01	8/5/91	1.0	6.85	20.0	5,700	>200	3.8
DW-01B	8/5/91	5.5	6.96	15.1	10,000	>200	9.4
DW-02	8/6/91	2.5	7.65	18.5	37,100	>200	27.2
DW-02B	8/5/91	5.0	7.77	18.9	38,500	>200	27.5
DW-03	8/2/91	4.0	7.54	19.5	39,500	6.72	25.5
DW-04	8/2/91	1.5	6.95	17.0	13,100	>200	8.9
DW-05	8/2/91	1.0	6.95	17.0	5,100	>200	3.3
DW-06	8/2/91	1.0	7.80	18.17	37,800	>200	26.9
DW-07	8/2/91	2.0	7.19	18.8	38,500	12.4	27.4
DW-07B	8/2/91	8.5	6.59	12.4	19,000	>200	14.0
DW-08	8/6/91	4.0	7.76	16.2	30,400	103.0	22.6
DW-08B	8/6/91	20.0	7.68	12.7	17,500	18.5	12.5
DW-09	8/6/91	3.5	8.60	16.0	32,100	42.2	24.0
DW-10B	8/6/91	3.0	7.06	16.9	22,800	33.2	16.7

4.5.2 Findings (Groundwater Conditions)

Prior to sampling, turbidity readings in several wells exceeded the maximum reading of the turbidity meter (i.e. greater than 200 NTUs). The lower turbidity readings reached during development suggest that suspended particulates in the groundwater are forming a mud cake on the sand pack during development and are subsequently being resuspended in the water after development ceases. This process may be assisted by the tidal action observed in some wells.

Salinity and specific conductivity readings obtained during sampling of the wells indicate brackish and saline water conditions. Table 4-14 summarizes the groundwater conditions during Phase II, III, and IV sampling events.

There were no immiscible product phases observed in any of the monitoring wells.

4.5.3 Laboratory Analytical Results

Groundwater samples were collected from all fourteen monitoring wells around the perimeter of the DRMO. In addition, one replicate sample (DW-11-04), collected from well DW-09 and one equipment rinseate field blank DRB-15-04 were included in the groundwater sampling program. The sample numbers are followed by "-04"to denote the fourth phase of work. A summary of valid groundwater results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in groundwater, NPDWR and proposed Federal Action Levels are used to evaluate the analytical data.

TCL Volatiles

Six of the fourteen groundwater samples, plus one replicate, had detectable volatile concentrations. Only two of these groundwater samples DW-08-04 and DW-08B-04 had

TABLE 4-14

SUMMARY OF GROUNDWATER CONDITIONS DURING PHASE II, III, AND IV SAMPLING EVENTS

DRMO (SWMU #6) PORTSMOUTH NAVAL SHIPYARD

WELL Nº	PHASE II 8/23 - 8/27/90 SALINITY(°/∞)	PHASE III 2/6 - 2/11/91 SALINITY(°/∞)	PHASE IV 8/2 - 8/6/91 SALINITY(°/∞)	GROUNDWATER CONDITION
DW-01	18.2	4.5	3.8	S-B
DW-01B	NA	6.8	9.4	B
DW-02	24.7	NA	27.2	S
DW-02B	NA	19.5	27.5	S
DW-03	23.2	24.1	25.5	S
DW-04	11.5	11.3	8.9	B
DW-05	6.1	0	3.3	B-F-B
DW-06	19.7	20.8	26.9	S
DW-07	23.2	10.5	27.4	S-B-S
DW-07B	NA	8.1	14.0	B
DW-08	NA	NA	22.6	S
DW-08B	NA	NA	12.5	B
DW-09	NA	NA	24.0	S
DW-10B	NA	NA	16.7	B

NA = Not Available
F = Fresh Water
B = Brackish Water
S = Saline Water

quantitative and qualitative volatile concentrations. Groundwater sample DW-08-04 had qualitative concentrations of toluene (2 ug/L), ethylbenzene (2 ug/L), and a quantitative and qualitative concentration of total xylenes (21 ug/L). There were no volatile concentrations above NPDWR or proposed Federal Action Levels.

TCL Semi-Volatiles

A total of six of the fourteen groundwater samples, plus one replicate, had qualitative semi-volatile concentrations. Only one groundwater sample DW-09-04 had a qualitative concentration of bis(2-Ethylhexyl)phthalate (9 ug/L) that may be above the proposed Federal Action Level of 3 ug/L. No other semi-volatile concentrations were above the proposed Federal Action Levels. Semi-volatiles are not listed under NPDWR.

A review of chromatograms and listed TICs indicate petroleum in groundwater samples DW-02B-04, DW-06-04, and DW-08-04. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum cannot be made at this time.

TCL Pesticide/PCBs

Groundwater samples DW-02B-04 and DW-06-04 had pesticide concentrations exceeding NPDWR and proposed Federal Action Levels.

Groundwater samples DW-02-04, DW-07-04 and DW-08-04 had PCB concentrations exceeding NPDWR and the proposed Federal Action Level.

Pesticide and PCB sample results exceeding NPDWR and proposed Federal Action Levels are summarized in Table 4-15. No other groundwater samples had any detectable concentrations of pesticides or PCBs.

TABLE 4-15

SUMMARY OF PESTICIDE/PCB CONCENTRATIONS–GROUNDWATER EXCEEDING NATIONAL PRIMARY DRINKING WATER REGULATIONS AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 2-6, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
PESTICIDE				
HEPTACHLOR EPOXIDE	DW-02B-04	0.35	0.2	0.004
4,4-DDD	DW-06-04	0.32	NA	0.1
PCBs	DW-02-04	13.00	0.5	0.005
	DW-07-04	3.50	0.5	0.005
	DW-08-04	12.00	0.5	0.005

NA = Not Available

TAL Inorganics

Detectable total (unfiltered) and dissolved (filtered) metal concentrations were found in all groundwater samples. Table 4-11 shows the detectable metal concentrations exceeding NPDWR and/or proposed Federal Action Levels. Qualitative beryllium concentrations that may exceed NPDWR and/or proposed Federal Action metal Levels are also summarized in Table 4-16.

No detectable cyanide concentrations were found in any of the groundwater samples.

4.5.4 Interpretations/Discussion

A review of chromatograms and listed TICs indicated a light petroleum product (i.e. gasoline) was present in monitoring well DW-08 and a heavier petroleum product was present in wells DW-02B and DW-06. Low concentrations of toluene, ethylbenzene, and total xylene were detected in monitoring well DW-08. Low concentrations of acetone, carbon disulfide, and chloroform, detected in some of the monitoring wells, may be naturally occurring. Acetone and carbon disulfide concentrations were also detected in the background river water samples discussed in Section 11.2.2. According to Howard (1990), carbon disulfide is common along coastal areas where microbial reduction of sulfates in soil produces fluxes of carbon disulfide. Acetone and chloroform can also be a naturally occurring volatile metabolite from vegetation and insects. Chloroform is also common in the chlorination of drinking water or municipal sewage. None of these volatiles detected were above NPDWR or proposed Federal Action Levels. No volatile concentrations were detected in Phase II or III groundwater samples.

Only qualitative bis(2-ethylhexyl)phthalate concentrations and one napthalene concentration were detected in some of the groundwater samples. One qualitative concentration of bis(2-ethylhexyl)phthalate detected in groundwater sample DW-09-04 may

TABLE 4-16

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER EXCEEDING NATIONAL PRIMARY DRINKING WATER REGULATIONS AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6) PORTSMOUTH NAVAL SHIPYARD

AUGUST 2-6, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
ANTIMONY	DW-02-04	289.0	NA	10.0
	DW-08-04	609.0	NA	10.0
	DW-09-04	309.0	NA	10.0
	DW-11-04*	213.0	NA	10.0
ARSENIC	DW-02-04	124.0	50.0	50.0
	DW-06-04	129.0	50.0	50.0
	DW-08-04	66.6	50.0	50.0
BARIUM	DW-08-04	1,650.00	1,000.0	1,000.0
BERYLLIUM	DW-01-04	0.30Q	NA	.008
	DW-01B-04	0.70Q	NA	.008
	DW-02-04	4.20Q	NA	.008
	DW-02F-04	0.05Q	NA	.008
	DW-04-04	2.00Q	NA	.008
	DW-05-04	1.40Q	NA	.008
	DW-06-04	2.40Q	NA	.008
	DW-07B-04	2.70Q	NA	.008
	DW-08-04	1.10Q	NA	.008
	DW-10B-04	0.05Q	NA	.008
	DW-11-04*	0.15Q	NA	.008

J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of DW-09-04
NA = Not Available

TABLE 4-16 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER
EXCEEDING NATIONAL PRIMARY
DRINKING WATER REGULATIONS
AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 2-6, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
CADMIUM	DW-02-04	47.0	5.0	10.0
	DW-04-04	9.0	5.0	10.0
	DW-05-04	8.0	5.0	10.0
	DW-05F-04	5.0	5.0	10.0
	DW-07B-04	13.0	5.0	10.0
	DW-08-04	56.0	5.0	10.0
	DW-09-04	5.0	5.0	10.0
CHROMIUM	DW-01-04	64.0	50.0	50.0
	DW-01B-04	224.0	50.0	50.0
	DW-02-04	524.0	50.0	50.0
	DW-04-04	189.0	50.0	50.0
	DW-05-04	123.0	50.0	50.0
	DW-06-04	131.0	50.0	50.0
	DW-07B-04	202.0	50.0	50.0
	DW-08-04	443.0	50.0	50.0
	DW-09-04	50.0	50.0	50.0
	DW-09-04	764.0J	50.0	50.0
	DW-11-04*	754.0J	50.0	50.0

J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of DW-09-04
NA = Not Available

TABLE 4-16 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER
EXCEEDING NATIONAL PRIMARY
DRINKING WATER REGULATIONS
AND/OR PROPOSED FEDERAL ACTION LEVELS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 2-6, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
LEAD	DW-01-04	74.5	50.0	50.0
	DW-02-04	49,200.0J	50.0	50.0
	DW-02F-04	213.0	50.0	50.0
	DW-03-04	446.0J	50.0	50.0
	DW-04-04	803.0	50.0	50.0
	DW-05-04	428.0	50.0	50.0
	DW-05F-04	59.5	50.0	50.0
	DW-06-04	728.0	50.0	50.0
	DW-07-04	624.0J	50.0	50.0
	DW-07F-04	119.0	50.0	50.0
	DW-08-04	6,560.0J	50.0	50.0
MERCURY	DW-02-04	2.9	2.0	2.0
	DW-08-04	7.7	2.0	2.0
	DW-09-04	9.7	2.0	2.0
	DW-11-04*	8.5	2.0	2.0
NICKEL	DW-02-04	2,800.0	NA	700.0
	DW-08-04	1,340.0	NA	700.0

J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of DW-09-04
NA = Not Available

be above the proposed Federal Action Level. Bis(2-ethylhexyl)phthalate is a common plasticizer and may be present throughout the fill material in the DRMO.

Monitoring wells DW-02B and DW-06 had pesticide concentrations of Heptachlor epoxide and 4,4-DDD, respectively, exceeding the NPDWR and/or proposed Federal Action Level. Pesticides were not detected in groundwater samples from previous phases. A former controlled PNS spraying program may be the source of the detected pesticides in groundwater. Evidence of a former spraying program is seen through the widespread detection of pesticides in background soil samples and near surface soil samples at the majority of SWMU locations.

PCBs exceeding NPDWR and proposed Federal Action Levels were present in groundwater collected from monitoring wells DW-02, DW-07, and DW-08. Only monitoring well DW-07 had a detectable PCB concentration during Phase III groundwater sampling. Possible scenarios for the presence of PCBs at the DRMO may be leaking transformers stored on-site or oil used in dust control.

Phase IV metal concentrations were comparable to the Phase II and Phase III sampling results for most wells. However, a lead concentration of 49,200 ug/L detected in monitoring well DW-02 was significantly higher than the previous Phase II sampling result of 51.40 ug/L. Monitoring well DW-02 was not sampled during Phase III. Higher metal concentrations appear to be associated with suspended particulates in groundwater. Only three dissolved metal samples (DW-02F-04, DW-05F-04, and DW-07F-04) had concentrations that exceeded NPDWR or proposed Federal Action Levels. All overburden and bedrock groundwater samples had at least one or more metals exceeding NPDWR and/or proposed Federal Action Levels. None of these metals were detected in the background river water samples.

4.6 Water-Level Measurements/Hydraulic Conductivity Testing

Groundwater levels in monitoring wells at the DRMO were measured and recorded hourly from September 24 to 27, 1991. Hydraulic conductivity testing was conducted in the same wells on October 3, 1991. The objective of such monitoring and testing was to provide data necessary to better characterize the groundwater regime at the DRMO and to determine the hydraulic conductivity of the various media underlying the DRMO.

4.6.1 Procedures

Water-Level Measurements

Groundwater levels were monitored in the 14 DRMO wells with pressure transducers and associated dataloggers, as described in Section 2.7.1. The transducer range, datalogger, and accuracy of each system used for each well are presented in Table 4-17. The accuracy of the 10 and 20 PSI transducers was previously discussed in Section 2.7.1. The accuracy of the 30 PSI transducer used in DW-8B is similarly computed. The transducer/datalogger system is reportedly accurate to 0.05 percent of 0.0005 of full scale of the transducer. Thus, the 30 PSI transducer, with an equivalent range of 69.3 feet of fresh water (2.31 feet/PSI), should have been accurate to 0.04 feet. To facilitate and permit the placement of transducer cables away from heavy machinery traffic, three dataloggers were used to record water levels.

The dataloggers were synchronized to begin hourly water-level measurements at 1130 hours on September 24, 1991. These measurements continued until 1000 hours on September 27, 1991 at which time the dataloggers were shut off and disconnected from the transducers. The transducers were removed from the wells, cleaned, and prepared for use at the JILF. The water-level data were downloaded from the dataloggers to a laptop computer for later analyses and interpretations.

TABLE 4-17

TRANSDUCER, DATALOGGER, AND ASSOCIATED ACCURACY OF WATER–LEVEL MEASUREMENTS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

SEPTEMBER 24 - 27, 1991

WELL Nº	TRANSDUCER RANGE (PSI)	DATALOGGER	ACCURACY (Ft.)
DW-1	10	#1	0.01
DW-1B	10	#1	0.01
DW-2	10	#2	0.01
DW-2B	20	#3	0.02
DW-3	10	#2	0.01
DW-4	10	#1	0.01
DW-5	10	#1	0.01
DW-6	10	#2	0.01
DW-7	10	#2	0.01
DW-7B	20	#2	0.02
DW-8	10	#2	0.01
DW-8B	30	#2	0.04
DW-9	10	#2	0.01
DW-10B	10	#2	0.01

10 PSI = 23.1 Feet
20 PSI = 46.2 Feet
30 PSI = 69.3 Feet
Dataloggers #1 and #2 = 16 Channel
Datalogger #3 = 8 Channel

Hydraulic Conductivity Testing

As with the JILF, preliminary hydrographs for each well were generated and superimposed on existing graphs of well screen and sandpack depths. These graphs were reviewed to determine whether and when the well screen and sandpack were saturated in reference to the tide. Ideally, the well screen and preferably the sandpack should be saturated for hydraulic conductivity testing.

Hydraulic conductivity testing was conducted via the slug test method, as described in Section 2.7.1. However, before slug testing could take place, the transducers were re-installed in the wells, since they had been previously removed for use at the JILF. Falling and rising head slug tests were conducted in all of the wells, with the exception of DW-1, which contained too little water to have inserted the slug rod without potentially damaging the transducer or the well invert. Instead, the slug rod was carefully inserted to the bottom of the well and the water level in the well allowed to equilibrate. A rising head test was then performed as previously described. The slug test data were downloaded from the dataloggers to a laptop computer for later analysis and interpretation via the Hvorslev method.

4.6.2 Findings

Water Level Measurements

Hydrographs generated from the hourly water-level data are provided in Appendix VIII. For graphing purposes, the data were shifted ahead one-half hour, to begin at 1200 hours instead of 1130 hours. To show possible groundwater responses to precipitation, a graph of rainfall data from at least three days prior to and including the days over which water levels were measured are shown on each hydrograph. Rainfall data are for Greenland, New Hampshire, located approximately 6 miles south-southwest of the site.

As evident from the hydrographs, tidal fluctuations influence water levels in all wells at the DRMO. The greatest influence is evident in the wells located along the river, where the water levels appear to rise and fall relatively freely with the tide. Such responses are consistent with the proximity of the wells to the river and the porous material in which most of the wells are screened. Tidal influence on water levels is characteristically dampened in the more inland wells. Of the more inland wells, DW-1 and DW-1B show the greatest response to the tide, though the range of water-level fluctuation is substantially less from that seen in wells along the river. Water levels in DW-5, DW-10B, and, to a lesser degree, DW-4 show a response to tide near and or at high tide; water levels in DW-5 rise minimally only at high tide. These wells then drain with the outgoing tide to a relatively flat hydrograph, particularly DW-5. This drainage pattern could be an expression of a sustained water table having established a relatively static minimum groundwater elevation. Tidal influences might thus be observed only when the tide elevation exceeds this minimum elevation. The hydrographs for wells DW-1, DW-4, and DW-5 also show a general rise in the minimum groundwater elevation in response to the rainfall events on September 25 and 26. The fact that this occurs and that the range of fluctuation decreases in DW-1 and DW-4 lends some support to a possible minimum groundwater elevation. However, DW-10B, for reasons not currently known, did not exhibit a similar rise in the minimum groundwater elevation.

Where the hydrographs illustrate groundwater responses to tide and rainfall and groundwater drainage patterns, they do not provide information necessary to completely evaluate groundwater flow. To that end, average groundwater elevations were computed following the method described in Serfes (1991). This method employs a filtering mechanism which effectively removed the influence of tides on the groundwater elevations, resulting in the average groundwater elevations presented in Table 4-18.

TABLE 4-18

AVERAGE GROUNDWATER ELEVATIONS

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

SEPTEMBER 24 - 27, 1991

WELL N°	AVERAGE GROUNDWATER ELEVATION (Ft. MHT)	MIDPOINT SCREEN ELEVATION (Ft. MHT)
DW-1*	99.34	99.86
DW-1B	98.90	89.95
DW-2*	97.44	96.01
DW-2B	96.83	86.48
DW-3	96.81	93.32
DW-4	99.67	97.31
DW-5	101.31	100.27
DW-6*	97.62	98.56
DW-7	96.73	94.87
DW-7B	97.76	79.50
DW-8	97.00	92.96
DW-8B	97.23	56.82
DW-9	96.99	93.10
DW-10B	99.28	95.92

MHT = Mean High Tide = Elevation 100'; Equal to 3.804' USGS System
* = Water Level Dropped Below Transducer Near or at Low Tide
DW-2 Elevation Based on Old Survey of Well

Several quality control statements need to be mentioned with regard to these averages. First, because the water levels in the wells DW-1, DW-2, and DW-6 apparently dropped below the transducer near or at low tide, the recorded water levels were consequently higher than the actual water levels in the screened material. Thus, the computed average groundwater elevations for these wells is too high. This could be significant particularly in DW-1 and DW-2, each of which are paired with a bedrock well. The computed average groundwater elevation in DW-1 is higher than that in DW-1B; however, the hydrographs show groundwater elevations in DW-1B to be consistently higher than those in DW-1 until DW-1 goes dry. The computed average groundwater elevation in DW-2 is higher than that in DW-2B; however, the hydrographs show groundwater elevations in these wells to be essentially the same until DW-2 goes dry.

Second, the transducers used to measure the water levels were referenced to the density of fresh water. Many of the wells at the DRMO contain brackish and/or seawater. Since such water is more dense than fresh water and thus requires less water to exert the same pressure on the transducer, water levels measured in brackish or seawater are higher than the actual water level in the well. For every foot of a column of seawater measured in reference to fresh water, the actual water level should be 0.0244 feet lower. These density differences do not significantly affect the horizontal groundwater flow interpretations. Such differences, however, can become important in evaluating groundwater elevations and thus gradients in well pairs.

The average groundwater elevations indicate that groundwater beneath the DRMO flows in a general southward direction to the river. However, possible groundwater mounding in the vicinity of DW-5, as indicated by the relatively high groundwater elevation, could result in a local radial deviation from the southward flow direction. The cause of such

mounding is not currently known, but a sewer pipe reportedly located very near DW-5 may be influencing the groundwater levels in that area. Further, salinity data collected during groundwater sampling show fresh to mildly brackish water in these wells, with DW-5 containing the fresher water. Such data may be an indication of a local source of fresh water (the sewer pipe) or possibly a natural fresh water lens near these wells.

The groundwater data indicate upward hydraulic gradients at well pairs DW-7/7B and DW-8/8B; that is, the groundwater elevations are higher in the bedrock wells. Salinity data collected during groundwater sampling show the groundwater to be significantly more saline in the overburden than in the bedrock. As such, the true groundwater elevations in the overburden wells should be lower relative to the bedrock elevations, thereby increasing the upward gradient.

Hydraulic Conductivity

Water-level recovery plots for each slug test are provided in Appendix VIII. The water-level recovery plots and associated regression line on the selected data provided the basic time lag, T_o, the variable necessary for estimating hydraulic conductivity via the Hvorslev method. No corrections were made for the effect of tides on the water-level recovery data. Such data were selected from relatively early parts of the slug tests before tide effects apparently became significant. The resulting estimates of hydraulic conductivity at the DRMO are presented in Table 4-19.

In general, hydraulic conductivity in the bedrock is lower than that in the overburden, except for DW-2B, within which water levels recovered too fast to estimate hydraulic conductivity. Hydraulic conductivity ranged from 9.66×10^{-5} cm/sec in DW-8B to 2.96×10^{-3} cm/sec in DW-1B. DW-10B exhibited a hydraulic conductivity comparable to that in the overburden. This is probably the result of being screened across the water table in highly-

TABLE 4-19

HYDRAULIC CONDUCTIVITY ESTIMATES

DRMO (SWMU #6)
PORTSMOUTH NAVAL SHIPYARD

OCTOBER 3, 1991

WELL N°	HYDRAULIC CONDUCTIVITY (K) Ft/Day	cm/Sec
DW-1**	10.21	3.60×10^{-3}
DW-1B	2.09	7.36×10^{-4}
DW-4	83.75	2.95×10^{-2}
DW-5*	5.25	1.85×10^{-3}
DW-6**	292.45	1.03×10^{-1}
DW-7**	170.60	6.02×10^{-2}
DW-7B	8.39	2.96×10^{-3}
DW-8	60.66	2.14×10^{-2}
DW-8B	0.27	9.66×10^{-5}
DW-9	50.04	1.77×10^{-2}
DW-10B	184.25	6.50×10^{-2}

Unless Otherwise Noted, Hydraulic Conductivity is Average of Falling and Rising Head Tests
* = Falling Head Test Only
** = Rising Head Test Only
DW-2, DW-2B, DW-2 Recovered Too Fast to Estimate K

fractured, near-surface bedrock. Hydraulic conductivity can vary widely in bedrock, depending on whether a well is screened across a significant fracture.

The overburden exhibits relatively high hydraulic conductivity, particularly in the wells along the river. Hydraulic conductivity ranged from 6.57×10^{-3} cm/sec in DW-5 to 1.03×10^{-1} cm/sec in DW-6, with values typically in the 10^{-2} cm/sec range. Such high hydraulic conductivities are at or above the limits at which the methods employed can accurately and reliably estimate hydraulic conductivity. This is evident in the water-level recovery data, where rapid water-level recovery coupled with water-level oscillations typical in permeable materials sometimes resulted in little difference between the equilibrium water level (H) and the maximum perturbed water level (H_o). In consequence, few data points were available from which to estimate T_o. Thus, the high hydraulic conductivity values should be taken as more qualitative than quantitative.

Wells DW-1, DW-4, DW-5, DW-6, and DW-7 were not fully saturated during the slug tests, making it difficult to distinguish between sandpack and formation hydraulic conductivity. Water-level recovery curves can show the change from sandpack drainage to formation drainage. This is best illustrated on the falling head plot for DW-5, where an early, straight-line recovery likely representing sandpack drainage shifts to a second, straight-line recovery likely representative of the formation. The rising head test appears to exhibit sandpack drainage and formation drainage, but the formation drainage is not sufficiently distinct to select a second line. Similar recovery curves exist for DW-1 and DW-4, though the signature of formation drainage is more difficult to identify. DW-6 did not exhibit a detectable difference in drainage.

4.7 Conclusions/Recommendations

Analytical results of surface soil samples and subsurface soil samples clearly show elevated metal concentrations throughout the soil column at the DRMO. The primary metals of concern in the soils appear to be copper, lead, mercury, nickel, and zinc. Elevated PCB concentrations were also present throughout the soil column, but were not as widespread as the elevated metal concentrations. The presence of the metal and PCB contamination in soil at the DRMO may be the direct result of past and on-going storage practices and operations.

Elevated metal concentrations, primarily lead, were present in near surface soil samples collected at Quarters "S" and "N" adjacent to the DRMO. Lead concentrations were found to decrease with depth in the soil column. The near surface lead contamination may be the direct result of air dispersion of lead from the DRMO.

Analytical results for groundwater indicate elevated total metal concentrations in all samples. The metals present are the same metals found throughout the soil column.

Water level measurements show that tidal fluctuations influence water levels in all wells at the DRMO. The greatest influence is evident in the wells located along the river, where the water levels appear to rise and fall relatively freely with the tide. The overburden exhibits relatively high hydraulic conductivity, particularly in the wells along the river. Hydraulic conductivities in and above the 10^{-2} cm/sec range are at or above the limits of the methods employed to accurately and reliably estimate hydraulic conductivity. Additional testing using methods designed for highly permeable material may be necessary to provide more accurate and reliable estimates of hydraulic conductivity.

Based on tidal fluctuations, the high hydraulic conductivity of overburden, observed slumping of overburden material into the river, and metal and PCB contaminated soil and groundwater at the DRMO, it is evident that the river is being impacted by past and present operations at the DRMO. Corrective measures need to be implemented to minimize the migration of contaminated soil and groundwater into the river.

5.0 FORMER GASOLINE STATION INVESTIGATION

The purpose of this phase of work at the former gas station was as follows:

-- Detect and locate possible underground storage tanks (USTs) associated with the former gas station;

-- Determine if a gasoline soil gas plume may have emanated from the USTs; and

-- Evaluate soil and groundwater quality in the vicinity of the USTs.

The following tasks were performed as part of the Phase IV field investigation at the former gas station:

- Soil Gas Survey
- Ground Penetrating Radar Survey
- Magnetometry Survey
- Drilling, Soil Sampling, and Monitoring Well Installation
- Monitoring Well Development
- Groundwater Sampling

5.1 Soil Gas Survey

A soil gas survey was conducted from July 8, 1991 through July 11, 1991 in the vicinity of the USTs at the former gas station (Figure 5-1). The purpose of the soil gas survey was to determine if a gasoline plume could be detected downslope, presumably downgradient, of the USTs.

5.1.1 Survey Procedures

An electric rotary hammer driven K.V. Soil Gas System with field portable screening devices was used to conduct the soil gas survey. The K.V. system consists of the following:

- 30 inch long by 1/2 inch O.D. stainless steel rods
- 8 inch long by 1/2 inch O.D. slotted intakes
- stainless steel drive points
- concrete auger
- hammer attachment
- retrieval jack
- hand pump attachment

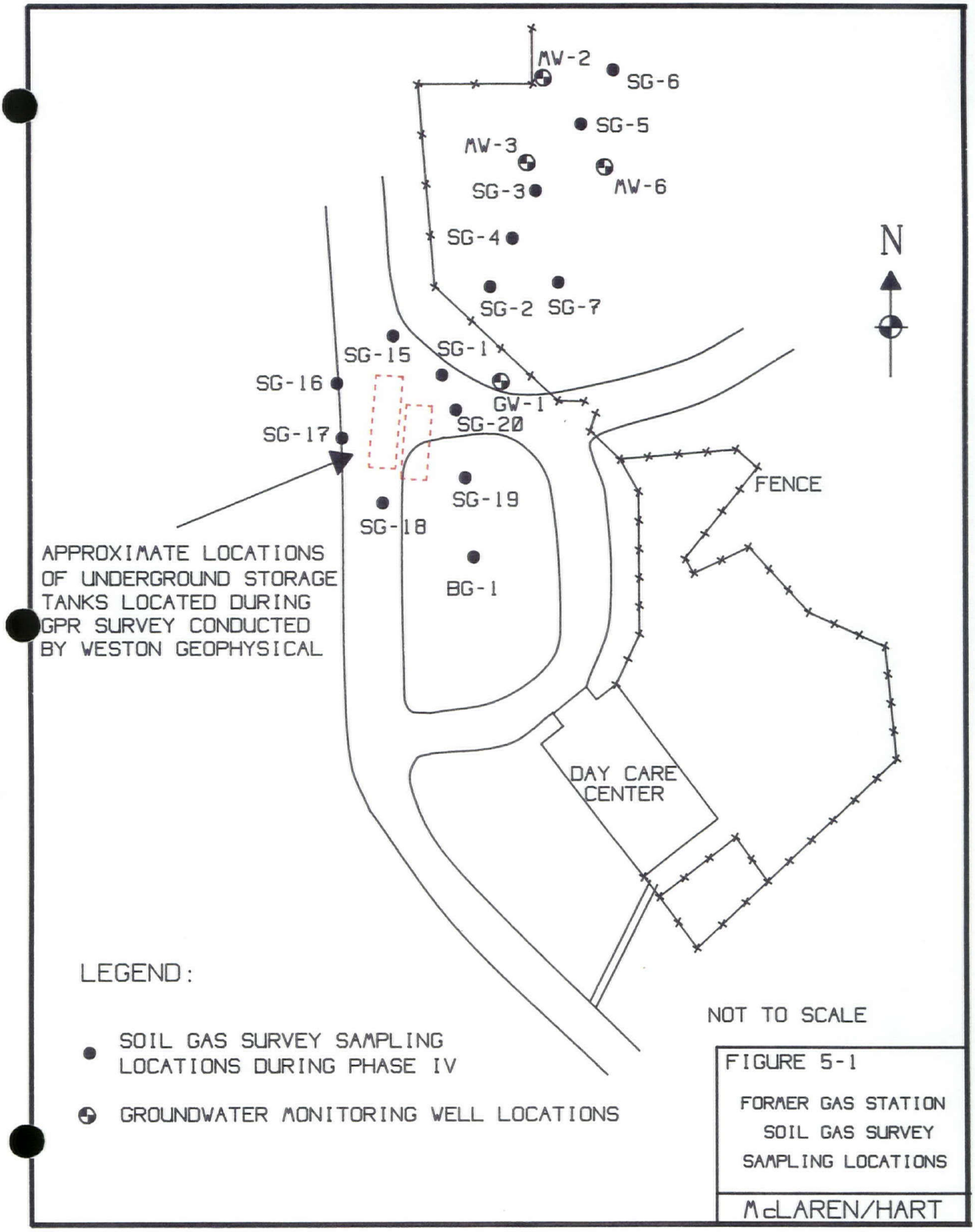


FIGURE 5-1

FORMER GAS STATION SOIL GAS SURVEY SAMPLING LOCATIONS

McLAREN/HART

With the K.V. system, the soil gas probes were driven to a desired depth without penetrating groundwater. Each hole was sealed at the surface with a bentonite pellet-water mixture prior to evacuation. The interstitial spaces of the soil were then evacuated through the probe using the hand pump attachment for 30 seconds to purge any air that may have infiltrated the borehole or probe from the surface. Following the evacuation of air from the system, an Organic Vapor Monitor (OVM) was connected to the soil gas probe with Tygon(TM) tubing. The OVM was used as a screening device to check for total volatile organics. By use of the OVM internal pump, the soil gas was drawn from the desired depth and analyzed by the non-destructive photoionization detector within the OVM to determine the total volatile organic concentration in parts per million (PPM). If a sample had a detectable volatile organic concentration, a one liter tedlar bag was filled through the outport of the OVM with the soil gas and analyzed using a Photovac 10S70 portable gas chromatograph.

The Photovac portable gas chromatograph is a field screening device which also contains a photoionization detector. Unlike the OVM, the Photovac possesses a chromatographic column which allows for separation and qualitation for individual compounds instead of a total volatile organic number. The Photovac also contains a computer which allows the operator to calibrate for numerous compounds, and by introducing a standard compound via injection, precise quantitation of these specific compounds is possible. For this survey, the Photovac was calibrated for benzene, toluene and xylene. Benzene, toluene and xylene were chosen because they are three major components of gasoline.

Although the Photovac must be run at isothermal temperature and can only be used for the vapor phase, it is extremely accurate and proves to be a strong tool for on-site analysis of volatile organics. Included as Appendix V are the individual chromatograms and an explanation of the chromatogram for each instrument blank, syringe blank, benzene standard, toluene standard, xylene standard and sample injected. An instrument blank was injected to clean out any residual contamination within the chromatographic column itself. Similarly, a syringe blank was injected to make sure that there was no residual contamination within the syringe. As discussed previously, standard compounds were injected into the Photovac initially and were run periodically to check for accuracy. In addition, a gas tank air sample was collected approximately one foot away from an open gas tank of one of the field vehicles to check the sensitivity of the gas chromatograph.

Soil gas probes were driven at seven locations (SG-1 through SG-7) downslope, presumably downgradient, of the USTs, and one probe was driven in a background location (BG-1), as shown in Figure 5-1. An attempt was made to sample soil gas at 2.5-foot intervals at each of these locations. Refusal, possibly a boulder or bedrock, was encountered at BG-1(3'8"), SG-1(3'10"), and SG-3(3.0'). Sample locations were approximately 50 feet apart.

On July 15, 1991, at the Navy's request, soil gas probes were driven at six additional locations (SG-15 through SG-20) around the two USTs defined from the GPR Survey (Section 5.2). There were no soil gas locations for location numbers SG-8 through SG-14. Refusal was encountered at one foot or less at all locations except SG-20. Refusal was encountered at 5.1 feet at location SG-20.

5.1.2 Survey Results

Neither benzene or toluene was found in any of the samples. Xylene was detected in sample SG-3 at a depth of 2.5 feet and was reported at a concentration of 13.85 ppm. The xylene concentration at SG-3 appears to be an isolated occurrence and does not appear to be attributable to a gasoline plume. Boats are stored in the area of SG-3 and an accidental gasoline spill from one of these boats may have caused the isolated xylene concentration. No other samples had detectable xylene concentrations.

A unique chromatogram peak was observed in samples SG-3 at 2.5 feet, SG-4 at 2.5 feet, and SG-7 at 2.5 feet. This peak had a retention time slightly shorter than that of benzene. These unique peaks may be related to acetone, as acetone's retention time is slightly shorter than benzene. An acetone standard was not run during the survey since gasoline was the potential contaminant of concern.

5.1.3 Interpretations/Discussion

Results of the soil gas survey did not reveal any detectable concentrations of benzene or toluene that may be associated with a gasoline plume from the two USTs at the former gas station. An isolated xylene concentration detected at SG-3 may be related to boats stored in the immediate vicinity of the sample location. Unique chromatogram peaks at SG-3, SG-4, and SG-7 may be acetone. A positive identification of these peaks could not be made because an acetone standard was not available for comparison during the survey. Acetone was detected in monitoring well MW-6 at 10 ppb. Acetone was not detected in monitoring wells MW-2 and MW-3. Acetone was not detected in monitoring wells MW-2, MW-3 or MW-6 during the Phase II or Phase III sampling events.

5.2 Ground Penetrating Radar (GPR)/Magnetometry Survey

On July 11, 1991, a GPR survey and a magnetometry survey were conducted in the vicinity of the former gas station. The purpose of the surveys was to detect and locate possible USTs associated with the former gas station. The GPR survey was conducted by Weston Geophysical Corporation (Weston) for McLaren/Hart. The magnetometry survey was conducted by McLaren/Hart personnel.

5.2.1 GPR Survey Procedures

Ground penetrating radar is an electromagnetic survey technique that reveals a graphic cross-sectional view of earth stratigraphy and point targets (i.e., drums, pipelines, utilities, boulders, etc.) below the ground surface. It is a reflection technique similar to the single-trace seismic reflection method commonly used in marine subbottom profiling. The two techniques differ in that the acoustic method uses audio frequency sound waves, while the radar method uses electromagnetic waves at frequencies of 80 to 1,000 megahertz (MHz).

In a radar system, high-frequency impulses of electromagnetic energy are generated by a transmitter in the antenna. Each impulse propagates downward through the ground surface and into the material below. At interfaces, part of the signal is reflected while part is transmitted still deeper to be reflected by other layers or isolated bodies. After transmitting the outgoing pulse, the antenna instantly switches from a transmitting mode to a receiving mode in order to detect the reflected signals.

During data acquisition, a graphic recorder provides an immediate view of the data. Radar impulses are transmitted in sync with a swept-stylus type graphic recorder. The graphic recorder stylus sweeps across the paper at a uniform speed. Reflected signals above

a user-selected threshold causes the paper to be darkened at points proportional to the amplitude of the reflection. Because the antenna is being pulled forward slowly, each pass of the stylus represents a slightly different antenna position. As the recorder paper advances, a continuous cross-section of reflections from subsurface stratigraphy and point targets is generated.

Data are recorded as a function of distance along the traverse versus time. Detected reflections are represented as the two way travel time to the reflector at a specific station location. Data enhancement is possible if the data are recorded on magnetic tape or diskette for later computer processing.

Data is plotted as a function of antenna position versus time. Accurate determination of the depth to any layer requires calibration of the radar system. Calibration is performed by moving the antenna over a metal target with a known depth, such as a buried metal plate or pipe. Metallic objects typically are depicted by a characteristic hyperbolic anomaly. The time scale can then be converted to a depth scale by determining the location of the known reflector on the GPR record. If the depth to an observed reflector is not known, a borehole can be drilled or an excavation conducted to establish its depth. This is a more costly procedure, but it provides an exact depth calibration.

An approximation of the depth to a reflector can be made by estimating the velocity of the medium and by directly reading the travel times of the radar signals on the GPR recording. Velocity can be estimated by the equation:

$$V_m \approx C/\sqrt{K'}$$

where

V_m is the velocity of the radar signals through the medium
C is the speed of light (2.998×10^8 m/s)

and K' is the dielectric constant. The values of the dielectric constant (electrical properties) for earth materials vary considerably and are affected by such conditions as porosity, degree of saturation, mineral composition, etc.

Depth of penetration in a given material is limited by attenuation of the signal. Attenuation is controlled by the amount of water and clay present in a material, the conductivity of the material and saturation fluids, and the degree of scattering of the electromagnetic signals. It is important to note that in a layered material a single, highly reflective layer alone can limit penetration by preventing the propagation of energy past it. In this case, apparent loss of energy is caused by reflection rather than by signal attenuation.

The area of investigation encompasses an approximately 80 foot by 80 foot area of the parking lot and adjacent road to the north and west of the former gas station. A five foot by five foot survey grid was established throughout the survey area by Weston field personnel, as shown on Figure 5-2. Survey lines were referenced by taped measurements to existing features, such as fences and curbs.

The GPR survey method was used to determine the depth and location of possible USTs. A GSSI model System 8 ground penetrating radar instrument, in conjunction with a 500 MHz antenna, was used to acquire data along the survey lines shown on Figure 5-2.

5.2.2 GPR Survey Results

An approximately 8 foot depth of investigation was achieved by GPR profiling at the former gas station. Figure 5-2 shows the locations of GPR anomalies.

EXPLANATION

- Fill location
- GPR survey line location
- 6 Point target indicative of utility or other point target and approximate depth in feet
- Inferred utility location
- Anomaly indicative of concrete or other reflective horizon
- Possible excavation
- Anomaly indicative of underground tank
- 3.5 Approximate tank location and depth

0 20 50
Scale in Feet

FROM: Weston Geophysical GPR Survey prepared for McLaren/Hart 8/6/91

FIGURE 5-2
FORMER GAS STATION
GPR COVERAGE AND ANOMALY MAP

McLAREN/HART

GPR anomalies indicative of two USTs were detected near the northwest corner of the former gas station. These anomalies are in proximity to existing fill caps (Figure 5-2). Both interpreted USTs appear to be oriented parallel to the existing road west of the former gas station. GPR results indicate that the eastern UST is the smaller of the two USTs and is buried at an approximate depth of 2 to 3 feet below grade.

The western UST appears to be approximately twice the length of the smaller UST and is interpreted to be located approximately 2.5 to 4 feet below grade. This UST appears to be shallower to the north possibly due to settlement of the tank. Figure 5-2 shows the approximate dimensions of the inferred USTs and the locations of utilities or other discrete objects ("point targets") disclosed by the GPR survey. An example GPR record showing the two interpreted underground tanks is provided as Figure 5-3.

GPR also detected a possible utility at a depth of 3 feet in the anticipated vicinity of the "grease pit". Evidence of excavation was also interpreted to the south of the known grease pit (Figure 5-2).

5.2.3 Magnetometry Survey Procedures

The magnetometry survey was completed at the former gas station using a UNIMAG II Portable Proton Magnetometer, Model G-846, manufactured by EG&G Geometrics. The area of survey was approximately 80 foot by 80 foot in area and used the same five foot by five foot survey grid established by Weston for the GPR survey (Figure 5-4). Direct Magnetic Field (DMF) measurements were made during the survey. DMF measurements were obtained by averaging three readings taken with the sensor detached from the unit and connected to a six-foot staff. A maximum possible resolution of one (1) gamma was obtained with the instrument in this configuration. Averaging three

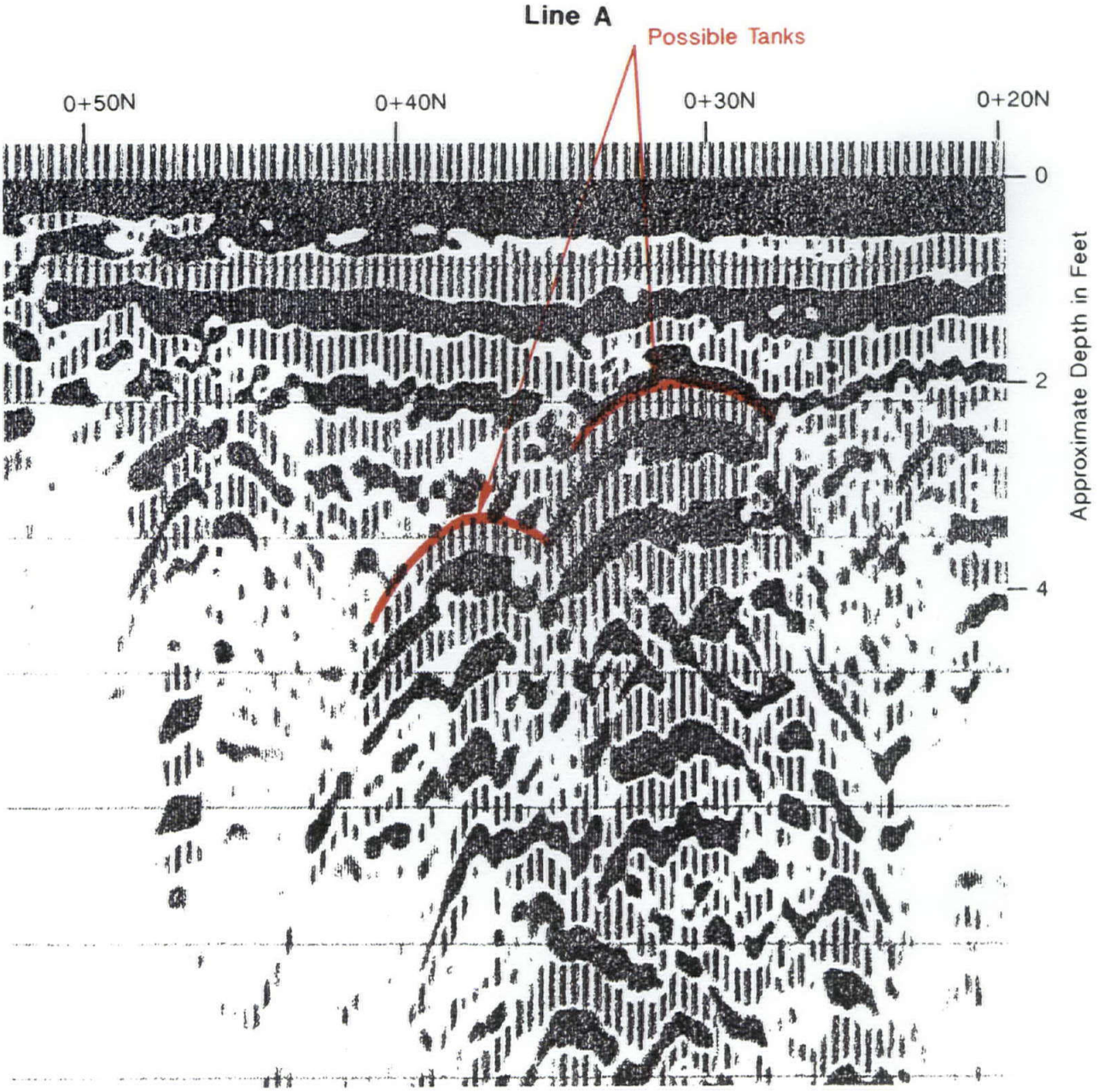


FIGURE 5-3

FORMER GAS STATION EXAMPLE GPR RECORD

McLAREN/HART

FROM: Weston Geophysical GPR Survey prepared for McLaren/Hart 8/6/91

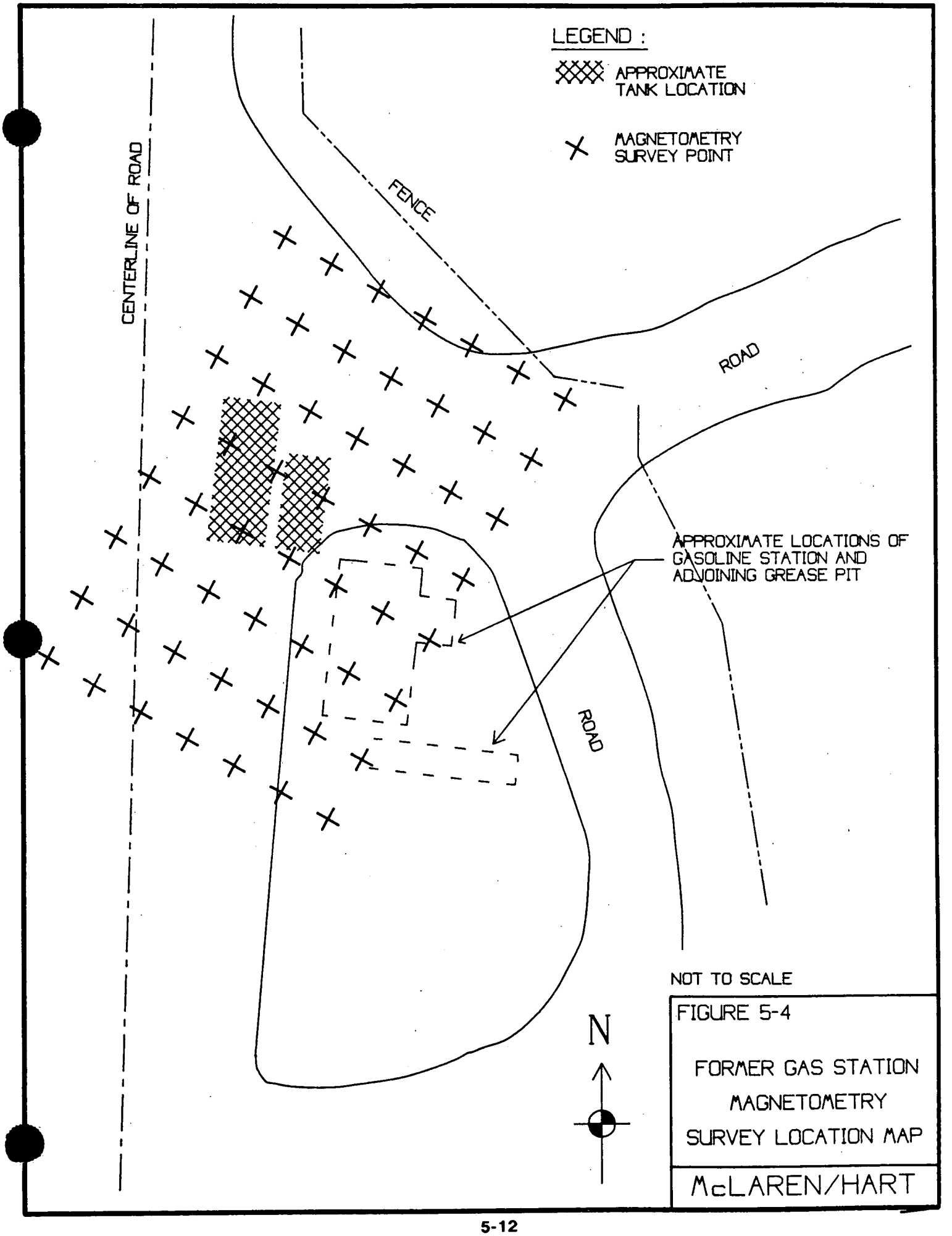


FIGURE 5-4

FORMER GAS STATION MAGNETOMETRY SURVEY LOCATION MAP

McLAREN/HART

readings per location checked instrument repeatability and increased data reliability. All magnetometer readings were obtained with the instrument pointing north which results in greater pole-to-pole anomalies. All data were recorded in gammas.

5.2.4 Magnetometry Survey Results

Figure 5-5 shows the magnetometry survey anomaly map. The anomaly map identifies a large anomaly in the vicinity of the two USTs. The center of the anomaly lies immediately south of the eastern (smaller) UST.

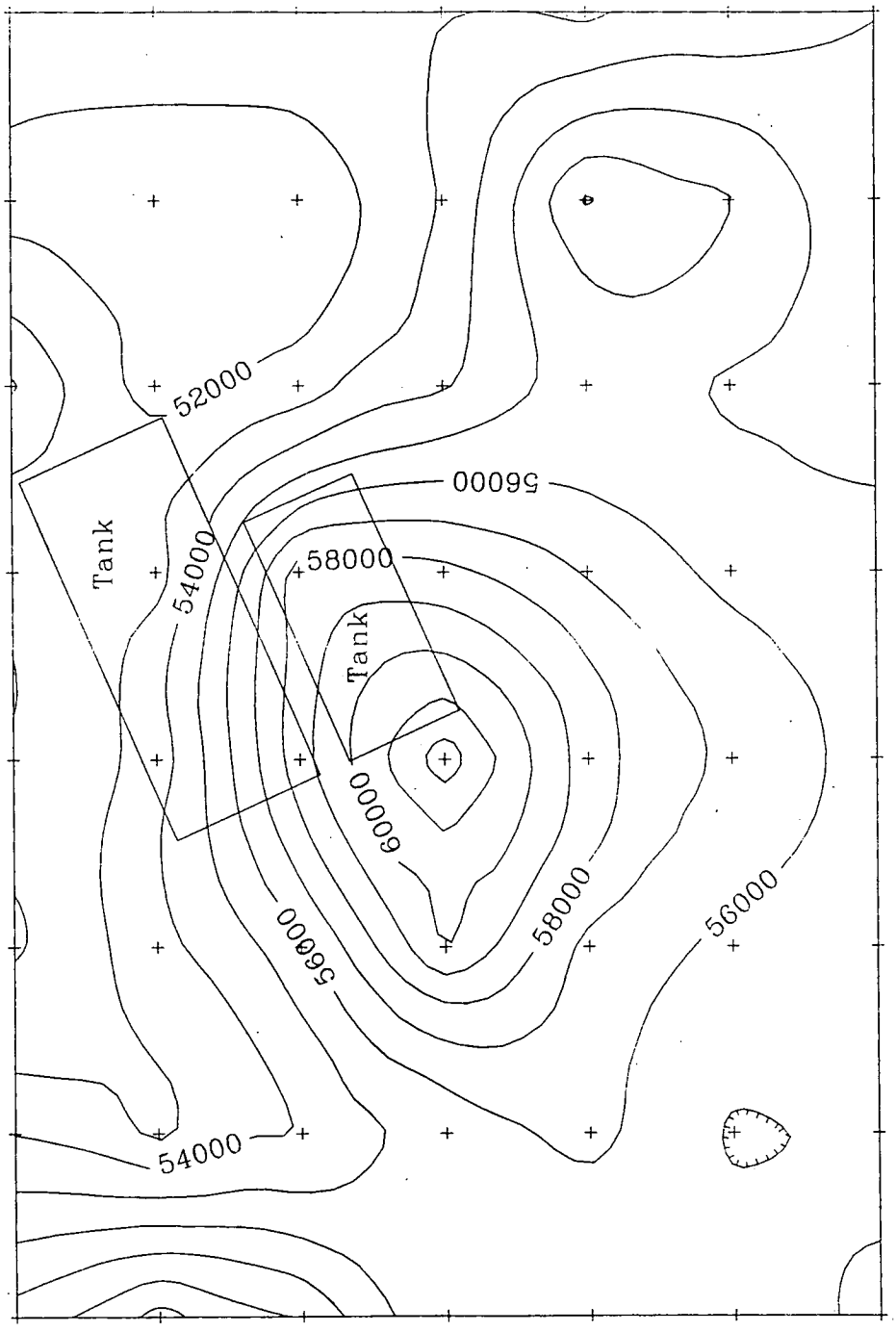
5.2.5 Interpretations/Discussion

The GPR survey had anomalies indicative of two parallel USTs. The eastern UST is the smaller of the two USTs and is buried approximately 2 to 3 feet below grade. The western UST appears to be twice the length of the eastern UST and is approximately 2.5 to 4 feet below grade.

The magnetometry survey had one large anomaly with its center located immediately south of the eastern UST. Results of the magnetometry survey are not as definitive as those of the GPR survey. The magnetometer is more susceptible to outside interferences (i.e., underground utilities, fences, etc.) than GPR. Therefore, magnetometry is not as reliable a remote sensing technique as GPR in areas with such interferences.

5.3 Drilling/Monitoring Well Installation

Drilling and monitoring well installation at the former gas station was conducted from July 17, 1991 through July 19, 1991. The test boring/monitoring well installation program was designed to provide information regarding the type, variability, and total thickness of fill and indigenous unconsolidated materials in the vicinity of the former gas station, and to define groundwater quality near the underground storage tanks.



LEGEND:

+ MAGNETOMETER SURVEY MEASUREMENT POINT

54000 MAGNETOMETER SURVEY CONTOUR LINE WITH CONTOUR INTERVAL IN GAMMAS

NOT TO SCALE

FIGURE 5-5

FORMER GAS STATION MAGNETOMETER SURVEY ANOMALY MAP

McLAREN/HART

5.3.1 Procedures

One test boring was drilled and completed as a bedrock monitoring well as shown in Figure 5-6. The test boring was advanced initially using the hollow-stem auger drilling technique. Groundwater was not encountered prior to reaching bedrock, so the ODEX drilling method was used to complete the test boring. CDS performed all drilling under the supervision of a McLaren/Hart geologist. A truck-mounted Gus Pech Brat 22 boring rig utilizing 4¼-inch ID, hollow-stem augers, and a truck-mounted Ingersoll-Rand TH-60 air-rotary rig, utilizing 6-inch ID casing were used for drilling. Cuttings produced by the drilling of test borings were contained in DOT-approved, 55 gallon drums supplied by PNS. The drums were labeled and later taken to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results.

The test boring was terminated within bedrock. An OVA, Geiger counter and a PDM-3 Miniram Aerosol Monitor were used to constantly monitor the drilling location for organic vapors, radiation, and airborne particulates during drilling.

Prior to drilling the first boring, the drilling equipment was steam-cleaned to remove possible contaminants. All drilling equipment which was to come in contact with the soil, as well as water tanks, pumps, and hoses, underwent the initial cleaning procedure. The drilling equipment was decontaminated between borings to prevent cross-contamination.

Prior to sampling, the split-spoons were decontaminated according to the protocol listed in Table 2-1. Samples to be submitted to the laboratory were placed into labeled, laboratory-supplied sample bottles and stored on ice in a field cooler for transport via courier to CEIMIC.

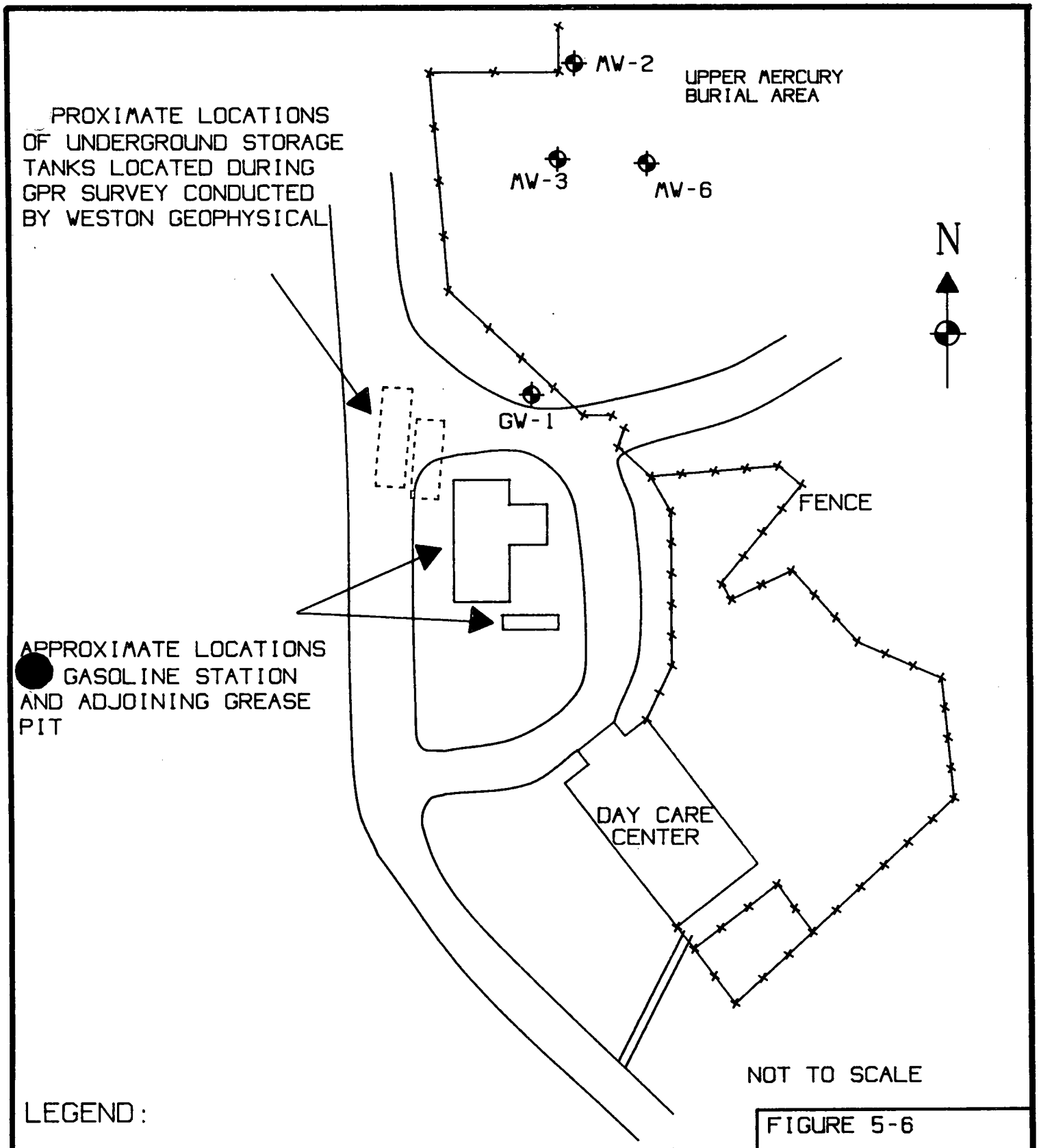


FIGURE 5-6

FORMER GAS STATION MONITORING WELL LOCATION

McLAREN/HART

A standard, two-foot, steel split-spoon was used to obtain soil samples in advance of drilling. Samples were obtained continuously. As each split-spoon soil sample was opened, the samples were immediately scanned with an OVA and a Geiger counter. Each sample was described in detail by a McLaren/Hart geologist. Detailed sample descriptions including blow counts, grain size, grain size distributions, and color are included in the test boring logs provided in Appendix I.

One soil sample was submitted to CEIMIC for chemical analysis of TCL Organics, TAL Inorganics, TOC, pH, percent moisture, and particle size analysis. Poor sample recovery, which occurred when coarse material was encountered in the subsurface, limited the number of samples collected and submitted for laboratory analyses.

A monitoring well was installed at the boring location. The monitoring well was constructed as described in Section 2.4.1. Monitoring well information is summarized in Table 2-7.

5.3.2 Findings

Information obtained from the subsurface boring indicates fill material overlying bedrock. Fill material was found to consist of brown fine to coarse grained sand with approximately 10 to 20% fine to medium grained gravel and approximately 20 to 35% silt. An approximately one foot thick weathered bedrock zone overlies competent bedrock.

5.3.3 Laboratory Analytical Results

One soil sample was collected in the test boring downslope of the USTs. QA/QC samples for this sample were collected as part of sampling at the JILF. The sample was analyzed for TCL Organics, TAL Inorganics, TOC, pH, percent moisture, and particle size analysis. A summary of the valid results of the soil sample collected during the Phase IV (July 17, 1991) sampling event are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in soils, New Jersey's Environmental Cleanup Responsibility Act (ECRA) Guidance Values and proposed Federal Action Levels documented in the Federal Register (55FR30865, July 27, 1990) are used for comparison purposes.

TCL Volatiles

There were no detectable volatile concentrations in the soil sample.

TCL Semi-Volatiles

There were no detectable semi-volatile concentrations in the soil sample.

A review of the chromatogram and the TICs listed for GSB-01(0-2) indicates petroleum in the sample. Since a petroleum identification was not performed on the sample, a determination as to the type of petroleum cannot be made.

TCL Pesticide/PCBs

Pesticides were detected, however, there were no pesticide concentrations above proposed Federal Action Levels. Pesticides are not listed under New Jersey ECRA Guidance Values. There were no detectable PCB concentrations in the soil sample.

TAL Inorganics

There was no detectable cyanide in the soil sample. Detectable metal concentrations were found in the soil sample. A semi-quantitative estimate for beryllium (0.88 mg/kg) exceeded the proposed Federal Action Level of 0.2 mg/kg. Lead, detected at 475 mg/kg, falls within the new Jersey ECRA Guidance Value range of 250 to 1,000 ppm. There were no other detectable metal concentrations exceeding either New Jersey ECRA Guidance Values or proposed Federal Action Levels.

TOC, pH, Percent Moisture

TOC was detected at 1.5%. pH was 8.7. Percent moisture was 4%.

Particle Size Analysis

The particle size analysis for GSB-01(0-2) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		16%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		59%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	9%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	36%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	14%	
Silt size, 0.074 to 0.005 mm:		25%
Clay, smaller than 0.005 mm:		0%
Colloids, smaller than 0.001 mm:		0%

5.3.4 Interpretations/Discussion

Only two metal concentrations (beryllium and lead) exceeded either the New Jersey ECRA Guidance Values or proposed Federal Action Levels. These metal concentrations fall within the ranges detected in background soil samples (Section 11.1.3). There does not appear to be any detectable prior releases from the two USTs based on visual observations from the soil boring and soil sample analysis at this location.

5.4 Monitoring Well Development

Groundwater monitoring well GW-01 was developed on July 25, 1991. Development began at least forty-eight (48) hours after the monitoring well was installed and prior to groundwater sampling. Development served to remove the finer grained material accumulating within the well screen and sand pack that may otherwise interfere with the water quality analyses, improve the hydraulic connection between the well and the surrounding formation, and to restore the groundwater affected by drilling fluids and other materials introduced during well construction.

5.4.1 Development Procedures

Monitoring well development of GW-01 was conducted according to the development procedures discussed in Section 2.5.1.

5.4.2 Development Findings

The following is a summary of the stabilized field parameters for GW-01:

Total Volume Removed (Gals)	pH	Temp (°C)	Specific Conductivity (umhos/cm)	Turbidity (NTUs)	Salinity (°/₀₀)
70	7.07	12.90	470	4.85	0

Based on the salinity and specific conductivity measurements, monitoring well GW-01 contains fresh water.

The turbidity measurements at monitoring well GW-01 stabilized below five (5) NTUs during development.

5.5 Groundwater Sampling

Groundwater sample GW-01-04 was collected from monitoring well GW-01 on August 13, 1991 (Figure 5-6).

The objective of sampling groundwater within the vicinity of the former gas station area is summarized as follows:

1) To provide valid, properly obtained groundwater sampling data.
2) To evaluate the quality of bedrock groundwater within the vicinity of the former gas station and the existing USTs.
3) To assess whether organic compounds and/or inorganic constituents related to past conditions of the former gas station and the existing USTs have impacted the groundwater.

4) To assess whether any organic compounds and/or inorganic constituents in the groundwater sample obtained from monitoring well GW-01 are present in concentrations that exceed applicable groundwater standards.

5.5.1 Sampling Procedures

Prior to collecting the groundwater sample, the static water level was measured, and the volume of water in the well was calculated. Monitoring well casing and groundwater elevation information during sampling are summarized below:

Depth to Groundwater from TC (ft.)	Total Depth of Well From TC (ft.)	TC Elevation (ft. MHT)	Groundwater Elevation (ft. MHT)	Bottom of Screen Elevation (ft. MHT)	Well Volume (Gal.)
9.63	28.20	119.48	109.85	91.28	3.03

MHT = Mean High Tide
TC = Top of Casing

Prior to purging, the groundwater was first checked for immiscible product phases using a precleaned, bottom-filling clear plexiglass bailer with a teflon check valve. The well was then purged as described in Section 2.6.1 using a dedicated, precleaned bottom-filling teflon bailer with a teflon check valve. The well was then purged until at least three well volumes were removed. All purge water was contained in DOT-approved 55-gallon drums supplied by PNS. The drums were labeled and later taken to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results to ensure proper disposal.

Monitoring well GW-01 was sampled immediately following purging as previously described in Section 2.6.1. The teflon bailer was decontaminated prior to use according to the protocol listed in Table 2-1.

The groundwater sample from monitoring well GW-01 was analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals).

The groundwater from well GW-01 was field analyzed for pH, temperature, specific conductivity, turbidity, and salinity prior to sample collection. Field parameter measurements were recorded in field notebooks (Appendix II). A summary of groundwater sampling and field parameters for monitoring well GW-01 are summarized below:

Total Volume Removed (Gals)	pH	Temp (°C)	Specific Conductivity (umhos/cm)	Turbidity (NTUs)	Salinity (‰)
9.5	7.47	16.0	437	> 200	0

Groundwater sample GW-01F-04 collected for dissolved metal analyses was field filtered through 0.45 micron cellulose prior to collection in a pre-preserved, laboratory-supplied bottle. Preservatives provided in the laboratory-supplied bottles, and their associated analyses were as follows:

Metals (both dissolved and total) - Nitric Acid
Cyanide - Sodium Hydroxide
Volatiles - Hydrochloric Acid

Upon collection, groundwater samples from monitoring well GW-01 were placed in a cooler which was kept chilled using ice. The groundwater sample cooler was delivered via courier to CEIMIC.

5.5.2 Findings (Groundwater Conditions)

Prior to sampling, the turbidity reading in monitoring well GW-01 exceeded the maximum reading of the turbidity meter (i.e. greater than 200 NTUs). The lower turbidity readings reached during development suggest that suspended particulates in the groundwater are forming a mudcake on the sand pack during development and are subsequently being resuspended in the water after development ceases.

Salinity and specific conductivity readings obtained during sampling of the well indicate fresh water conditions.

There were no immiscible product phases observed in the groundwater.

5.5.3 Laboratory Analytical Results

Groundwater sample GW-01-04 was collected from monitoring well GW-01 in the vicinity of the former gas station. The sample number is followed by "-04" to denote the fourth phase of work. A summary of valid groundwater results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

The State of Maine does not have published clean-up guidelines for contamination in groundwater, therefore, NPDWR and proposed Federal Action Levels are used to evaluate the analytical data.

TCL Volatiles

There were no detectable volatile concentrations in groundwater sample GW-01-04.

TCL Semi-Volatiles

Only one detectable semi-volatile compound was found in groundwater sample GW-01-04. Bis(2-Ethylhexyl)phthalate detected at 18 ug/L exceeds the proposed Federal Action Level of 3 ug/L. Bis(2-Ethylhexyl)phthalate is not listed under NPDWR.

A review of the chromatogram and the TICs listed for GW-01-04 indicates petroleum in the sample. Since a petroleum identification was not performed on the sample, a determination as to the type of petroleum cannot be made at this time.

TCL Pesticide/PCBs

There were no detectable pesticide or PCB concentrations in groundwater sample GW-01-04.

TAL Inorganics

Detectable total (unfiltered) and dissolved (filtered) metal concentrations were found in groundwater sample GW-01-04 and GW-01F-04, respectively. Only two metal concentrations exceeded NPDWR and/or proposed Federal Action Levels in sample GW-01-04. Cadmium detected at 8 ug/L exceeded the NPDWR value of 5.0 ug/L. A semi-quantitative estimate of chromium (53.0 ug/L) exceeded the NPDWR and proposed Federal Action Level of 50.0 ug/L. There were no metal concentrations in GW-01F-04 exceeding NPDWR or proposed Federal Action Levels.

There was no detectable cyanide concentration found in groundwater sample GW-01-04.

5.5.4 Interpretations/Discussion

There were no detectable volatile concentrations in groundwater sample GW-01-04. However, a review of the chromatogram and the TICs listed for the sample indicates the presence of petroleum. Since none of the main components of gasoline (benzene, toluene, ethylbenzene, or xylene) were detected in the sample, it may be assumed that the petroleum indicated in the chromatogram is not gasoline. In any future sampling of monitoring well GW-01 a petroleum identification should be requested as part of the analysis to determine the type of petroleum present in the groundwater.

Two metal concentrations, cadmium (8 ug/L) and a semi-quantitative estimate of chromium (53 ug/L), barely exceeded the NPDWR and/or proposed Federal Action Levels for these two metals in the unfiltered sample. There were no metal concentrations which approached NPDWR or proposed Federal Action Levels in the filtered sample. Future sampling events should monitor unfiltered metal concentrations. Because of the low metal concentrations in the filtered sample, future sampling events do not need to include analysis for filtered metals.

5.6 Conclusions/Recommendations

Results of a soil gas survey conducted in the vicinity of the former gasoline station did not reveal any evidence of contamination attributable to a gasoline plume from the two USTs. An isolated xylene concentration was detected at location SG-3 (Figure 5-1) three feet below grade. This concentration may be associated with boats stored in the immediate vicinity of the sample location. Unique chromatogram peaks, similar to that of acetone, were identified at locations SG-3, SG-4, and SG-7. A positive identification of these peaks could not be made because an acetone standard was not available to run during the survey.

GPR and magnetometry surveys were conducted in the vicinity of the former gas station to detect and locate possible USTs. The GPR survey had anomalies indicative of two parallel USTs (Figure 5-2). The eastern UST is the smaller of the two USTs and is buried approximately 2 to 3 feet below grade. The western UST appears to be twice the length of the eastern UST and is approximately 2.5 to 4 feet below grade.

The magnetometry survey had one large anomaly with its center located immediately south of the eastern UST (Figure 5-5). Results of the magnetometry survey are not as definitive as those of the GPR survey. The magnetometer is more susceptible to outside interferences (i.e.,underground utilities, fences, etc.) than GPR. Therefore, magnetometry is not as reliable a remote sensing technique as GPR in areas with such interferences.

A test boring was drilled and completed as a bedrock monitoring well (GW-01) downslope, presumably downgradient, of the USTs (Figure 5-6). Groundwater was not encountered in the overburden, therefore, an overburden well was not installed. A soil sample collected during drilling did not have contaminant concentrations attributable to prior releases from the USTs.

A groundwater sample collected from monitoring well GW-01 did not have any detectable concentrations of gasoline components. However, a review of the chromatogram and the TICs listed for the sample indicated the presence of petroleum. An additional groundwater sample should be collected from GW-01 and a petroleum identification requested to determine the type of petroleum present in groundwater. No additional groundwater or soil studies at the former gasoline station are deemed necessary at this time. It is recommended, however, that the volume be determined of any remaining liquid in each tank. All liquids should be properly identified and removed for disposal, with the emptied tanks and pipelines cleaned and removed from the ground. Confirmation soil sampling should be completed after each tank has been removed to verify site condition immediately surrounding the tank.

6.0 FUEL OIL SPILLAGE AREA (SWMU #27)

According to PNS personnel, an abandoned fuel line system carrying #6 fuel oil ran parallel to and along Berth 6 at a depth of approximately six feet. In 1978, a leak was detected in the pipeline. The pipe, which carried the #6 fuel oil, was found to be deteriorated and leaking when the piping was excavated and removed.

A Phase II exploratory test pit investigation was performed on August 8, 1990 at Berth 6 (SWMU #27) to assess the potential for soil contamination in the vicinity of the former fuel oil pipeline. Soil samples collected showed concentrations of TPH ranging from 200 mg/kg to 4,600 mg/kg.

The Phase III investigation consisted of drilling ten test borings on January 6-7, 1991 and sampling subsurface soil to further characterize the extent and concentration of contamination in the vicinity of the former fuel oil pipeline. A total of eight soil samples were collected during this Phase III investigation for TPH and PAH analysis. In addition, a petroleum fingerprint analysis was performed on two of these samples. The results exceeded the New Jersey ECRA Guidance Value of 100 ppm for TPH in soil in every sample ranging from 140 to 2,000 mg/kg. Detectable concentrations of PAHs were also found, however, only one sample, FSB-6(2-6) at 18.18 mg/kg, had Total PAHs concentration exceeding the New Jersey ECRA Guidance Value of 10 ppm for Total PAHs in soil. The petroleum fingerprint analyses indicated the presence of a weathered diesel fuel in the soil along Berth 6 (SWMU #27).

The Phase IV investigation related to this SWMU consisted of an environmental assessment, a subsurface soil sampling program around the tank farm, excavation of exploratory test pits along Berth 6, test boring/monitoring well installation along Berth 6, groundwater sampling and outfall sampling. These tasks were designed to characterize the source, nature and extent of contamination in the vicinity of the former fuel oil pipeline and the tank farm.

6.1 Environmental Assessment

From July 10 through July 12, 1991, an environmental assessment was conducted at the Fuel Oil Spillage Area, which includes Berth 6 and the adjacent Tank Farm. The purpose of the assessment was to identify potential causes for fuel oil contamination observed at SWMU #27.

6.1.1 Procedures

The environmental assessment consisted of interviews with knowledgeable PNS personnel, a review of available PNS maps and documents relating to the assessment area, and an on-site visual inspection of the area.

6.1.2 Findings

The following is a summary of the information obtained from the assessment of Tanks T1, T2, and T6, and Berth 6. Included in the summary is general tank information, release incidents, and findings from an on-site visual inspection.

** TANK T1 -- #6 FUEL OIL **

General Tank Information

- Installation date: Late 1920's
- Capacity: 190,000 barrels (1 barrel = 42 gallons petroleum product)
- Tank Location: Aboveground
- Tank Material of Construction (MOC): Steel
- Piping Location: Underground
- Piping MOC: Steel
- Contents: #6 Fuel Oil
- Surrounded by earthen berm
- Storm sewer drain within bermed area to oil/water separator.

Incident -- Release/Contaminated Soil

- PNS MEMO 23JUN84. Facility site map defining area of contaminated soil within bermed area of T1 corresponds with location of underground piping. 2,200 cubic yards of contaminated soil was removed and the excavation backfilled. Specific source and date or duration of the release was not mentioned. Source of release is generally stated as equipment failure.

- PNS MEMO NOV84, AWARD OF CONTRACT NOTICE 1984. Contaminated soils removed and excavation backfilled in 1984.

- PNS MEMO NOV83. Earliest documented evidence of the release.

- According to PNS personnel, no confirmatory sampling was done following soil removal. The release may have been due to tank corrosion prior to 1982. The tank was refurbished in 1982.

- No other information concerning this release was uncovered.

On-Site Visual Inspection

- Free oil was observed in a small excavation near T1. It appeared that maintenance of the underground piping was underway in this excavation. The source of the free product (oil) was not discovered.

- No evidence of additional contamination was observed.

** TANK T2 -- #6 FUEL OIL **

General Tank Information

- Installation date: Late 1920's
- Capacity: 150,000 barrels
- Tank Location: Aboveground
- Tank MOC: Steel
- Piping Location: Underground
- Piping MOC: Steel
- Contents: #6 Fuel Oil
- Surrounded by earthen berm
- Storm sewer drain within bermed area to oil/water separator.

Incident -- Release/Contaminated Soil (Late 1970s)

- According to PNS personnel, a damaged valve released several thousand gallons of #6 fuel oil to the surface soil within the bermed area of T2. Most of the released oil was recovered, the remaining oil (no estimate of amount) was covered in place with clean fill.

- No other information concerning this release was uncovered.

Incident -- Release/Contaminated Soil (Early 1980s)

- According to PNS personnel, a release of #6 fuel oil to the soil occurred within the bermed area of T2. A leaking underground pipe from T2 was the most likely source. Duration of the release is unknown.

- PNS MEMO 23JUN84. A facility site map defined the area of contaminated soil within the bermed area of T2 to be removed. Specific source and date or duration of release was not mentioned. The source of release is generally stated as equipment failure.

- PNS MEMO NOV84, AWARD OF CONTRACT NOTICE 1984. Contaminated soils removed and excavation backfilled in 1984.

- According to PNS personnel, no confirmatory sampling was done following soil removal.

- No other information concerning this release was uncovered.

On-Site Visual Inspection

- A layer of oil contaminated soil, approximately 4" thick and 2' feet below grade, was observed in a small excavation near T2. It appeared that maintenance of the underground piping was underway in this excavation. The source of this contamination may be the reported release in the late 1970's.

- Also observed in this excavation were oil stained concrete pipe containment structures, indicating the likelihood of leaking pipes.

<u>** TANK T6 -- #2 FUEL OIL **</u>

General Tank Information

- Installation date: Late 1942
- Capacity: 55,000 barrels
- Tank Location: Aboveground
- Tank MOC: Steel
- Piping Location: Underground
- Piping MOC: Steel
- Contents: #2 Fuel Oil
- Surrounded by earthen berm
- Storm sewer drain within bermed area to oil/water separator.

Incident -- Release/Contaminated Soil (Before 1982)

- PNS MEMO APR84. A release at T6 occurred over an extended period of time. The ground was saturated in the area. The source of the release is attributed to the poor condition of the tank.

- According to PNS personnel, the tank was refurbished in 1982. No confirmatory sampling was done following soil removal.

- PNS MEMO NOV84, AWARD OF CONTRACT NOTICE 1984. Contaminated soils were removed and the excavation backfilled in 1984.

Incident -- Release/Contaminated Soil/Contaminated Water (1984)

- PNS MEMO 16APR84. On 12APR84 a sheen was observed on the pond near T6. Upon investigation it was found that the berm around T6 adjacent to the pond was saturated with oil.

- PNS MEMO 20JUN84. A #2 fuel oil leak was discovered in the T6 distribution line. The leak was located 100 feet from the tank end. A 30' section of underground pipe was examined and corrosion was found.

- According to PNS personnel, a sheen was noticed on the adjacent pond along with stressed vegetation. Free oil was observed seeping out of the T6 earthen berm and into the T6 bermed area and the pond. The T6 distribution line was replaced in 1984-1985.

- PNS MEMO 04OCT85. A hydrostatic test of Tank T6 and its distribution line was conducted. The tank and line passed the hydrostatic test.

On-Site Visual Inspection

- No evidence of contamination was observed.

<u>** BERTH 6 **</u>

Incident -- Release/Contaminated Soil (1981)

- PNS MEMO 11SEP81. An oil leaching problem was discovered at Berth 6. The oil distribution lines at this location were capped and tested. An 8" #6 fuel oil line and a 6" #2 fuel oil line failed hydrostatic testing.

- According to PNS personnel, the capped lines were abandoned in place. It was reported that a contractor recently cut and removed a portion of the abandoned lines from an excavation near Building 151. Over a short period of time the excavation partially filled with oil from the cut lines.

- According to PNS personnel, it was likely that all six of the distribution lines were corroded and possibly leaked.

- Corrosion of the distribution lines is evident in a 1981 photograph.

On-Site Visual Inspection

- No evidence of contamination was observed.

- One pipe bunker has not yet been removed. Evidence of backfilling was observed at the locations of the other bunkers. No evidence of backfilling was observed along the path of the underground distribution lines. It is possible the abandoned lines are still in place.

6.2 Tank Farm Subsurface Soil Sampling

The subsurface soil sampling investigation around the tank farm was conducted on July 31 and August 1, 1991. Soil samples were collected from shallow auger borings around the tank farm to evaluate the nature and extent of potential petroleum contamination due to documented releases within the bermed areas. The samples were also collected to assess the potential that the petroleum contamination found along Berth 6 during Phases I and III is related to the documented releases at the tank farm.

6.2.1 Sampling Procedures

A total of twenty-one shallow auger borings were drilled around the tank farm as shown in Figure 6-1. A second boring (TSB-04A) at location TSB-04 was drilled on August 7, 1991 to obtain soil samples for submission to CEIMIC. Asphalt, concrete, bedrock and surface obstructions blocked access at location TSB-18, therefore, no boring was drilled at this location and no sample was collected.

All shallow auger borings were drilled utilizing the Gus Pech Brat 22 hollow stem auger rig or a two man power auger. The auger was advanced to the desired depth or to bedrock refusal and the sample was collected. Cuttings produced by the drilling of the shallow borings were used as backfill.

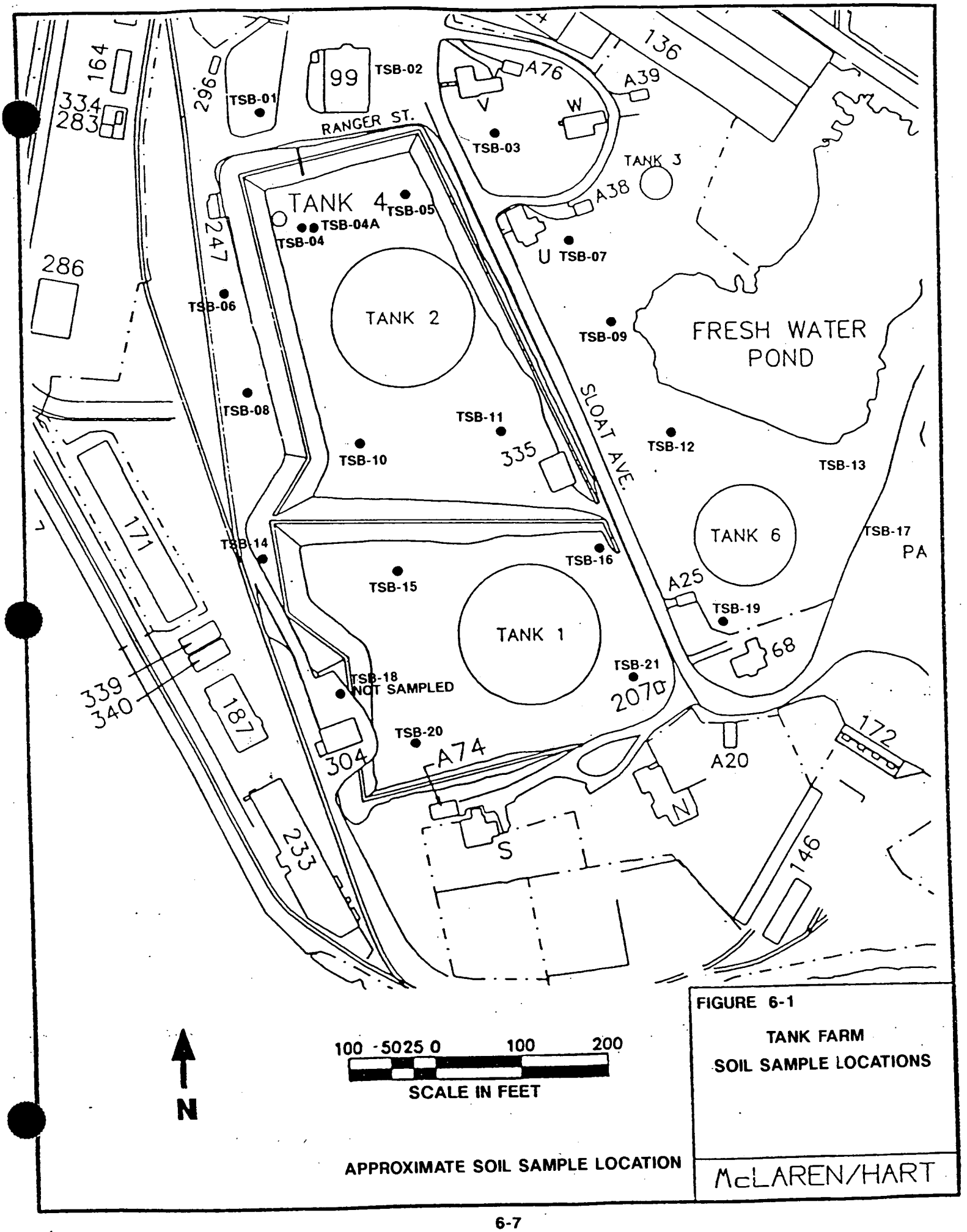


FIGURE 6-1

TANK FARM
SOIL SAMPLE LOCATIONS

An HNU photoionization detector or Organic Vapor Monitor (OVM), Geiger Counter and a PDM-3 Miniram Aerosol Monitor were used to constantly monitor each boring location for organic vapors, radiation and airborne particulates during drilling.

Prior to drilling at each location, the lead (initial) auger was steam cleaned to prevent cross-contamination between locations. Prior to drilling with the power auger, the auger was decontaminated according to the protocol listed in Table 2-1. In addition, all sampling equipment including split-spoons, hand auger and stainless-steel mixing bowls and trowels were also decontaminated according to the protocol listed in Table 2-1.

Soil samples were collected with a standard, two-foot, steel split-spoon, a hand auger or a stainless-steel trowel. All samples and borings were scanned with the HNU or OVM and Geiger Counter. Soil samples were collected from all borings and were submitted to McLaren/Hart's on-site mobile laboratory for petroleum hydrocarbon analysis. The petroleum hydrocarbon analysis was by Gas Chromatograph (GC) and all results were quantitated using N° 2 fuel oil as a reference. Based on these results, a representative group of samples were sent to CEIMIC for further analysis. CEIMIC analyzed the samples for TPH by Infrared Spectrophotometry (IR) and a quantitative petroleum identification (ID).

A total of twelve soil samples and one equipment rinseate field blank (TRB-14-04) were submitted to the laboratory for various analyses. Eight of the twelve samples were analyzed for Total Petroleum Hydrocarbons (TPH) and petroleum ID only, two samples were analyzed for TCL Organics, TAL Inorganics, pH and percent moisture, one sample was analyzed for TCL Organics, TAL Inorganics, pH, percent moisture, TOC, TPH and petroleum ID, and the last sample was analyzed for TCL Organics, TAL Inorganics, pH, percent moisture, TPH, petroleum ID, grain size distribution and Atterberg limits. Samples

to be submitted to CEIMIC were placed into laboratory-supplied bottles and stored on ice in field coolers for transport via courier to CEIMIC.

The equipment rinseate field blank was collected by pouring laboratory-supplied blank water over the sampling equipment after the equipment underwent the cleaning procedure. The water was collected directly into laboratory-supplied sample bottles. The equipment rinseate field blank was submitted along with the other samples and analyzed for TCL Organics, TAL Inorganics, and TOC.

6.2.2 Findings

The soil at all of the shallow auger borings consisted primarily of silty sands with varying amounts of gravel and clay. Bedrock refusal was encountered at almost all of the locations between 1.5 and 3.5 feet. No readings were detected on any of the monitoring instruments at any of the borings.

Visual evidence of contamination was observed at three of the locations. A weathered petroleum product was observed in the soil at TSB-05, a tar-like petroleum product was noticed in the soil at TSB-10 and an apparent dried fuel substance was noticed staining the surface soil at location TSB-15. No other odors or visual evidence of contamination was noticed at any of the other shallow auger borings.

6.2.3 Laboratory Analytical Results

Soil samples from all shallow auger boring locations, with the exception of TSB-04A, were submitted to McLaren/Hart's on-site mobile laboratory for TPH analysis by GC. Table 6-1 shows the intervals sampled along with the analytical results from the mobile laboratory. In addition, the table also shows the samples sent to CEIMIC and the analytical parameters for which each sample was analyzed.

TABLE 6-1

TANK FARM SHALLOW SOIL SAMPLING RESULTS
TPH--McLAREN/HART MOBILE LABORATORY

TANK FARM
PORTSMOUTH NAVAL SHIPYARD

KEY FOR CEIMIC PARAMETER ANALYSIS

A = TCL VOLATILES
B = TCL SEMI-VOLATILES
C = TCL PESTICIDES/PCBs
D = TAL METALS
E = CYANIDE
F = TOC
G = pH
H = PERCENT MOISTURE
I = TPH
J = PETROLEUM ID
K = PARTICLE SIZE DISTRIBUTION
L = ATTERBERG LIMITS

SAMPLE ID	INTERVAL (Ft)	CONCENTRATION (PPM)	SENT TO CEIMIC	PARAMETERS ANALYZED
TSB-01	6-8	< 1.0	X	IJ
TSB-02	1.5-3.5	16.47	X	IJ
TSB-03	1.7-2.0	1.609		
TSB-04	2-2.5	2560.68	X	IJ
TSB-04A*	1-2	NA	X	ABCDEGH
TSB-04A*	2.4-3.0	NA	X	ABCDEGH
TSB-05	2.6-3.1	2167.27		
TSB-06	3.2-3.8	< 1.0		
TSB-07	3.2-3.8	< 1.0	X	IJ
TSB-08	2.2-2.5	4.439	X	IJ
TSB-09	1-1.5	< 1.0		
TSB-10	2.6-3.8	87.59	X	ABCDEFGHIJ
TSB-10RE**	2.6-3.8	4202.18		
TSB-11	2-4	5.69		
TSB-12	1.2-1.8	< 1.0		
TSB-13	1.8-2.4	2.722		
TSB-14	1.9-2.2	2.675		
TSB-15	1.3-1.6	11.347	X	ABCDEFGHIJKL
TSB-16	2-2.5	9.90	X	IJ
TSB-17	3-4	< 1.0		
TSB-19	2.1-2.75	< 1.0	X	IJ
TSB-20	1.7-2.0	< 1.0	X	IJ
TSB-21	1.3-1.8	2.72		

NOTES:

NA = Not Analyzed
* = TSB-4A Sampled 8-7-91 For Submission to CEIMIC Only
** = Reanalyzed--Tar Like Substance in TSB-10 to Check Concentration
TSB-18 Not Drilled Due to Lack of Access

Proposed Federal Action Levels do not provide an action level for TPH in soil and the New Jersey ECRA Guidance Value of 100 ppm for TPH in soils is based on infrared spectroscopy. The difference in analytical methods does not allow for an accurate comparison of TPH results by GC analysis and the New Jersey ECRA Guidance Value.

Twelve of these soil samples and the equipment rinseate field blank were sent to CEIMIC for confirmation of the mobile laboratory results and further analysis. The specific samples sent to the laboratory and the respective analyses are given on Table 6-1.

A summary of valid analytical results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

The State of Maine does not have any published clean-up guidelines for contamination in soils, therefore, New Jersey Environmental Clean-up Responsibility Act (ECRA) Guidance Values and proposed Federal Action Levels documented in the Federal Register (55 FR 30865, July 27, 1990) are used for comparison purposes.

TCL Volatiles

Volatiles were analyzed only for soil samples TSB-04A(1-2), TSB-04A(2.4-3.0), TSB-10(2.6-3.8) and TSB-15(1.3-1.6), along with the equipment rinseate field blank. There were no detectable volatile concentrations in any of the samples, including the equipment rinseate field blank, above the proposed Federal Action Levels. There were also no detectable volatile concentrations above New Jersey ECRA Guidance Values either for an individual analyte or for total volatiles.

A review of the chromatograms and listed TICs contained in the laboratory data package indicated a petroleum product in all four of the above listed samples. The specific petroleum product could not be positively identified in the two samples from TSB-04A since a petroleum ID was not one of the parameters analyzed. Petroleum ID was conducted on some of the other samples, which is discussed later in this section.

TCL Semi-Volatiles

Detectable semi-volatile concentrations were found in all samples with the exception of TSB-15(1.3-1.6) and the equipment rinseate field blank. No detectable concentrations exceed proposed Federal Action Levels or New Jersey ECRA Guidance Values for individual analytes. One soil sample, TSB-10(2.6-3.8) had a total base neutral concentration of 27.5 mg/kg. This concentration is comprised of qualitative detections only and exceeds the New Jersey ECRA Guidance Value of 10 ppm for total base neutrals in soil. There were no samples exceeding the New Jersey ECRA Guidance Value for acid extractables.

A review of the chromatograms and listed TICs contained in the laboratory data package indicated a petroleum product in all of these samples. The specific petroleum product could not be positively identified in the two samples from TSB-04A since petroleum ID was not one of the analytical parameters for these samples. Petroleum ID was conducted on some of the other samples, which is discussed later in this section.

TCL Pesticide/PCBs

There were no detectable concentrations of pesticides in any of the soil samples. There was one detectable concentration of PCBs in soil sample TSB-10(2.6-3.8). This concentration was a valid analytical result of 930 ug/kg (0.93 mg/kg) for Aroclor-1260. This concentration does not exceed the New Jersey ECRA Guidance Value range of 1-5 ppm but does exceed the proposed Federal Action Level of 0.09 mg/kg.

TAL Inorganics

There were no detectable concentrations of cyanide in any of the soil samples. Detectable concentrations of metals were found in all soil samples and in the equipment rinseate field blank. Table 6-2 summarizes the metals concentrations that exceed New Jersey ECRA Guidance Values and/or proposed Federal Action Levels in each of the soil samples.

TABLE 6-2

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

TANK FARM
PORTSMOUTH NAVAL SHIPYARD

JULY 31, AUGUST 1 AND AUGUST 7, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
ANTIMONY	TSB-10(2.6-3.8)	12.50Q	10.0	30.0
BERYLLIUM	TSB-04A(1-2)	0.99J	1.0	0.2
	TSB-04A(2.4-3.0)	1.10J	1.0	0.2
	TSB-10(2.6-3.8)	0.95Q	1.0	0.2
	TSB-15(1.3-1.6)	1.20	1.0	0.2
CADMIUM	TSB-04A(2.4-3.0)	4.10	3.0	40.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available

TOC, pH and Percent Moisture

Table 6-3 shows the results for TOC, pH and percent moisture analyses. Analysis for TOC was conducted on only two of the four soil samples and on the equipment rinseate field blank. The pH ranged from 5.2 to 7.7 and the percent moisture ranged from 15.6 to 20 percent. The TOC results were 5.2, and 2.1 percent for samples TSB-10(2.6-3.8) and TSB-15(1.3-1.6), respectively. TOC was also detected in the equipment rinseate field blank (TRB-14-04), however, since TOC in water is reported in mg/L (ppm) and TOC in soil is reported in percent, the concentration in the equipment rinseate field blank does not affect the soil sample results.

Particle Size Analysis

A particle size distribution analysis was conducted on soil sample TSB-15(1.3-1.6). The results of this analysis are given below:

Gravel, passing 3-inch and retained on No. 4 sieve:		59%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		20%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	8%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	7%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	5%	
Silt size, 0.074 to 0.005 mm:		21%
Clay, smaller than 0.005 mm:		0%
Colloids, smaller than 0.001 mm:		0%

TABLE 6-3

SUMMARY OF TOC, pH, AND
PERCENT MOISTURE RESULTS

TANK FARM
PORTSMOUTH NAVAL SHIPYARD

JULY 31, AUGUST 1 AND AUGUST 7, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	TOC METHOD REPORTING LIMIT(°/∞)*	pH (SU)	PERCENT MOISTURE
TSB-04A(1-2)	NA	0.1	7.1	16.5
TSB-04A(2.4-3.0)	NA	0.1	7.7	15.6
TSB-10(2.6-3.8)	5.2	0.1	5.5	19.0
TSB-15(1.3-1.6)	2.1	0.1	5.2	20.0
TRB-14-04	1.0	1.0	NA	NA

* = Result is a Percent on a Dry Weight Basis
NA = Not Analyzed

Atterberg Limits

Atterberg limits were conducted on soil sample TSB-15(1.3-1.6). The results of this analysis are given below:

Parameter	Sample Result (%)
Liquid Limit (LL)	44.4
Plastic Limit (PL)	25.2
Plasticity Index (PI)	19.1

Total Petroleum Hydrocarbon (TPH)/Petroleum ID

A total of ten soil samples were submitted to CEIMIC for TPH and petroleum ID analyses. As part of the analysis and prior to quantitation, CEIMIC identified the type of petroleum product present and the concentration was quantitated with reference to a standard of the same petroleum product. The differences in the concentrations reported by McLaren/Hart's mobile lab and CEIMIC are the result of the differences in the analytical methodology and differences in how the results were quantitated. Direct comparisons of analytical data can only be made between results obtained by the same analytical methodology and quantitated with reference to the same petroleum product standard.

Table 6-4 summarizes the TPH and petroleum ID sample results for each of the soil samples analyzed. Eight out of the ten samples had detectable concentrations of TPH and five of those results exceeded the New Jersey ECRA Guidance Value of 100 ppm. In addition, five of the ten samples also had detectable concentrations of specific petroleum products as shown in Table 6-4. There are no standards or guidance values for these petroleum products in soils. Further, the New Jersey ECRA Guidance Value of 100 ppm is based on the IR method of analysis. Since the petroleum ID analysis utilizes the GC method, accurate comparisons of the analytical results may not be made between these sample results and the New Jersey ECRA Guidance Value of 100 ppm.

TABLE 6-4

SUMMARY OF TOTAL PETROLEUM HYDROCARBON/PETROLEUM ID CONCENTRATIONS – SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

TANK FARM
PORTSMOUTH NAVAL SHIPYARD

McLAREN/HART SAMPLE I.D.	TPH CONCENTRATION (PPM)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PETROLEUM ID CONCENTRATION (PPM)	TYPE OF PETROLEUM PRODUCT
TSB-01(6-8)	83	100	ND	---
TSB-02(1.5-3.5)	4500	100	ND	---
TSB-04(2-2.5)	44000	100	4157	DIESEL FUEL
TSB-07(3.2-3.8)	48	100	139	BUNKER OIL
TSB-08(2.2-2.5)	23000	100	379	TRANSMISSION FLUID
TSB-10(2.6-3.8)	22000	100	11730	BUNKER OIL
TSB-15(1.3-1.6)	1100	100	352	TRANSMISSION FLUID
TSB-16(2.0-2.5)	<34	100	ND	---
TSB-19(2.1-2.75)	<37	100	ND	---
TSB-20(1.7-2.0)	61	100	ND	---

ND =Not Detected
--- =None Identified
Bunker Oil is the Same as Nº 6 Fuel Oil

6.2.4 Interpretations/Discussion

Soil samples were collected from twenty-one shallow auger borings around the tank farm in an attempt to identify the source and the extent of petroleum contamination associated with SWMU #27. A total of twenty soil samples were collected and submitted to McLaren/Hart's on-site mobile laboratory for TPH analysis by GC. A portion of one of the samples (TSB-10RE(2.6-3.8)) was reanalyzed to evaluate the concentration of a tar-like substance in the sample. Soil samples from ten of these locations were sent to CEIMIC for further analysis. Two additional soil samples (TSB-04A(1-2) and TSB-04A(2.4-3.0)) from a second boring (TSB-04A) adjacent to TSB-04 were also submitted to CEIMIC.

The chromatograms for TCL Volatiles and TCL Semi-volatiles for samples TSB-04A(1-2), TSB-04A(2.4-3.0), TSB-10(2.6-3.8) and TSB-15(1.3-1.6) indicate the presence of a petroleum product in the soil. The chromatograms alone are sufficient for stating that a petroleum product is present but are insufficient for positively identifying the specific petroleum product. In order to positively identify the specific petroleum product, a petroleum ID analysis must be conducted.

A total of ten soil samples were submitted for petroleum ID analysis (Table 6-1) to verify the type(s) of petroleum present in the soil around the tank farm. The petroleum ID results indicate the presence of diesel fuel in the soil from TSB-04(2-2.5), Bunker oil (#6 fuel oil) in TSB-07(3.2-3.8) and TSB-10(2.6-3.8) and transmission fluid in TSB-08(2.2-2.5) and TSB-15(1.3-1.6). No petroleum products were detected in any of the other ten samples submitted to CEIMIC.

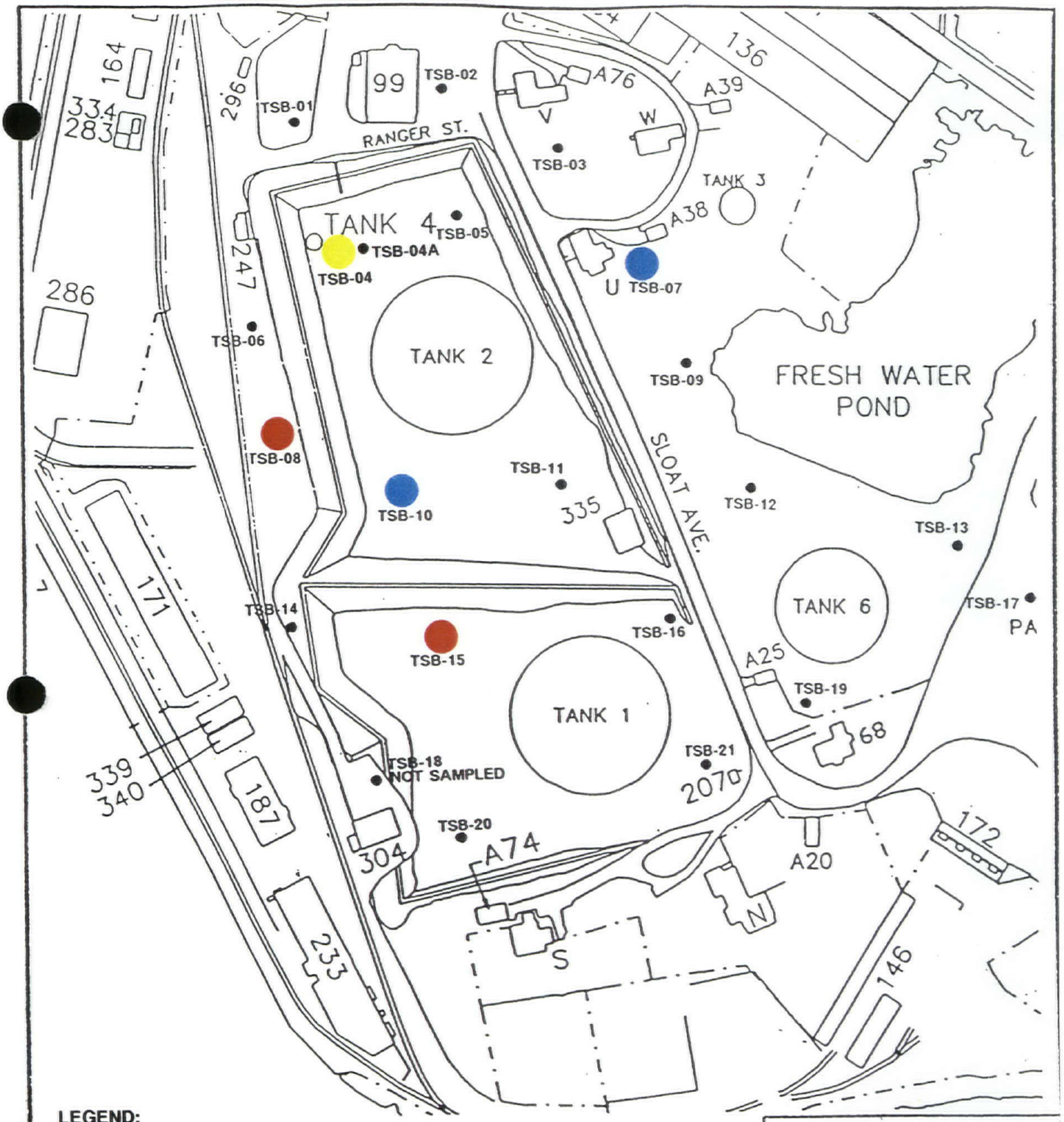
Two of these samples, TSB-10(2.6-3.8) and TSB-15(1.3-1.6) were analyzed for TCL Volatiles, TCL Semi-volatiles and petroleum ID among other parameters. For both samples, the petroleum ID analysis positively identified the petroleum product present. The

chromatograms generated for TCL Volatiles and TCL Semi-volatiles were used for comparison purposes to help identify the petroleum product in other samples.

The chromatograms generated for samples TSB-04A(1-2) and TSB-04A(2.4-3.0) were almost identical and did not correlate well with the chromatograms for TSB-10(2.6-3.8) and/or TSB-15(1.3-1.6). This indicates that the petroleum product in boring TSB-04A is not the same bunker oil or transmission fluid positively identified in borings TSB-10 and TSB-15, respectively. The chromatograms for samples TSB-04A(1-2) and TSB-04A(2.4-3.0) closely resemble the chromatogram generated by diesel fuel. In addition, boring TSB-04A was drilled in close proximity to boring TSB-04 where petroleum ID analysis positively identified diesel fuel present in sample TSB-04(2-2.5). For these reasons, there is a strong possibility that the petroleum product detected in both samples from boring TSB-04A is diesel fuel. Figure 6-2 shows the boring locations with the petroleum ID results.

The source(s) of these petroleum products in the soil has not been identified. According to PNS files reviewed during the Environmental Assessment (Section 6.1.2), several incidents were reported involving the release of bunker oil (#6 fuel oil) within the bermed area around Tank 2 and diesel fuel (#2 fuel oil) within the bermed area around Tank 6. The bunker oil found in boring TSB-10 is probably due to any of several reported bunker oil releases associated with Tank 2 and the underground piping. The other petroleum products discovered (diesel in TSB-04 and TSB-04A, transmission fluid in JSB-08 and TSB-15 and bunker oil in TSB-07) in the borings do not appear to be directly related to the incidents discussed in Section 6.1.2and are probably due to small localized spills such as drum storage leaks or vehicle leaks.

The observed concentrations of PCBs and TAL metals were above New Jersey ECRA Guidance Values and/or proposed Federal Action Levels. Possible sources of these analytes are unknown.



LEGEND:

- TRANSMISSION FLUID
- DIESEL OIL (#2 FUEL OIL)
- BUNKER OIL (#6 FUEL OIL)
- OTHER SOIL SAMPLING LOCATIONS

100 50 25 0 100 200

SCALE IN FEET

N

FIGURE 6-2

TANK FARM

PETROLEUM IDENTIFICATION

ANALYSIS RESULTS

McLAREN/HART

6.3 Exploratory Excavations/Drilling/Monitoring Well Installation

Exploratory test pits were excavated at the fuel oil spill area from August 2, 1991 through August 7, 1991. The purpose of the test pits was to collect shallow subsurface soil samples and to clear locations for monitoring well installation.

Drilling and monitoring well installation at the fuel oil spillage area was conducted from August 5, 1991 through August 8, 1991. The test boring/monitoring well installation program was designed to provide information regarding the type, variability, and total thickness of fill in the fuel oil spillage area, and to define groundwater quality.

6.3.1 Procedures

A total of five exploratory test pits were excavated at the fuel oil spill area during this phase of the investigation. The locations of the test pits are shown on Figure 6-3 along with the six monitoring well locations. Monitoring well FW-02 was drilled adjacent to test boring FSB-08, from the Phase III field investigation, therefore, no test pit was excavated in this area.

The test pit excavation was conducted by William A. Renaud Jr. Trucking, Inc. using a Case 580 Construction King backhoe under the supervision of a McLaren/Hart geologist. Each test pit was excavated to approximately six feet below ground surface. Following completion of the excavation, one composite soil sample was collected from each excavation for analysis.

Soil samples were collected using precleaned stainless-steel hand trowels and mixing bowls. Soil was scraped from the sides of the excavation prior to sample collection to avoid sampling soil that may have come in contact with the backhoe shovel. Soil from several points in each excavation was then placed into a stainless-steel mixing bowl and homogenized with a stainless-steel hand trowel. Five soil samples, plus one duplicate, were

submitted to CEIMIC for chemical analysis of TCL Organics, TAL Inorganics, pH and percent moisture. In addition to these analyses, one of the samples was submitted for Atterberg limits and particle size analysis and one of the samples was submitted for TOC analysis. All samples for volatile analysis were collected directly into the laboratory-supplied sample containers to prevent possible contaminant losses during homogenization. Upon completion of sample collection activities, all test pits were backfilled with the excavated material and drilling activities for monitoring well installation were initiated.

Six test borings were drilled and completed as monitoring wells as shown in Figure 6-3. The test borings were advanced using the hollow-stem auger drilling technique. CDS performed all drilling under the supervision of a McLaren/Hart geologist. A truck-mounted Gus Pech Brat 22 boring rig utilizing 4¼-inch ID, hollow-stem augers was used for drilling. Cuttings produced by the drilling of the test borings were contained in DOT-approved 55 gallon drums supplied by PNS. The drums were labeled and later transported to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results prior to disposal.

All of the test borings were terminated within bedrock. An organic vapor monitor (OVM), Geiger Counter and a PDM-3 Miniram Aerosol Monitor were used to constantly monitor the drilling location for organic vapors, radiation, and airborne particulates during drilling.

Prior to drilling the first boring, the drilling equipment was steam-cleaned to remove possible contaminants. All drilling equipment which was to come in contact with the soil, as well as water tanks, pumps, and hoses, underwent the initial cleaning procedure. The drilling equipment was decontaminated between borings to prevent cross-contamination.

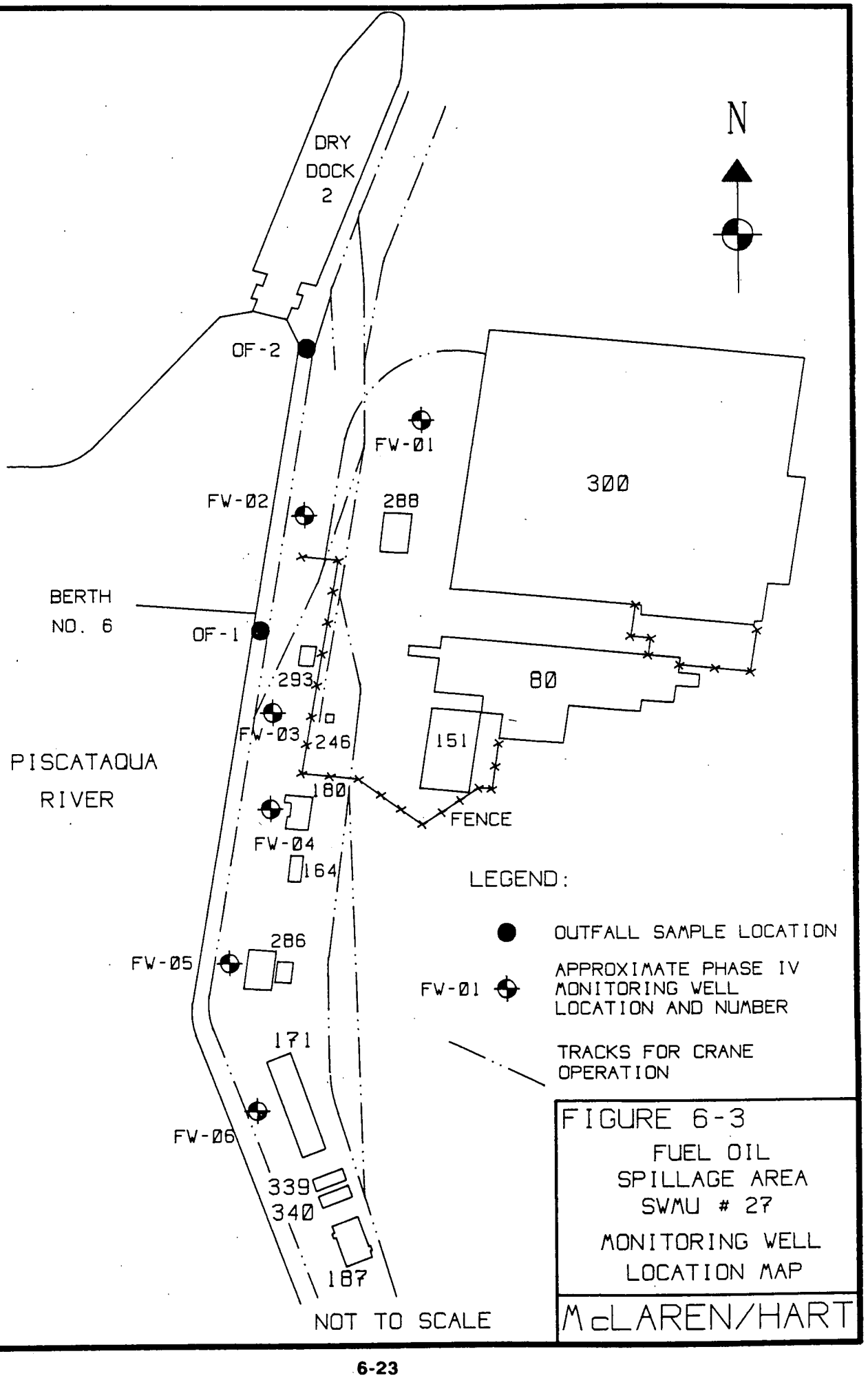


FIGURE 6-3
FUEL OIL
SPILLAGE AREA
SWMU # 27
MONITORING WELL
LOCATION MAP

McLAREN/HART

Because of the coarse material encountered during drilling operations, split-spoon samples were unobtainable. Soil samples at the drilling locations were obtained during the exploratory test pit excavations described earlier in this section.

A monitoring well was installed at each boring location. The monitoring wells were constructed as described in Section 2.4.1. Monitoring well information is summarized in Table 6-5.

6.3.2 Findings

Material encountered during test pit and drilling activities consisted of fill overlying weathered bedrock. Fill composition varied upon location, but consisted predominantly of sand and gravel with varying amounts of cobbles, rock fragments, silt, and clay. Petroleum product, presumably #6 fuel oil, was encountered when drilling and installing monitoring well FW-06. This petroleum product was encountered at approximately ten feet which was below the total depth of the exploratory test pit. Small bundles of old copper wire were encountered approximately eight to nine feet below grade at location FW-03.

Weathered bedrock was encountered from ten to twelve feet below grade. The weathered bedrock zone at the test boring locations ranged from 2.5 to 7 feet in thickness.

6.3.3 Laboratory Analytical Results

Soil samples were collected from all five exploratory test pits excavated along Berth 6. A summary of valid soil sample results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have any published clean-up guidelines for contamination in soils, New Jersey Environmental Clean-up Responsibility Act (ECRA) Guidance Values and proposed Federal Action Levels documented in the Federal Register (55 FR 30865, July 27, 1990) are used for comparison purposes.

TABLE 6-5

MONITORING WELL DETAILS

FUEL OIL SPILLAGE AREA (SWMU #27)
PORTSMOUTH NAVAL SHIPYARD

WELL Nº	SCREEN SETTING (FT.)[1]	SAND PACK (FT.)[1]	SAND CHOKER COLLAR (FT.)[1]	BENTONITE SEAL (FT.)[1]
FW-01	10.5-15.5	8.5-15.75	6.3-8.5	4-6.3
FW-02	10-15	8-17	7-8	1-7
FW-03	7.6-12.6	5.5-12.6	4.5-5.5	2-4.5
FW-04	10-15	8-16	7-8	4-7
FW-05	11.2-16.2	9-17	8-9	4-8
FW-06	5-15	4-16	4-5	1-4

[1] Below Grade

TCL Volatiles

There were no detectable volatile concentrations above the proposed Federal Action Levels. There were also no detectable volatile concentrations above New Jersey ECRA Guidance Values.

A review of the chromatograms contained in the laboratory data package indicated the presence of a petroleum product in the following soil samples: FSB-01-04(3-5), FSB-04-04(3-5), FSB-04-04(1-3) (duplicate of FSB-04-04(3-5)) and FSB-05-04(3-5). The specific petroleum product could not be identified since petroleum ID was not one of the analytical parameters.

TCL Semi-Volatiles

Detectable semi-volatile concentrations were found in soil samples FSB-01-04(3-5), FSB-04-04(3-5) and FSB-04-04(1-3), a Duplicate of FSB-04-04(3-5). Only one soil sample, FSB-04-04(1-3), had a total base neutral concentration (11.6 mg/kg) that marginally exceeded the New Jersey ECRA Guidance Value of 10 ppm for total base neutrals in soil. There were no samples exceeding the New Jersey ECRA Guidance Value for total acid extractables.

A review of the chromatograms and listed TICs contained in the laboratory data package indicated the presence of a petroleum product in the following soil samples: FSB-01-04(3-5), FSB-04-04(3-5), FSB-04-04(1-3) (duplicate of FSB-04-04(3-5)) and FSB-05-04(3-5). The specific petroleum product present could not be identified since petroleum ID was not one of the analytical parameters determined.

TCL Pesticide/PCBs

There were no detectable concentrations of pesticide/PCBs in any of the samples.

TAL Inorganics

There were no detectable concentrations of cyanide in any of the soil samples. Detectable metal concentrations were found in all of the soil samples. Table 6-6 summarizes soil samples which exceed New Jersey ECRA Guidance Values and/or proposed Federal Action Levels for metals in soil.

TOC, pH and Percent Moisture

Table 6-7 summarizes the results for TOC, pH and percent moisture analyses. Analysis for TOC was conducted on only one sample, FSB-06-04(3-5), and the result was 3.3 percent. The pH results ranged from 6.7 to 7.9 and percent moisture ranged from 7.3 to 21.9 percent.

Particle Size Distribution

A particle size distribution analysis was conducted on soil sample FSB-03-04(3-5). The results of this analysis are given below.

Gravel, passing 3-inch and retained on No. 4 sieve:		38%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		53%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	19%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	26%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	8%	
Silt size, 0.074 to 0.005 mm:		8%
Clay, smaller than 0.005 mm:		1%
Colloids, smaller than 0.001 mm:		0%

TABLE 6-6

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

FUEL OIL SPILLAGE AREA (SWMU #27) PORTSMOUTH NAVAL SHIPYARD

AUGUST 2-7, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
BERYLLIUM	FSB-01-04(3-5)	1.00Q	1.0	0.2
	FSB-03-04(3-5)	0.39Q	1.0	0.2
	FSB-04-04(3-5)	0.91J	1.0	0.2
	FSB-04-04(1-3)*	0.78Q	1.0	0.2
	FSB-05-04(3-5)	0.44Q	1.0	0.2
	FSB-06-04(3-5)	0.45Q	1.0	0.2
CADMIUM	FSB-01-04(3-5)	5.90	3.0	40.0
	FSB-04-04(3-5)	4.30	3.0	40.0
	FSB-04-04(1-3)*	4.00	3.0	40.0
COPPER	FSB-01-04(3-5)	306.00J	170.0	NA
LEAD	FSB-01-04(3-5)	534.00	250.0	NA
	FSB-04-04(3-5)	615.00	250.0	NA
	FSB-04-04(1-3)*	650.00	250.0	NA
SILVER	FSB-04-04(3-5)	5.80	5.0	200.0
ZINC	FSB-01-04(3-5)	1,510.00J	350.0	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of FSB-04-04(3-5)

TABLE 6-7

SUMMARY OF TOC, pH, AND
PERCENT MOISTURE RESULTS

FUEL OIL SPILLAGE AREA (SWMU #27)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 2-7, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)**	pH (SU)	PERCENT MOISTURE
FSB-01-04(3-5)	NA	7.1	21.9
FSB-03-04(3-5)	NA	7.0	7.3
FSB-04-04(3-5)	NA	7.9	12.1
FSB-04-04(1-3)*	NA	7.4	12.2
FSB-05-04(3-5)	NA	6.7	20.0
FSB-06-04(3-5)	3.3	7.5	15.0

* = McLAREN/HART Duplicate Sample of FSB-04-04(3-5)
** = Result is a Percent on a Dry Weight Basis
NA = Not Analyzed

Atterberg Limits

Atterberg limits were conducted on soil sample FSB-03-04(3-5). The result for the soil sample is that the material is non-plastic, which is indicative of silts, sands and gravels (coheionless, granular).

6.3.4 Interpretations/Discussion

A total of six soil samples were collected from five test pits at the fuel oil spill area, one from each test pit, plus a duplicate. The chromatograms for TCL Volatiles and TCL Semi-volatiles indicate the presence of a petroleum product in samples FSB-01-04(3-5), FSB-04-04(3-5), FSB-04-04(1-3) (duplicate of FSB-04-04(3-5)) and FSB-05-04(3-5). The chromatograms for samples FSB-04-04(1-3) and FSB-04-04(3-5) correlate well with the chromatograms for TSB-10(2.6-3.8) which, by petroleum ID analysis, is known to contain bunker oil. For this reason, there is a strong possibility that the petroleum product in samples FSB-04-04(1-3) and FSB-04-04(3-5) is bunker oil.

The petroleum product in the other two samples, FSB-01-04(3-5) and FSB-05-04(3-5), could not be identified using this method. The petroleum product in these two samples is a higher specific gravity, higher boiling point oil based on the location of the responses on the chromatogram. This pattern on the chromatogram generally indicates bunker oil, however, without a petroleum ID analysis and/or better chromatogram correlation, positive identification of the petroleum product present cannot be accomplished.

According to PNS files reviewed during the Environmental Assessment (Section 6.1.2), there have been incidents involving the release of both bunker oil (#6 fuel oil) and diesel fuel (#2 fuel oil) from a number of underground oil distribution lines along Berth 6. There is a strong possibility that these releases are the source of the petroleum contamination found in the soil at Berth 6.

Detectable concentrations of TAL metals were found in all of the soil samples. Possible sources of these metals are unknown at this time.

6.4 Monitoring Well Development

Groundwater monitoring wells FW-01, FW-02, FW-03, FW-04, FW-05, and FW-06, installed during Phase IV field activities at the Fuel Oil Spillage Area (SWMU #27) were developed from August 20-23, 1991. Development began at least forty-eight hours after installation of the monitoring wells and prior to groundwater sampling. Development serves to remove the finer grained material from the well screen and sand pack which may otherwise interfere with water quality analyses, improve the hydraulic connection between the well and the surrounding formation, and to restore the groundwater affected by drilling fluids and other materials introduced during well construction.

6.4.1 Development Procedures

All six of the monitoring wells installed during Phase IV at the Fuel Oil Spillage Area were developed according to the development procedures discussed in Section 2.5.1

6.4.2 Development Findings

All stabilized field parameters and the dates over which each well was developed are summarized in Table 6-8. All monitoring wells recharged quickly and were successfully developed in one day, except for FW-01 which was developed over two days after drying out at low tide.

Based on salinity and conductivity measurements given in Table 6-8, all monitoring wells contain saline water conditions. The temperatures recorded during development ranged from 18.0 to 24.0°C. These temperatures are comparable with the groundwater temperatures elsewhere on-site with the exception of monitoring well FW-02. This elevated temperature (24.0°C) may be the result of underground steam lines in the vicinity of the well.

TABLE 6-8

STABILIZED FIELD PARAMETERS

FUEL OIL SPILLAGE AREA (SWMU #27)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 20-23, 1991

Well N°	Development Date(s)	Total Volume Removed (Gals)	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTUs)	Salinity (°/∞)
FW-01	8/22-8/23/91	170	6.88	21.0	26,000	61.0	18.0
FW-02	8/22/91	100	7.42	24.0	24,500	6.0	17.5
FW-03	8/22/91	95	7.25	20.5	27,200	9.5	19.3
FW-04	8/21/91	80	7.13	19.1	28,700	10.1	20.5
FW-05	8/21/91	135	7.46	18.0	33,100	134.5	25.1
FW-06	8/20/91	165	6.80	18.5	30,000	35.3	22.8

Final turbidity measurements after development ranged from 6.0 to 134.5 NTUs. Development was considered complete after obtaining three consecutive turbidity measurements with five percent or less variation.

6.5 Groundwater Sampling

Groundwater samples were collected from all six monitoring wells installed at the Fuel Oil Spillage Area from August 26 to August 27, 1991 (Figure 6-3). One replicate sample, labeled FW-06I-04, collected from well FW-06 and one equipment rinseate field blank FRB-19-04 were included in this groundwater sampling.

The objectives of groundwater sampling at the Fuel Oil Spillage Area are summarized as follows:

1) To provide properly obtained groundwater sampling data for all monitoring wells;
2) To evaluate the quality of overburden groundwater within the vicinity of a former #6 fuel oil pipeline.
3) To assess whether organic compounds and/or inorganic constituents related to past or current conditions at the Fuel Oil Spillage Area have migrated to groundwater and potentially off-site.
4) To assess whether any organic compounds and/or inorganic constituents in groundwater samples obtained from the monitoring wells at the Fuel Oil Spillage Area are present in concentrations that exceed applicable groundwater standards.

6.5.1 Sampling Procedures

Prior to collecting groundwater samples, static water levels were measured in each of the monitoring wells and the volume of water in the well was calculated. All wells, with the exception of FW-06 due to the presence of free product in the well, were first checked for immiscible product phases prior to purging using a precleaned bottom-filling clear

plexiglass bailer with a teflon check valve. The wells were then purged as described in Section 2.6.1 using separate, dedicated, precleaned bottom-filling stainless-steel or teflon bailers with teflon check valves. The wells were purged until at least three well volumes were removed. All purge water was contained in DOT-approved 55-gallon drums supplied by the PNS. The drums were labeled and later taken to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results to ensure proper disposal.

All wells were sampled immediately following purging as previously described in Section 2.6.1. Bailers were decontaminated prior to use according to the protocol listed in Table 2-1.

All groundwater samples from the Fuel Oil Spillage Area monitoring wells were analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals). Groundwater from each well was field analyzed for pH, temperature, specific conductivity, salinity, and turbidity prior to sample collection. No field parameters or dissolved (filtered) metal samples were obtained in groundwater from monitoring well FW-06 due to product within the groundwater that could potentially contaminate the field equipment. All of the field parameter measurements were recorded in field notebooks (Appendix II). A summary of groundwater sampling and field parameter information is contained in Table 6-9.

Samples collected for dissolved metal analyses were field filtered through 0.45 micron cellulose prior to collection in pre-preserved, laboratory-supplied bottles. Preservatives provided in the laboratory-supplied bottles, and their associated analyses were as follows:

Metals (both dissolved and total) - Nitric Acid
Cyanide - Sodium Hydroxide
Volatiles - Hydrochloric Acid

TABLE 6-9

GROUNDWATER SAMPLING AND FIELD PARAMETER INFORMATION

FUEL OIL SPILLAGE AREA (SWMU #27)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 26-27, 1991

Well N°	Sampling Date	Total Volume Removed (Gals)	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity NTUs)	Salinity (°/∞)
FW-01	8/26/91	4.0	6.49	20.1	24,700	>200	17.3
FW-02	8/26/91	1.5	7.15	20.3	28.800	>200	20.5
FW-03	8/27/91	4.0	7.03	19.0	28,800	>200	20.2
FW-04	8/26/91	2.5	7.12	21.1	29,700	>200	20.4
FW-05	8/26/91	5.0	6.99	21.0	31,500	>200	21.9
FW-06	8/27/91	5.0	NA	NA	NA	NA	NA

NA = Not Available

Upon collection, samples were placed in coolers which were kept chilled using ice. Groundwater sample coolers were delivered via courier to CEIMIC.

6.5.2 Findings

Prior to sampling, turbidity readings in all wells exceeded the maximum reading of the turbidity meter (i.e. greater than 200 NTUs). The lower turbidity readings reached during development suggest that suspended particulates in the groundwater are forming a mud cake on the sand pack during development and are subsequently being resuspended in the water after development ceases. This process may be assisted by the tidal action observed in all wells.

Salinity and specific conductivity readings obtained during sampling of the well indicate saline water conditions. The temperatures recorded during sampling are comparable with the groundwater temperatures elsewhere at PNS.

No apparent immiscible product phases were observed in any of the monitoring wells, however, well FW-06 had free product and a sheen within the groundwater that covered the teflon bailer during purging. Monitoring well FW-02 also had a petroleum odor and a slight sheen on the groundwater, but not as noticeable as well FW-06.

6.5.3 Laboratory Analytical Results

Groundwater samples were collected from all six monitoring wells within the vicinity of the former fuel oil pipeline. In addition, one replicate sample (FW-06I-04), collected from well FW-06 and one equipment rinseate field blank (FRB-19-04) were included in the groundwater sampling program. The sample numbers are followed by "-04"to denote the fourth phase of work. A summary of valid groundwater results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in groundwater, NPDWR and proposed Federal Action Levels are used to evaluate the analytical data.

TCL Volatiles

Qualitative volatile concentrations were found in groundwater samples FW-01-04, FW-02-04, and FW-04-04, however, no concentrations exceeded the NPDWR and/or proposed Federal Action Levels.

A review of the chromatograms and listed TICs contained in the laboratory data package indicate the presence of a petroleum product in the groundwater sample from monitoring well FW-06 only. The specific petroleum product could not be identified since a petroleum ID analysis was not conducted, however, since benzene, toluene, ethylbenzene and xylene were not detected in the sample, there is a strong possibility that the petroleum product is not gasoline. The presence of this petroleum product is further confirmed by an almost identical chromatogram for sample FW-06I-04, the replicate of FW-06-04.

TCL Semi-Volatiles

There were no detectable semi-volatile concentrations found in any of the groundwater samples. A qualitative concentration of bis(2-ethylhexyl)phthalate (1 ug/L) was detected in the equipment rinseate field blank FRB-19-04. This concentration does not exceed the proposed Federal Action Level of 3.0 ug/L. Semi-Volatiles listed on the TCL Organic parameter list are not currently regulated under NPDWR. Bis(2-ethylhexyl)phthalate was not detected in any other groundwater sample and does not have any affect on the results.

A review of the chromatograms and listed TICs contained in the laboratory data package indicate the presence of a petroleum product in the groundwater sample from monitoring well FW-06 only. The specific petroleum product could not be positively identified without a petroleum ID analysis, however, based on the shape and position of the chromatogram and the field observations during drilling, the petroleum product is probably #6 fuel oil. The presence of the petroleum product is further confirmed by an almost identical chromatogram for sample FW-06I-04, the replicate of FW-06-04.

TCL Pesticide/PCBs

There were no detectable pesticides or PCB concentrations found in any of the groundwater samples.

TAL Inorganics

There were no detectable cyanide concentrations found in any of the groundwater samples. Detectable total (unfiltered) and dissolved (filtered) metal concentrations were found in all groundwater samples. Table 6-10 shows the detectable metal concentrations exceeding NPDWR and/or proposed Federal Action Levels. Qualitative metal concentrations that may exceed NPDWR and/or proposed Federal Action Levels are also summarized in Table 6-10. In general, monitoring well FW-05 had the highest concentrations of the metals that exceeded NPDWR and/or proposed Federal Action Levels.

6.5.4 Interpretations/Discussion

Groundwater samples were collected from each of the six groundwater monitoring wells along Berth 6. One replicate (FW-06I-04) collected from FW-06 and an equipment rinseate field blank were also included in this sampling. The chromatograms for TCL Volatiles and TCL Semi-Volatiles indicate the presence of a petroleum product in samples

TABLE 6-10

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER
EXCEEDING NATIONAL PRIMARY
DRINKING WATER REGULATIONS
AND/OR PROPOSED FEDERAL ACTION LEVELS

FUEL OIL SPILLAGE AREA (SWMU #27)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 26 - 27, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
ARSENIC	FW-01-04	72.20J	50.0	50.0
	FW-03-04	62.20J	50.0	50.0
	FW-05-04	891.00J	50.0	50.0
	FW-06-04	296.00J	50.0	50.0
	FW-06I-04*	292.00J	50.0	50.0
BARIUM	FW-05-04	2310.00J	50.0	50.0
BERYLLIUM	FW-01-04	6.20	NA	0.008
	FW-02-04	1.60Q	NA	0.008
	FW-03-04	2.20Q	NA	0.008
	FW-04-04	1.00Q	NA	0.008
	FW-05-04	21.30	NA	0.008
	FW-06-04	7.70	NA	0.008
	FW-06I-04*	10.70	NA	0.008
CADMIUM	FW-01-04	6.00J	5.0	10.0
	FW-05-04	91.00J	5.0	10.0
	FW-06-04	27.00J	5.0	10.0
	FW-06I-04*	23.00J	5.0	10.0
CHROMIUM	FW-01-04	190.00J	50.0	50.0
	FW-02-04	127.00J	50.0	50.0
	FW-03-04	120.00J	50.0	50.0
	FW-04-04	73.00J	50.0	50.0
	FW-05-04	1800.00J	50.0	50.0
	FW-06-04	623.00J	50.0	50.0
	FW-06I-04*	596.00J	50.0	50.0

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of FW-06-04
NA = Not Available

TABLE 6-10 (CONTINUED)

SUMMARY OF METAL CONCENTRATIONS–GROUNDWATER EXCEEDING NATIONAL PRIMARY DRINKING WATER REGULATIONS AND/OR PROPOSED FEDERAL ACTION LEVELS

FUEL OIL SPILLAGE AREA (SWMU #27) PORTSMOUTH NAVAL SHIPYARD

AUGUST 26 - 27, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (ug/L)	NATIONAL PRIMARY DRINKING WATER REGULATIONS (ug/L)	PROPOSED FEDERAL ACTION LEVELS (ug/L)
LEAD	FW-01-04	800.00	50.0	50.0
	FW-02-04	250.00	50.0	50.0
	FW-03-04	652.00	50.0	50.0
	FW-04-04	278.00	50.0	50.0
	FW-05-04	3570.00	50.0	50.0
	FW-06-04	4500.00	50.0	50.0
	FW-06I-04*	4640.00	50.0	50.0
MERCURY	FW-03-04	2.90	2.0	2.0
	FW-05-04	4.70	2.0	2.0
	FW-06-04	6.20	2.0	2.0
	FW-06I-04*	5.40	2.0	2.0
NICKEL	FW-05-04	1360.00J	NA	700.0
SELENIUM	FW-03-04	13.60J	10.0	NA
	FW-03F-04	13.00J	10.0	NA
	FW-05-04	74.00	10.0	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
* = McLAREN/HART Replicate Sample of FW-06-04
NA = Not Available

FW-06-04 and FW-06I-04 (replicate of FW-06-04). This petroleum product cannot be positively identified without a petroleum ID analysis, however, based on similar chromatograms that were positively identified as #6 fuel oil, the results of the environmental assessment (Section 6.1.2)and field observations, the petroleum product was probably weathered #6 fuel oil.

Qualitative concentrations of methylene chloride were found in samples FW-01-04, FW-02-04 and FW-04-04. The concentrations detected were below the proposed Federal Action Level of 5.0 ug/L. The NPDWR do not define a value for methylene chloride in water. Methylene chloride is a common laboratory contaminant which is a possible source for the concentrations in these samples.

The only other detectable volatile concentration from the Fuel Oil Spillage Area monitoring wells was a qualitative concentration of trichloroethene at 2 ug/L in sample FW-01-04. This concentration is below the NPDWR and proposed Federal Action Level of 5.0 ug/L. Trichloroethene is commonly used as a degreaser and/or solvent and is fairly mobile in soils and groundwater. Since there is no pavement in the area around monitoring well FW-01, the source of the trichloroethene may be a localized spill that leached to the groundwater. No other TCL Organics were found in the groundwater samples at the Fuel Oil Spillage Area.

Table 6-10 summarizes all of the TAL metal results that exceeded NPDWR and/or proposed Federal Action Levels. All of the metal concentrations listed were detected in the unfiltered samples from each of the wells with the exception of the selenium concentration detected in sample FW-03F-04. In every case, the detected concentration of each of the metals decreased below NPDWR and/or proposed Federal Action Levels or to non-detectable for the filtered sample from each well. As previously stated, no filtered samples

were collected from monitoring well FW-06 due to the presence of free product in the well. The only exception to this occurred in monitoring well FW-03 for selenium. The concentration detected in both the unfiltered and filtered samples were comparable suggesting that most of the selenium in this well was dissolved.

Metals such as calcium, magnesium, sodium and potassium were present in high concentrations in both unfiltered and filtered samples. These metals are common ions dissolved in seawater. Given the salinity and conductivity reading in these monitoring wells, the detected concentrations of these four metals are not a concern. The remainder of the metals on the TAL Inorganic list were either not detected in both unfiltered and filtered samples or, if detected, do not have a corresponding NPDWR value and/or proposed Federal Action Level for comparison.

6.6 Outfall Sampling

Outfall samples were collected at the Fuel Oil Spillage Area on August 21, 1991 at the two sampling locations shown on Figure 6-3. This sampling and analysis program was designed to characterize the chemical characteristics of runoff onto and from the Fuel Oil Spillage Area.

6.6.1 Sampling Procedures

Outfall samples were collected during stormwater runoff onto and from the Fuel Oil Spillage Area. Sampling of the outfalls during a stormwater runoff event was necessary since collectable volumes of water did not issue from both sampled outfalls until such runoff occurred. Owing to the location of the outfalls along the berths and consequent difficult access thereto, samples were collected from instream manholes located directly upstream of the outfall locations. Outfall sample OF-01 was collected by placing the laboratory-supplied sample containers directly into the water, with the container opening facing

upstream. Outfall sample OF-02 was collected by removing water from the manhole with a clean section of WaTerra tubing and foot valve and transferring the water directly into the sample containers. A separate, small volume of water was collected concurrently and analyzed in the field for pH, temperature, specific conductivity, turbidity, and salinity. The outfall samples were stored on ice in a field cooler and transported via courier to CEIMIC for TCL Organic and TAL Inorganic analyses.

6.6.2 Findings

Table 6-11 presents the field parameters for the outfall samples. The field parameters indicate that OF-01 was fresh water, whereas OF-02 was brackish water. Given that these outfall samples were collected near high tide, seawater could have encroached into, and mixed with runoff in, the manhole from which OF-02 was collected thus rendering OF-02 brackish. Water temperature in OF-02 was significantly higher than that in OF-01. The cause of this is not currently known, but might be associated with hot water and steam pipes present near the sampling location of OF-02.

6.6.3 Laboratory Analytical Results

A summary of valid outfall results is provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have any published clean-up guidelines for contamination in stormwater, NPDWR and proposed Federal Action Levels for groundwater are used for comparison purposes.

TCL Volatiles

A qualitative concentration of acetone (6.00 ug/l) in OF-02 was the only detectable volatile organic compound (VOC) in the outfall samples. Such a concentration does not exceed either NPDWR or the proposed Federal Action Level.

TABLE 6-11

OUTFALL SAMPLING FIELD PARAMETER INFORMATION

FUEL OIL SPILLAGE AREA (SWMU #27)
PORTSMOUTH NAVAL SHIPYARD

AUGUST 21, 1991

Oufall N°	Sampling Date	pH	Temp. (°C)	Specific Conductivity (µmhos/cm)	Turbidity (NTUs)	Salinity (°/∞)
OF-01	8/21/91	8.26	18.4	138	31.0	0.0
OF-02	8/21/91	7.84	26.5	2,680	17.6	1.5

OF = Denotes Outfall

TCL Semi-Volatiles

Qualitative concentrations of bis(2-ethylhexyl)phthalate were detected in OF-01 (1.00 ug/L) and OF-02 (1.00 ug/L), these concentrations do not exceed the proposed Federal Action Level of 3.00 ug/L. Semi-volatiles listed on the TCL Organic parameter list are not currently regulated under NPDWR.

TCL Pesticide/PCBs

There were no detectable concentrations of pesticides or PCBs in either outfall sample.

TAL Inorganics

There were no detectable concentrations of cyanide in either outfall sample. Detectable concentrations of metals were present in both outfall samples; however, none of the concentrations exceeded NPDWR or proposed Federal Action Levels.

6.6.4 Interpretations/Discussion

The relatively high water temperature in OF-02 might be attributable to hot water and steam pipes nearby the sampling location of OF-02. Non-contact cooling water discharges to storm sewer outfalls could also affect temperature measured at the outfall. Few parameters were detected (other than inorganics, which is typical) and, of those that were detected, none exceeded NPDWR or proposed Federal Action Levels.

6.7 Conclusions & Recommendations

The Phase IV investigation of SWMU #27 involved an Environmental Assessment, subsurface soil sampling around the tank farm, exploratory test pits/drilling/monitoring well installation, groundwater sampling and outfall sampling. These tasks were designed to further characterize the source and extent of petroleum contamination in the vicinity of SWMU #27 contamination discovered in previous phases of the RCRA Facility Investigation.

The Environmental Assessment involved a review of PNS files, personnel interviews with knowledgeable PNS employees, and an on-site visual inspection of the tank farm and Berth 6. According to PNS files and personnel, a number of releases involving #6 and #2 fuel oil have occurred at both the tank farm and Berth 6.

Analytical results of numerous soil samples collected from the shallow auger borings around the tank farm indicated some type of petroleum product. Petroleum ID analysis results for five of the samples indicated that the petroleum product was either bunker oil (#6 fuel oil), diesel fuel (#2 fuel oil) or transmission fluid. The petroleum product in other samples could not be positively identified since petroleum ID was not analyzed for those samples. With the exception of boring TSB-10, the petroleum contamination around the tank farm could not be attributed to an obvious source. The contamination in the soil samples from boring TSB-10 can be attributed to one or more of the documented releases within the Tank 2 bermed area.

The soil samples obtained from the exploratory test pits along Berth 6 indicated the presence of petroleum product in the soil. At least some of this contamination can be attributed to the reported leakage of #6 and #2 fuel oil from underground distribution pipelines. This may or may not be the only source of the petroleum contamination along Berth 6. These results are consistent with the analytical results of the soil samples collected during Phase II and Phase III of the RCRA Facility Investigation.

Groundwater samples were collected from all monitoring wells installed along Berth 6. Very few qualitative concentrations of TCL Organics were detected in these samples. None of these concentrations exceeded the applicable standards, NPDWR and/or proposed Federal Action Levels, and are not of major concern.

The chromatograms for TCL Volatiles and TCL Semi-volatiles indicated the presence of a petroleum product in monitoring well FW-06. Based on field observations, the shape and position of the chromatogram and the results of the Environmental Assessment, this petroleum product is probably #6 fuel oil. The source of this petroleum product can probably be attributed to the documented fuel oil pipeline leaks along Berth 6.

TAL metals were detected in all of the groundwater samples. With the exception of the selenium concentrations detected in sample FW-03-04, all of the concentrations that exceed NPDWR and/or proposed Federal Action Levels were found in the unfiltered samples only. In general, the majority of the metals (aluminum, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, nickel, vanadium and zinc) that were detected in the unfiltered samples were either not detected or displayed a significant decrease in concentration in the filtered samples. This is the result of the fact that these metals tend to adsorb onto or are a constituent of suspended solids contained in the groundwater samples and have generally low solubilities unless pH is very low. The turbidities of these samples, all greater than 200 NTUs, support the theory that most of these metals are entrained on sediment particles. Further, the measured pH range, 6.49 to 7.15 at the time of sampling, is too high to promote these metals going into solution. The exact source of these metals is unknown at this time but may be attributed to fill material used during construction of Berth 6.

Most of the remaining metals are less affected by filtering because they tend to exist in the dissolved state. These metals, calcium, magnesium, potassium, and sodium, are present in comparable concentrations in both the unfiltered and filtered samples. These metals are also abundant in seawater and, given the groundwater salinity and conductivity in each well, the presence of these metals can be attributed to the seawater. The

concentrations of these metals being attributable to the seawater is further evidenced by the concentrations detected in the background river samples discussed in Section 11.0.

The remaining few metals, antimony, barium, mercury, selenium, silver, and thallium, were detected in very low concentrations or were not detectable in the groundwater samples. The detectable concentrations of these metals did not consistently follow either of the previously described patterns between the unfiltered and filtered sample results. The presence of these metals may be attributed to the fill material used to construct Berth 6 and possibly to the seawater.

Stormwater was collected from two manholes directly upstream of two outfalls along Berth 6. The analytical results showed no analytes above NPDWR and/or proposed Federal Action Levels. McLaren/Hart recommends no further investigation of these outfalls at this time.

Based on these conclusions, McLaren/Hart recommends that additional soil sampling be conducted around the tank farm to further characterize the source and extent of petroleum contamination. Analyses of these samples should include petroleum ID so any petroleum found can be positively identified.

Further investigation should be conducted to characterize the source and extent of petroleum and TAL metal contamination along Berth 6. Analyses of these samples should also include petroleum ID, so any petroleum found can be positively identified, and TAL metals. Further investigation should also be conducted to verify whether any of the documented releases of contamination around the tank farm are contributing to the contamination along Berth 6.

Further investigation should include additional test borings and/or exploratory test pits to collect soil samples and additional monitoring well installation to collect groundwater

samples. The collection of soil samples using split-spoon samplers was nearly impossible below six to eight feet due to the coarse nature of the fill material. Exploratory test pits should be excavated such that soil samples below six feet may be collected and analyzed. These test pits would also allow for a better visual inspection of the subsurface for potential sources of the metals and possible petroleum contamination. Groundwater samples should be collected to further define the nature and extent of petroleum and metals contamination around the Fuel Oil Spillage Area (SWMU #27).

7.0 BATTERY ACID TANK (SWMU #10) AND TANK RELATED SWMUs 13, 16, 21, AND 23

7.1 Drilling/Subsurface Soil Sampling (SWMU #10)

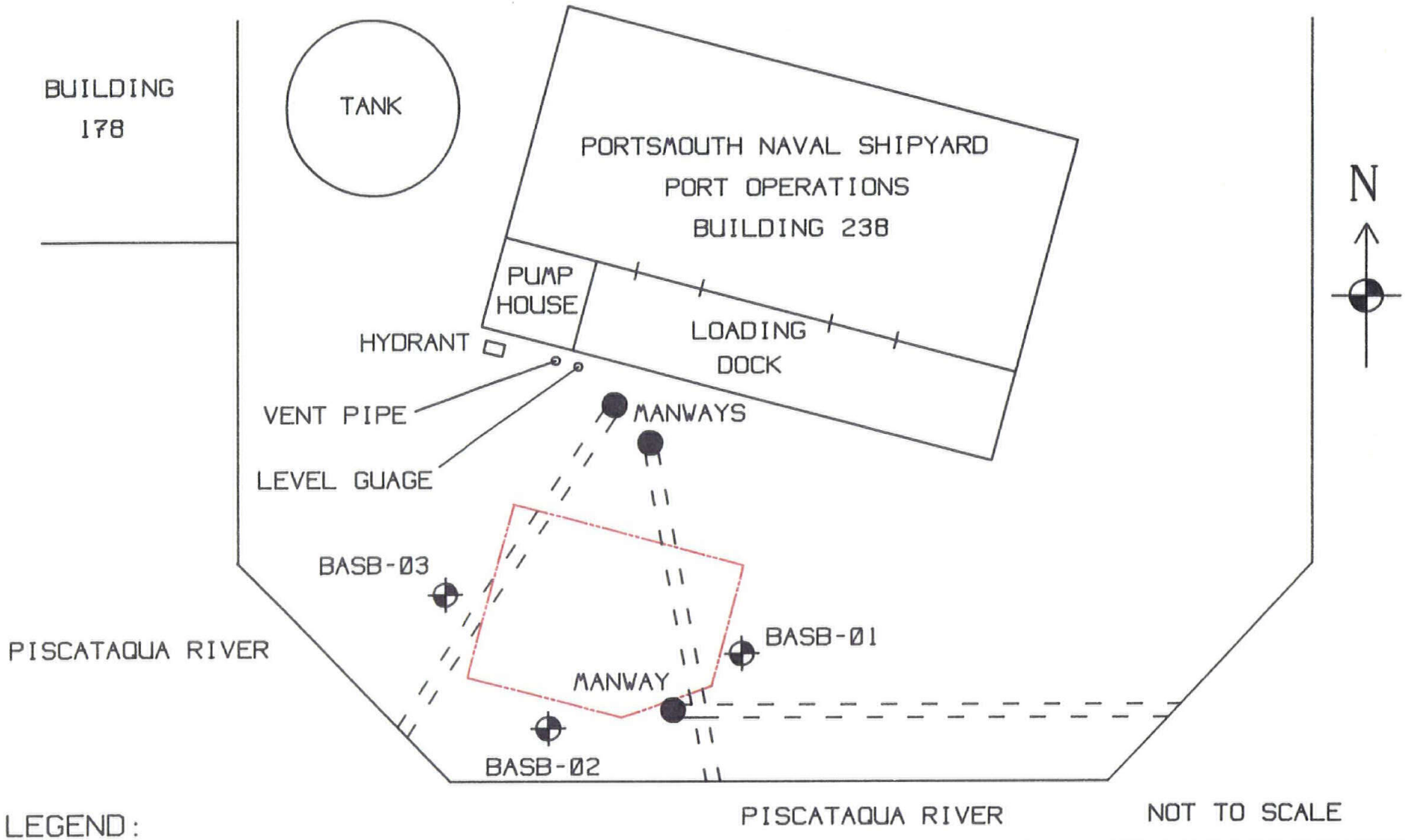
Drilling at the former battery acid tank was conducted from July 18, 1991 through July 19, 1991. The test boring program was designed to provide information regarding the type, variability, and total thickness of fill and indigenous unconsolidated materials at the location of the former battery acid tank, and to define soil quality.

7.1.1 Sampling Procedures

Three test borings were drilled as shown in Figure 7-1. The test borings were advanced using the hollow-stem auger drilling technique. CDS performed all drilling under the supervision of a McLaren/Hart geologist. A truck-mounted Gus Pech Brat 22 boring rig utilizing 4¼-inch ID, hollow-stem augers was used for drilling. Cuttings produced by the drilling of test borings were contained in DOT-approved, 55 gallon drums supplied by PNS. The drums were labeled and later taken to the PNS Hazardous Waste Storage Area where each drum was sampled and temporarily stored while awaiting laboratory analytical results.

The test borings were terminated upon auger refusal and grouted to grade with a cement/bentonite slurry. An OVA, Geiger Counter and a PDM-3 Miniram Aerosol Monitor were used to constantly monitor the drilling location for organic vapors, radiation, and airborne particulates during drilling.

Prior to drilling the first boring, the drilling equipment was steam-cleaned to remove possible contaminants. All drilling equipment which was to come in contact with the soil, as well as water tanks, pumps, and hoses, underwent the initial cleaning procedure. The drilling equipment was decontaminated between borings to prevent cross-contamination.



NOT TO SCALE

LEGEND:

SOIL TEST BORING LOCATIONS

SEWER LINE FROM MANWAY

BATTERY ACID TANK EXCAVATION AREA

FIGURE 7-1

TEST BORING LOCATION MAP
BATTERY ACID TANK AREA
(SWMU #10)

McLAREN/HART

Prior to sampling, the split-spoons were decontaminated according to the protocol listed in Table 2-1. Samples to be submitted to the laboratory were placed into labeled, laboratory-supplied sample bottles and stored on ice in a field cooler for transport via courier to CEIMIC.

A standard, two-foot, steel split-spoon was used to obtain soil samples in advance of drilling. Samples were obtained continuously. As each split-spoon soil sample was opened, the samples were immediately scanned with an OVA and a Geiger counter. Each sample was described in detail by a McLaren/Hart geologist. Detailed sample descriptions including blow counts, grain size, grain size distributions, and color are included in the test boring logs in Appendix I.

Three soil samples, plus one duplicate and one equipment rinseate field blank, were submitted to CEIMIC for chemical analysis of TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. In addition, a particle size analysis was conducted on sample BASB-03(1-3). Poor sample recovery, which occurred when coarse material was encountered in the subsurface, limited the number of samples collected and submitted for laboratory analyses.

7.1.2 Findings

Information from the test borings shows 7.5 to 9 feet of fill material overlying bedrock. Fill material was found to consist of black, fine to coarse grained sand and gravel with approximately 10 to 20% silt.

7.1.3 Laboratory Analytical Results

A summary of the valid results of the soil samples collected during the Phase IV (July 18-19, 1991) sampling event are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

Since the State of Maine does not have published clean-up guidelines for contamination in soils, New Jersey's Environmental Cleanup Responsibility Act (ECRA) Guidance Values and proposed Federal Action Levels documented in the Federal Register (55FR30865, July 27, 1990) are used for comparison purposes.

TCL Volatiles

There were no volatile concentrations exceeding New Jersey ECRA Guidance Values or proposed Federal Action Levels.

TCL Semi-Volatiles

Detectable semi-volatile concentrations were found in all soil samples. There were no semi-volatile concentrations exceeding proposed Federal Action Levels. A total base neutral concentration of 15.01 mg/kg (ppm) in sample BASB-03(3-5), duplicate sample of BASB-03(1-3), exceeded the New Jersey ECRA Guidance Value of 10 ppm total base neutrals in soil. There were no samples exceeding the New Jersey ECRA Guidance Value for total acid extractables.

A review of chromatograms and TICs indicate petroleum in the following samples: BASB-01(5-7), BASB-02(1-5), BASB-03(1-3), and BASB-03(3-5). Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum cannot be made at this time.

TCL Pesticide/PCBs

There were no pesticide concentrations above proposed Federal Action Levels. Pesticides are not listed under New Jersey ECRA Guidance Values. There were no detectable PCB concentrations in any of the soil samples.

TAL Inorganics

There were no detectable cyanide concentrations in any of the soil sample. Detectable metal concentrations were found in all soil samples. Table 7-1 summarizes soil

TABLE 7-1

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES

BATTERY ACID TANK (SWMU #10) PORTSMOUTH NAVAL SHIPYARD

JULY 18-19, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVELS (mg/kg)
ARSENIC	BASB-02(1-5)	34.60J	20.0	80.0
BERYLLIUM	BASB-01(5-7)	0.48Q	1.0	0.2
	BASB-02(1-5)	0.91Q	1.0	0.2
	BASB-03(1-3)	0.48Q	1.0	0.2
	BASB-03(3-5)*	0.55Q	1.0	0.2
CADMIUM	BASB-03(3-5)*	4.10	3.0	40.0
COPPER	BASB-03(1-3)	619.00	170.0	NA
	BASB-03(3-5)*	1,130.00	170.0	NA
LEAD	BASB-01(5-7)	1,350.00	250-1,000	NA
	BASB-02(1-5)	785.00	250-1,000	NA
	BASB-03(1-3)	680.00	250-1,000	NA
	BASB-03(3-5)*	1,330.00	250-1,000	NA
MERCURY	BASB-01(5-7)	1.60J	1.0	20.0
	BASB-02(1-5)	1.00J	1.0	20.0
	BASB-03(1-3)	1.20J	1.0	20.0
	BASB-03(3-5)*	2.40J	1.0	20.0
ZINC	BASB-02(1-5)	444.00J	350.0	NA
	BASB-03(1-3)	428.00J	350.0	NA
	BASB-03(3-5)*	1,010.00J	350.0	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of BASB-03(1-3)

samples which exceed New Jersey ECRA Guidance Values or proposed Federal Action Levels.

TOC, pH, Percent Moisture

Table 7-2 shows the results for TOC, pH, and percent moisture analyses. The TOC values ranged from 5.6% to 19%, and pH ranged from 6.8 to 8.8. Percent moisture of the samples analyzed ranged from 13% to 15%.

Particle Size Analysis

A particle size analysis was conducted on soil sample BASB-03(1-3). The particle size analysis for BASB-03(1-3) is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		41%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		44%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	13%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	23%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	8%	
Silt size, 0.074 to 0.005 mm:		14%
Clay, smaller than 0.005 mm:		1%
Colloids, smaller than 0.001 mm:		0%

7.1.4 Interpretations/Discussion

The semi-volatile compounds detected in the soil samples are primarily polynuclear aromatic hydrocarbons (PAHs). A review of chromatograms indicate petroleum in all of the samples collected. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum cannot be made at this time.

TABLE 7-2

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS

BATTERY ACID TANK (SWMU #10)
PORTSMOUTH NAVAL SHIPYARD

JULY 18-19, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
BASB-01(5-7)	19	6.8	14
BASB-02(1-5)	19	7.7	15
BASB-03(1-3)	8.7	8.2	13
BASB-03(3-5)*	5.6	8.8	13

* = McLAREN/HART Duplicate Sample of BASB-03(1-3)

Elevated lead concentrations detected in the soil samples may be related to material stored within the former battery acid tank.

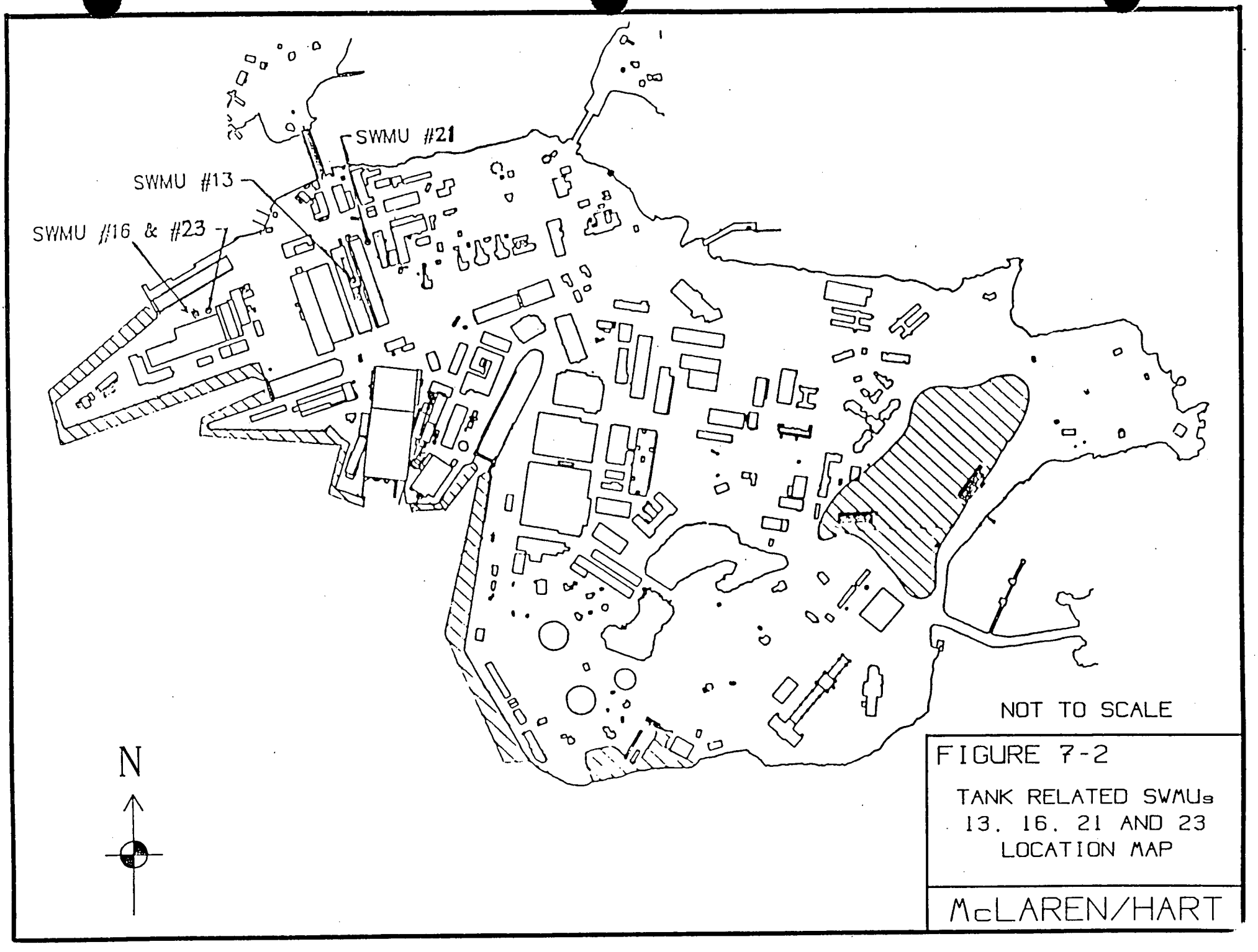
7.2 Tank Removal/Soil Sampling (SWMUs 13, 16, 21, and 23)

Tank contents were sampled on October 10-11, 1991, and the samples were analyzed for hazardous characteristics. Excavation and removal of the USTs related to SWMUs 13, 16, 21, and 23 was conducted from November 13, 1991 through November 18, 1991. In addition to the removal of the USTs, soil samples were collected in the excavations to determine if any spills or leaks from the USTs adversely affected surrounding soils. Figure 7-2 shows the SWMU locations.

7.2.1 Procedures

Tank contents were sampled with stainless-steel bailers or WaTerra tubing and foot valve where bailers would not fit into tank fill ports. Tank samples were analyzed for the hazardous characteristics, reactivity, ignitability, corrosivity, and full TCLP, as defined in 40 CFR Part 261 Subpart C.

Prior to excavation, all tanks were reportedly pumped dry by PNS personnel utilizing a vacuum tanker. Site Remediation Services of East Windsor, Connecticut was retained by PNS to complete excavations, transport tanks to the PNS Hazardous Waste Storage Area, remove contaminated soil, if necessary, and backfill the excavations. Excavation was performed utilizing a John Deere 610 backhoe, jack hammers and a concrete saw. A McLaren/Hart geologist was present during all excavations and conducted confirmation soil sampling upon tank removal. All sampling equipment was decontaminated prior to use at each sampling location in accordance with the protocol outlined in Table 2-1.


SWMU #21
SWMU #13
SWMU #16 & #23
NOT TO SCALE
N
FIGURE 7-2
TANK RELATED SWMUs
13, 16, 21 AND 23
LOCATION MAP
McLAREN/HART

Soil samples were collected from the bottom and side walls of each excavation. In order to adequately assess the presence or absence of contaminated soils in the excavations, a total of four composite soil samples were collected from each SWMU excavation. Two composite soil samples were collected from the floor of the excavation, one composite soil sample was collected from the north and west walls of the excavation, and one composite soil sample was collected from the south and east walls of the excavation. This sampling protocol provided complete coverage of the excavation's outer limits and provided a means of determining future sampling or remedial efforts. Each composite sample collected from excavation walls or bottom was comprised of a minimum of three sample locations of the wall or bottom. The three locations sampled were approximately at the bottom third of the excavation for walls and the center of the tanks (longitudinal) for the bottom. Soil samples collected were analyzed for grain size, percent moisture, TOC and Appendix IX Organics and Inorganics.

7.2.2 Findings

The following is a summary of the activities and findings at SWMUs 13, 16, 21, and 23. Table 7-3 shows tank capacity, usage and dates of use for each of the four SWMUs.

SWMU #13 Rinse Water Tank

On November 13, 1991, excavation began at the 695 gallon rinse water tank adjacent to Building #76 in the Controlled Industrial Area (CIA). The removal of a twelve (12) inch thick concrete slab, with dimensions of 15.5' by 22.0', hampered removal of the tank for two days. At the time of removal, a visual inspection of the tank indicated that the tank was intact with no evidence of structural deterioration. A two inch PVC inflow pipe, extending from the concrete wall to the tank, was free of product and was also removed. Corrosion at the tank connection and staining of the concrete around the pipe connection was

TABLE 7-3

TANK RELATED SWMUs 13, 16, 21, AND 23

PORTSMOUTH NAVAL SHIPYARD

SWMU N°	PNS TANK IDENTIFICATION	TANK USAGE	CAPACITY AND USAGE DATES
13	Rinse Water Tank No. 27	Unspecified Rinse Water	695 gal. Capacity 1974 to Present
16	Rinse Water Tank No. 34	Unspecified Rinse Water	750 gal. Capacity 1978 to Present
21	Acid/Alkaline Drain Tank	Spent Cleaning Solutions	695 gal. Capacity 1974 to Present
23	Chemical Cleaning Facility Tank	Spent Cleaning Solutions	2,270 gal. Capacity 1978 to Present

observed. Hold down rods connecting the tank to a solid concrete saddle were cut to facilitate the tank's removal. Removed fill material consisted of light to dark sand mixed with gravel. There was no visual or olfactory evidence of contamination in the removed fill material. Backfill material consisted of the removed fill material. An eighteen inch layer of sandy gravel was added to bring the excavation up to grade. Hot asphalt was added as a final cap. The tank, as well as the other tanks removed as part of this task, taken to the Hazardous Materials Storage Area to be cleaned by PNS personnel. Final removal of excavated tanks will be conducted by Northeast Tank Disposal of East Windsor, Connecticut. Contents of this tank did not exhibit hazardous characteristics as defined in 40 CFR Part 261 Subpart C.

SWMU #16 Rinse Water Tank

On November 14, 1991 the 750 gallon UST adjacent to Building #174 was removed. All fill lines running from the building had been disconnected and were free of product. Excavated material consisted of a four inch layer of asphalt overlying sandy gravel with chunks of concrete block. A concrete saddle and anchor rods held the tank in place. Water was encountered at approximately seven feet below grade. Visual inspection of the tank upon its removal indicated no structural damage. The fill line connection at the top of the tank was slightly corroded. The removed tank held approximately two inches of clear liquid. There was no visual or olfactory evidence of contamination in the removed fill material. A composite soil sample could not be collected from the bottom of the excavation because of a concrete saddle underlying the tank. A duplicate sample was collected from the walls of the excavation. Backfill consisted of replacing the removed fill material and adding an eighteen inch layer of sandy gravel. Fill material was compacted with a hand-operated soil compactor. A four inch layer of hot asphalt was added as a final cap. The tank was taken

to the Hazardous Waste Storage Area for cleaning and final disposal. Contents of this tank did not exhibit hazardous characteristics as defined in 40 CFR Part 261 Subpart C.

SWMU #21 Acid/Alkaline Drain Tank

Removal of the 695 gallon UST took place on November 18, 1991. Excavated material consisted of sandy clay mixed with rounded gravel. Overlying the sandy clay was an eight inch layer of concrete covered with asphalt. Fill material was visually contaminated with wet product. Bedrock, exposed as fill was removed, was also stained with product. A concrete base, with anchor tie rods, totally encapsulated the bottom half of the tank. Groundwater was not encountered during excavation. A four to eight inch sand layer was exposed between the tank bottom and the concrete base.

Upon visual inspection, each end of the tank exhibited a hole approximately one by two feet. Six inches of product and sludge was visible within the tank. During tank removal, some product spilled from the holes at the tank ends onto the fill material. Confirmation soil sampling was carried out as previously discussed, with care taken to sample areas not freshly spilled upon. The excavation was then immediately backfilled. Backfill consisted of replacing removed fill material along with a fresh hot tar soil mix. Compaction of the fill materials was accomplished with a hand-operated soil compactor. Hot asphalt was added as a final cap. The tank was taken to the Hazardous Waste Storage Area for cleaning and final disposal. Contents of this tank did not exhibit hazardous characteristics as defined in 40 CFR Part 261 Subpart C.

SWMU #23 Chemical Cleaning Facility Tank

Removal of the 2270 gallon UST took place on November 13, 1991. Excavated material consisted of light to dark colored sandy gravel. Clay was observed at the bottom of the excavation. A four inch layer of asphalt overlaid the excavated material. The tank

was secured to a concrete saddle with tie down rods. There was no visual or olfactory evidence of contamination in the removed fill material. Six inches of product was observed in the tank. The inflow line from Building #174 contained a small amount of liquid which flowed into the excavation when the line was severed from the tank. Groundwater was encountered at seven feet below grade. A visual inspection of the tank after its removal indicated no structural damage from corrosion or tank removal.

Backfilling operations consisted of returning the excavated material to the excavation, adding eighteen inches of sandy gravel, compacting the backfilled material, and placing a final four inch layer of hot asphalt for a cap. The tank was taken to the Hazardous Waste Storage Area for cleaning and final disposal. Contents of this tank exhibited the hazardous characteristic of toxicity in reference to cadmium, which was detected at 1.63 ppm. As stated in 40 CFR Part 261.24, the regulatory level for cadmium, at and above which a waste can be deemed toxic and thus hazardous, is 1.0 ppm.

7.2.3 Laboratory Analytical Results

A summary of valid soil sampling results is provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV. Since the State of Maine does not have published clean-up guidelines for contamination in soils, New Jersey ECRA Guidance Values and proposed Federal Action Levels for soils were used to evaluate the data.

Appendix IX Volatiles

All but one soil sample (STSE-13F1) from the tank excavations had detectable concentrations of volatile organic compounds (VOCs); however, none of the detected VOC concentrations exceeded ECRA guidance values or proposed Federal Action Levels.

Appendix IX Semi-Volatiles

Detectable semi-volatile concentrations were found in all soil samples. Table 7-4 shows soil samples containing concentrations of total base neutrals and PAHs which exceed New Jersey ECRA Guidance Values. No soil samples contained acid extractables in concentrations exceeding ECRA. Further, no soil samples contained semi-volatile compounds in concentrations exceeding proposed Federal Action Levels.

A review of chromatograms and TICs indicate petroleum in all the soil samples. Since a petroleum identification was not performed on the samples, the specific petroleum product(s) could not be determined.

Appendix IX Pesticide/PCBs

Pesticides were detected in several soil samples, though at concentrations below proposed Federal Action Levels. Pesticides are not currently listed under ECRA. PCBs were not detected in any of the soil samples.

Appendix IX Herbicides

Herbicides were not detected in any of the soil samples.

Appendix IX Inorganics

Detectable concentrations of metals were found in all soil samples. Table 7-5 summarizes soil samples that contained metals in concentrations which exceed New Jersey ECRA Guidance Values or proposed Federal Action Levels. Cyanide was not detected in any of the soil samples.

Total Sulfide and TOC

Table 7-6 presents the total sulfide and TOC results. Total sulfide was detected in five samples, ranging from 3 to 7 ppm. TOC ranged from 0.1% to 2.8%, with a median value of 0.3% and a mean of 0.6%. The median value is reported, since the mean was biased high by the 2.8% and 1.9% in samples STSE-21F2 and STSE-2NW, respectively.

TABLE 7-4

SUMMARY OF TOTAL BASE NEUTRAL AND PAH CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES

TANK RELATED SWMUs 13, 16, 21, AND 23
PORTSMOUTH NAVAL SHIPYARD

NOVEMBER 13 - 18, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)
TOTAL BASE NEUTALS	STSE-13NW	16.16	10.00
	STSE-13SE	12.04	10.00
	STSE-16INW*	13.88	10.00
	STSE-16SE	48.69	10.00
	STSE-21F1	562.40	10.00
	STSE-21F2	517.80	10.00
	STSE-21NW	88.66	10.00
	STSE-21SE	193.35	10.00
	STSE-23F2	16.60	10.00
TOTAL PAH	STSE-13NW	15.51	10.00
	STSE-13SE	11.50	10.00
	STSE-16INW*	13.64	10.00
	STSE-16SE	48.16	10.00
	STSE-21F1	554.20	10.00
	STSE-21F2	497.10	10.00
	STSE-21NW	82.33	10.00
	STSE-21SE	185.50	10.00
	STSE-23F2	16.39	10.00

* = McLAREN/HART Duplicate Sample of STSE-16NW

TABLE 7-5

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

TANK RELATED SWMUs 13, 16, 21, AND 23 PORTSMOUTH NAVAL SHIPYARD

NOVEMBER 13 - 18, 1991

PARAMETER	SWMU	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVELS (mg/kg)
ANTIMONY	13	STSE-13SE	10.20Q	10.00	30.00
	16	STSE-16INW*	10.50Q	10.00	30.00
	21	STSE-21F1	15.10	10.00	30.00
	21	STSE-21NW	13.20	10.00	30.00
ARSENIC	21	STSE-21F1	22.00	20.00	80.00
	21	STSE-21F2	22.30	20.00	80.00
CADMIUM	21	STSE-21F2	4.10	3.00	40.00
	21	STSE-21NW	4.10	3.00	40.00
	21	STSE-21NE	5.30	3.00	40.00
COPPER	13	STSE-13F1	388.00	170.00	NA
	13	STSE-13SE	390.00	170.00	NA
NICKEL	13	STSE-13F1	101.00	100.00	2,000.000
ZINC	13	STSE-13F1	359.00J	350.00	NA

* = McLAREN/HART Duplicate Sample of STSE-16NW
NA = Not Available

TABLE 7-6

TOTAL SULFIDE AND TOTAL ORGANIC CARBON (TOC)–SOIL

TANK RELATED SWMUs 13, 16, 21, AND 23
PORTSMOUTH NAVAL SHIPYARD

NOVEMBER 13 - 18, 1991

McLAREN/HART SAMPLE I.D.	TOTAL SULFIDE (mg/kg)	TOC (%)
STSE-13F1	ND	0.6
STSE-13F2	ND	0.2
STSE-13NW	3	0.1
STSE-13SE	ND	0.4
STSE-16NW	ND	0.3
STSE-16SE	ND	0.2
STSE-16INW*	ND	0.3
STSE-21F1	ND	0.3
STSE-21F2	3	2.8
STSE-21NW	7	1.9
STSE-21SE	3	0.9
STSE-23F1	4	0.2
STSE-23F2	ND	0.3
STSE-23NW	ND	0.2
STSE-23SE	ND	0.2

* = McLAREN/HART Duplicate Sample of STSE-16NW
ND = Not Detected

Particle Size Analysis

Particle size analyses were performed on each soil sample. The soil samples typically consisted of coarse to fine sand, with a trace to little silt and clay, and little to some gravel. Laboratory-supplied results, which show proportions of grain sizes in each sample, are provided in Appendix IV.

7.2.4 Interpretation/Discussions

The semi-volatile compounds detected in the soil samples are primarily polynuclear aromatic hydrocarbons (PAHs). The compounds detected, in addition to information provided on associated chromatograms, are indicative of petroleum products. The presence of such products may be related to material which was stored within the tanks. However, since a petroleum identification was not performed on the samples, the specific petroleum product(s) could not be determined.

The elevated metal concentrations indicated on Table 7-5 also may be related to material which was stored within the tanks.

8.0 CHILD DEVELOPMENT CENTER

The purpose of the Phase IV soil sampling at the existing Child Development Center (CDC), formerly referred to as the Day Care Center, was to further characterize the vertical and horizontal extent of contamination measured in Phase III. Information obtained from this field work will provide additional data for risk assessment purposes that establish warranted concerns with children coming into contact with the soil.

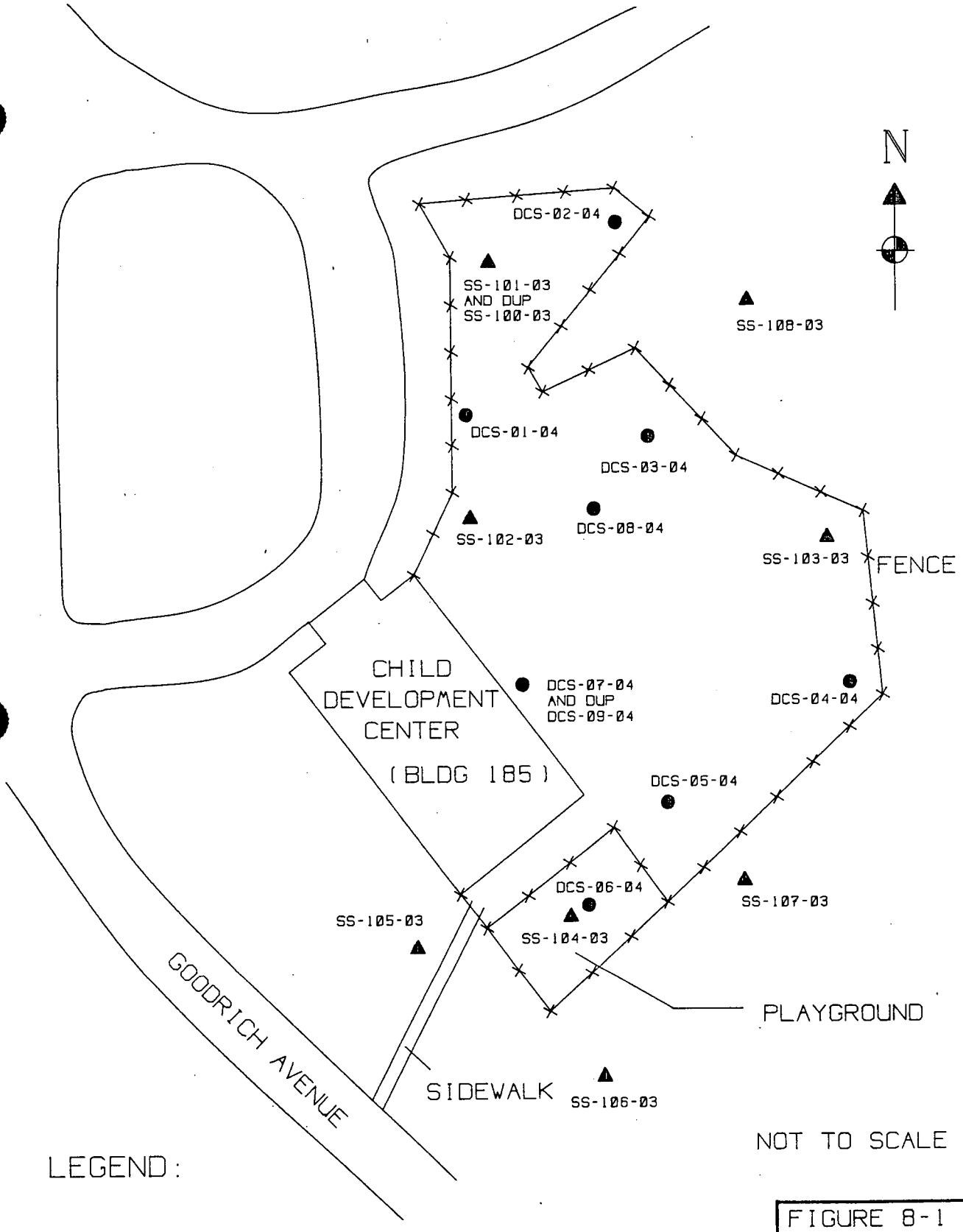
8.1 Surface Soil Sampling

On July 10, 1991, eight surface soil samples, plus one duplicate sample and one equipment rinseate field blank, were collected within the fenced area of the existing CDC. Figure 8-1 shows these sample locations along with previous Phase III surface soil sample locations.

8.1.1 Sampling Procedures

Surface soil samples were obtained from the upper twelve inches of the soil column or until refusal at each location. Prior to obtaining soil samples, the surface grass layer was removed. The samples collected were labeled DCS-01 through DCS-08 followed by "-04" to denote the fourth phase of work. A duplicate sample, labeled DCS-09-04, was collected at location DCS-07-04.

Each sample was collected using a properly decontaminated hand auger and a stainless-steel trowel. The sample was placed in a precleaned stainless-steel mixing bowl, homogenized and transferred to the appropriate laboratory-supplied sample bottles. The sampling equipment was decontaminated prior to use at each location to prevent cross-contamination according to the protocol described in Table 2-1. All samples were stored on ice in a field cooler and delivered via courier to CEIMIC to be analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Two soil samples DCS-02-04 and DCS-05-04 were also selected for particle size analysis. All soil sample locations were measured from fixed points described in the field notebook (Appendix II).



LEGEND:

- ● SURFACE SOIL SAMPLING LOCATION DURING PHASE IV
- ▲ SURFACE SOIL SAMPLING LOCATION DURING PHASE III

FIGURE 8-1
CHILD DEVELOPMENT CENTER
SURFACE SOIL SAMPLING LOCATIONS

McLAREN/HART

8.1.2 Findings

All soil samples collected were obtained by hand augering the upper twelve inches of the soil column or until refusal. In general, the soil consisted of brown, fine to medium grained sand and silt, with a trace of fine grained gravel and organics. No soil discoloration or staining was observed and no unnatural odors were detected in any of the soil samples.

8.1.3 Laboratory Analytical Results

Since the State of Maine does not have published clean-up guidelines for contamination in soils, New Jersey ECRA Guidance Values and proposed Federal Action Levels are used for comparison purposes. A summary of valid surface soil sample results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

TCL Volatiles

Only two soil samples, DCS-01-04 and DCS-09-04, had qualitative concentrations of toluene at 2 ppb. There were no other detectable volatile concentrations in any of the surface soil samples.

TCL Semi-Volatiles

Detectable quantitative-qualitative semi-volatile concentrations were found in surface soil samples DCS-05-04 through DCS-09-04. Qualitative concentrations of semi-volatiles were found in all samples. Soil samples DCS-07-04 and duplicate sample DCS-09-04 exceeded the New Jersey ECRA Guidance Value of 10 ppm for total base neutrals in soil. These results are summarized in Table 8-1. There were no acid extractable concentrations exceeding the New Jersey ECRA Guidance Value of 10 ppm. No proposed Federal Action Levels were available for total base/neutral and acid extractables.

A review of chromatograms indicate petroleum in all of the surface soil samples. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum cannot be accomplished.

TCL Pesticide/PCBs

Detectable pesticide concentrations were found in all surface soil samples. Two soil samples DCS-02-04 and DCS-05-04 had detectable pesticide concentrations exceeding proposed Federal Action Levels as shown in Table 8-1. Pesticides are not listed under New Jersey ECRA Guidance Values. There were no detectable PCB concentrations in any of the soil samples.

TAL Inorganics

There were no detectable cyanide concentrations in any of the surface soil samples. Detectable metal concentrations were found in all surface soil samples. Qualitative estimates of beryllium exceeded proposed Federal Action Levels in all samples. Three surface soil samples plus one duplicate sample had metal concentrations exceeding New Jersey ECRA Guidance Values. These results are summarized in Table 8-1.

TOC, pH, and Percent Moisture

Table 8-2 shows the results for TOC, pH, and percent moisture analyses. The TOC values ranged from 0.9% to 6.9%. Measurements of pH ranged from 5.6 to 6.5. Percent moisture ranged from 4% to 17%.

Particle Size Analysis

A particle size analysis was conducted on surface soil samples DCS-02-04 and DCS-05-04. The particle size analysis results for DCS-02-04 is as follows:

TABLE 8-1

SUMMARY OF ORGANIC & INORGANIC CONCENTRATIONS – SURFACE SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

CHILD DEVELOPMENT CENTER PORTSMOUTH NAVAL SHIPYARD

JULY 10, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
TOTAL BASE NEUTRALS	DCS-07-04	11.59	10.0	NA
	DCS-09-04*	13.45	10.0	NA
PESTICIDES				
4,4'-DDD	DCS-02-04	4.80	NA	3.0
4,4'-DDE	DCS-05-04	4.00	NA	2.0
4,4'-DDT	DCS-02-04	2.10	NA	2.0
	DCS-05-04	2.80	NA	2.0
METALS				
ARSENIC	DCS-03-04	25.90	20.0	80.0
	DCS-05-04	21.20J	20.0	80.0
ANTIMONY	DCS-07-04	26.20J	10.0	30.0
BERYLLIUM	DCS-01-04	0.83Q	1.0	0.2
	DCS-02-04	0.57Q	1.0	0.2
	DCS-03-04	0.85Q	1.0	0.2
	DCS-04-04	0.68Q	1.0	0.2
	DCS-05-04	0.87Q	1.0	0.2
	DCS-06-04	0.51Q	1.0	0.2
	DCS-07-04	0.71Q	1.0	0.2
	DCS-08-04	0.76Q	1.0	0.2
	DCS-09-04*	0.62Q	1.0	0.2
ZINC	DCS-07-04	404.00J	350.0	NA
	DCS-09-04*	923.00J	350.0	NA

NA = Not Available
Q = Qualitative Only
J = Qualitative and Semi-Quantitative
* = McLAREN/HART Duplicate Sample of DCS-07-04

TABLE 8-2

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS

CHILD DEVELOPMENT CENTER PORTSMOUTH NAVAL SHIPYARD

JULY 10, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
DCS-01-04	5.1	6.0	8
DCS-02-04	0.9	6.2	4
DCS-03-04	6.1	5.6	10
DCS-04-04	6.2	6.5	4
DCS-05-04	4.8	6.2	7
DCS-06-04	3.9	6.1	6
DCS-07-04	4.1	6.0	9
DCS-08-04	4.5	6.3	17
DCS-09-04*	6.9	6.0	6

* = McLAREN/HART Duplicate Sample of DCS-07-04

Gravel, passing 3-inch and retained on No. 4 sieve:		20%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		62%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	5%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	39%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	18%	
Silt size, 0.074 to 0.005 mm:		17%
Clay, smaller than 0.005 mm:		1%

The particle size analysis results for DCS-05-04 is as follows:

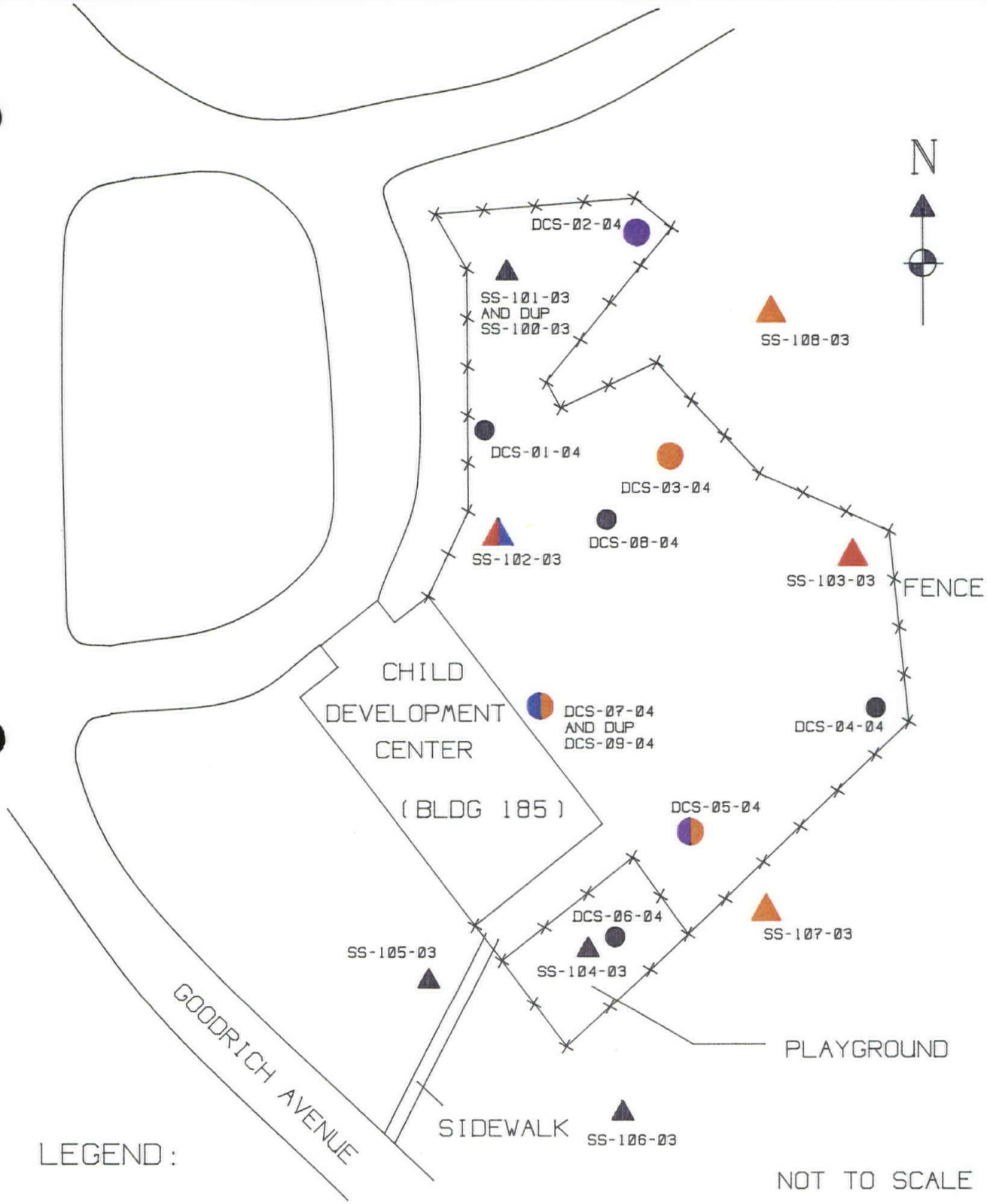
Gravel, passing 3-inch and retained on No. 4 sieve:		5%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		39%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	5%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	15%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	19%	
Silt size, 0.074 to 0.005 mm:		55%
Clay, smaller than 0.005 mm:		1%

8.1.4 Interpretations/Discussion

There were no volatile concentrations above proposed Federal Action Levels or the New Jersey ECRA Guidance Value for total volatiles from the Phase IV sampling event. However, two surface soil samples SS-102-03 and SS-103-03 exceeded the New Jersey ECRA Guidance Value of 1 ppm for total volatiles in soil in the Phase III sampling event.

Four surface soil samples plus one duplicate from the Phase IV sampling event had detectable concentrations of semi-volatile organic compounds. All eight surface soil samples collected from the Phase III sampling event had detectable concentrations of semi-volatile organic compounds. Only two samples plus one duplicate, SS-102-03 (Phase III) and DCS-07-04 and duplicate DCS-09-04 (Phase IV), had total base neutral concentrations which exceeded the 10 ppm New Jersey ECRA Guidance Value. The sample locations exceeding the New Jersey ECRA Guidance Value for total base neutrals are shown in Figure 8-2. The base neutrals detected are indicative of petroleum products. Possible sources for elevated base neutral concentrations include contaminated fill material spread in this area, run-off from asphalt paved areas that may have petroleum products presumably from vehicles, and petroleum may have been used as a carrier for pesticides to enhance persistence in the environment. A review of chromatograms and listed TICs also indicate petroleum in all Phase IV surface soil samples.

All sixteen surface soil samples collected from the Phase III and Phase IV sampling events had detectable concentrations of pesticides. Only two samples DCS-02-04 and DCS-05-04 collected from the Phase IV sampling event had pesticide concentrations that exceeded proposed Federal Action Levels as shown in Table 8-1. Sample locations exceeding the proposed Federal Action Levels for pesticides are shown in Figure 8-2. New Jersey ECRA Guidance Values are not available for pesticides in soil. A source for pesticides may be a former PNS controlled spraying program.



LEGEND:

● SURFACE SOIL SAMPLING LOCATION DURING PHASE IV

▲ SURFACE SOIL SAMPLING LOCATION DURING PHASE III

TOTAL VOLATILES
TOTAL BASE NEUTRALS
PESTICIDES
METALS

SOIL CONCENTRATIONS EXCEEDING PROPOSED FEDERAL ACTION LEVELS AND/OR NEW JERSEY ECRA GUIDANCE VALUES

FIGURE 8-2
CHILD DEVELOPMENT CENTER
SURFACE SOIL SAMPLING RESULTS

McLAREN/HART

Detectable metal concentrations were found in all surface soil samples collected in the Phase III and IV sampling events. Qualitative estimates of beryllium exceeded proposed Federal Action Levels in all Phase IV samples. Two Phase III surface soil samples (SS-107-03 and SS-108-03) had lead (35,000 mg/kg) and mercury (1.00 mg/kg) concentrations, respectively, exceeding New Jersey ECRA Guidance Values. As previously stated in Section 8.1.3 and shown in Table 8-1, three out of eight surface soil samples plus one duplicate collected from the Phase IV sampling event had metal concentrations exceeding New Jersey ECRA Guidance Values. Sample locations exceeding the New Jersey ECRA Guidance Values for metals are shown in Figure 8-2. The source of elevated metal concentrations in the surface soil samples around the CDC is unknown. Some possible sources for elevated metals include contaminated fill material that may have foreign material in the vicinity of the sample, additives found in pesticides (arsenic and mercury) and possibly storage batteries (arsenic, lead, antimony, zinc).

8.2 Conclusions/Recommendations

A total of sixteen surface soil samples were collected in the vicinity of the CDC during the Phase III and IV sampling events.

Two surface soil samples exceeded the New Jersey ECRA Guidance Value of 1 ppm for total volatiles in soil. Currently, the source of the volatiles is unknown. The volatiles detected are not believed to be associated with the former gasoline station located immediately northwest of the CDC, as there were no gasoline related compounds detected in the soil gas survey or in monitoring well GW-1, presumably downgradient of the USTs. Total volatile contamination appears to be localized in two areas and not continuous throughout the CDC.

Two surface soil samples exceeded the New Jersey ECRA Guidance Value of 10 ppm for total base neutrals in soil. The base neutrals detected are indicative of petroleum products as stated in Section 8.1.4. The semi-volatiles detected may be associated with the former gasoline station and/or from former PNS pesticide spraying. Total base neutral concentrations exceeding the New Jersey ECRA Guidance Value appear to be localized immediately northeast of the CDC (Building No. 185).

Two surface soil samples exceed the proposed Federal Action Levels for pesticides. Pesticide contamination appears to be localized in two areas and not continuous throughout the CDC area.

Five surface soil samples plus one duplicate sample exceed the New Jersey ECRA Guidance Value for metals. Metal contamination does not appear continuous throughout the CDC area. The source of elevated metal concentrations in the surface soil samples around the CDC is unknown.

Phase III and Phase IV analytical results should be evaluated by means of a human health risk assessment to determine whether the current or proposed future use of the site warrants concerns.

9.0 FRESH WATER PONDS

9.1 Discharge Inventory

On July 11, 1991 a stormwater and process wastewater discharge inventory was conducted on the fresh water ponds to identify any potential sources of chemical discharge into the ponds.

9.1.1 Procedures

Utility maps were reviewed, PNS personnel interviewed, and a field inspection of the ponds conducted to locate potential discharges into the fresh water ponds.

9.1.2 Findings

No process wastewater was found to discharge into the fresh water ponds. Three stormwater discharge points were located, as shown on Figure 9-1. A discharge point located in the northwestern portion of the northern pond drains the roof and parking lot of Building 156. A discharge point located in the northeastern portion of the northern pond was found on a utility map but not observed in the field. A discharge point located in the southeastern corner of the southern pond was blocked at both ends following a #2 fuel oil release from Tank T6 (see Section 6.1) in 1984.

9.2 Sediment Sampling

On July 29 and 30, 1991 sediment samples were collected from eight locations in the fresh water ponds, as shown on Figure 9-2. Each sampling location approximately corresponds to the Phase III water and sediment sampling locations. One sediment sample was collected at each location, except for SD-06, where one duplicate sample (SD-09) was additionally collected. Also one equipment rinseate blank was collected. All sediment samples were analyzed for TCL Organics, TOC, TAL Inorganics, pH, and percent moisture.

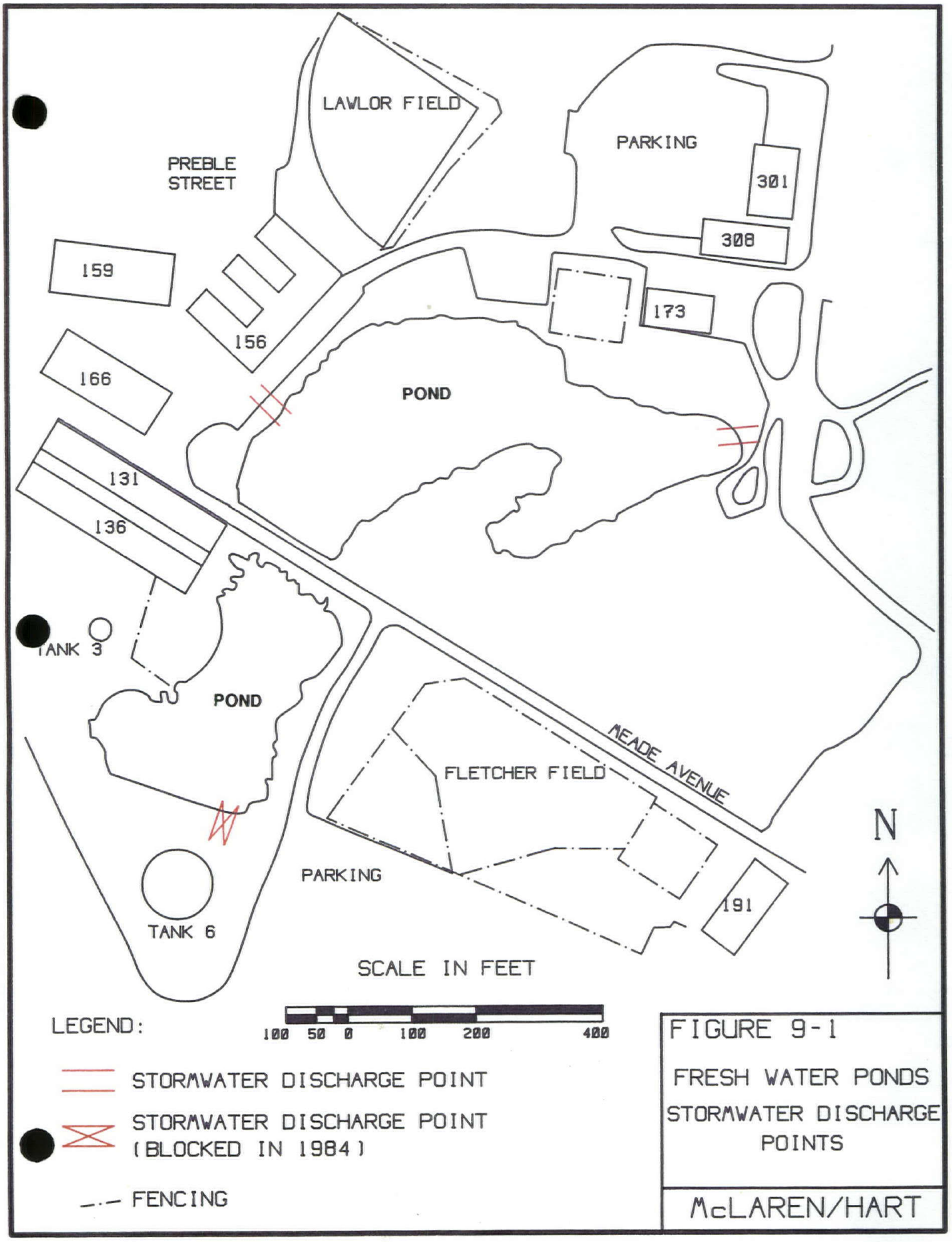


FIGURE 9-1

FRESH WATER PONDS STORMWATER DISCHARGE POINTS

McLAREN/HART

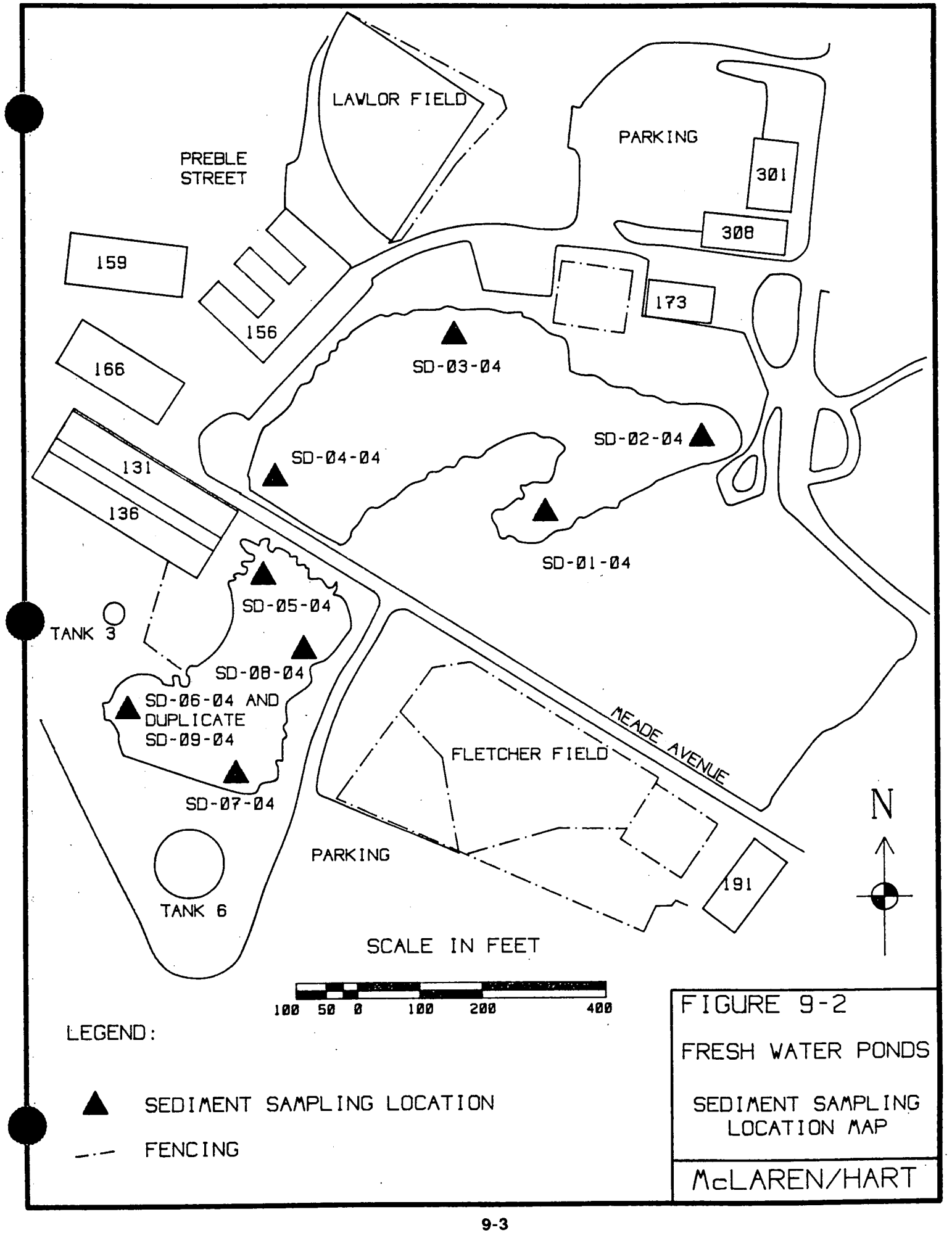


FIGURE 9-2

FRESH WATER PONDS

SEDIMENT SAMPLING LOCATION MAP

McLAREN/HART

9.2.1 Sampling Procedures

Sediment samples were collected with a 3" I.D., stainless steel, hand-operated, sediment corer with a stainless steel auger cutting head. The core barrel was 16 inches long, within which removable, properly-cleaned, plastic sleeves were placed for each sample. The sampling equipment was decontaminated on-shore prior to use at each sampling location, in accordance with the protocol outlined in Table 2-1, with the exception of the plastic liners, which reacted, and consequently were not rinsed, with methanol. The sediment samples were obtained by augering, from a row boat, the core barrel into the sediment. Augering continued to refusal, which was typically at 0.3 to 0.5 feet. Refusal was not a result of an obstruction, rather it was the limit at which enough down pressure could be applied to advance the auger head. The location of the boat at the sampling locations was maintained during sampling by the core barrel itself, as it was securely seated in the sediment. Where MS/MSD and duplicate samples were collected, thus requiring more than one sample run, a section of the core rod was driven into the sediment to mark the sampling location for additional samples. Upon retrieval of the core barrel into the boat, the auger head was removed and the sample placed in a properly-cleaned, stainless steel mixing bowl. Owing to the fact that the sediment was tightly packed in the auger head and the core barrel, the sediment had to be removed from the auger head and core barrel by hand. Sampling personnel wore new latex surgical gloves when removing the sample.

Sediment samples were collected in the boat immediately after the sediment was removed from the auger head and core barrel. Owing to the dense nature of the sediments (typically dense clay), the samples had to be retrieved from the bowl and placed in the sample containers by hand. As previously mentioned, sampling personnel wore new latex surgical gloves for each sample. The TCL VOA sample containers were filled first. The

sediment collected constituting the VOA samples was taken from representative portions of the sediment in the bowl. The dense nature of the sediment precluded mixing of the sample. The TOC sample container was then filled followed by the remaining sample containers for TAL Inorganics, pH, and percent moisture. All samples were placed in a cooler, chilled with ice, and hand delivered via courier to CEIMIC for laboratory analysis.

9.2.2 Findings

Described below are the depths and descriptions of the sediment encountered at the eight sediment sampling locations. No abnormal visual evidence or odors were detected in any samples.

SD-01-04	0-6" dense brown clay; trace of fine gravel; organics on top, roots
SD-02-04	0-4" dense greenish-blue clay; 1" organic on top with little sand; yellow streaks
SD-03-04	0-7" dense gray clay
SD-04-04	0-4" dense gray clay
SD-05-04	0-9" dense blue-gray clay; organics on top; MS/MSD collected
SD-06-04	0-4" dense blue-gray clay; organics on top; duplicate SD-09-04 sample collected
SD-07-04	0-6" dense blue-gray clay; organics on top
SD-08-04	0-4" dense blue-gray clay; yellow streaks

9.2.3 Laboratory Analytical Results

A summary of valid sediment sampling results is provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV. The State of Maine does not have published clean-up guidelines for contamination in sediment; therefore, New Jersey ECRA Guidance Values and proposed Federal Action Levels for soils are used for comparison purposes.

TCL Volatiles

No volatile organic compounds were detected in the sediment samples in concentrations exceeding New Jersey ECRA Guidance Values or proposed Federal Action Levels. Only acetone was consistently detected in the sediment samples.

TCL Semi-Volatiles

No semi-volatile organic compounds were detected in the sediment samples in concentrations exceeding New Jersey ECRA Guidance Values or proposed Federal Action Levels. Low concentrations of phthalates were detected in several samples.

A review of chromatograms indicate the presence of a petroleum product in the following samples: SD-01, SD-02, SD-04, SD-05, SD-06, SD-07, and SD-09. Since a petroleum identification was not performed on the samples, a determination as to the type of petroleum cannot be made.

TCL Pesticide/PCBs

No pesticides or PCBs were detected in the sediment samples.

TAL Inorganics

Cyanide was not detected in any of the sediment samples.

Detectable concentrations of metals were found in all sediment samples. Beryllium was detected in all samples in concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels. In addition copper and cadmium were detected in samples SD-04 and SD-08, respectively, in concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels. Table 9-1 lists the metals present, their concentrations, and the associated New Jersey ECRA Guidance Values and/or proposed Federal Action Levels.

TABLE 9-1

SUMMARY OF METAL CONCENTRATIONS – SEDIMENT
EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES
AND/OR PROPOSED FEDERAL ACTION LEVELS

FRESH WATER PONDS
PORTSMOUTH NAVAL SHIPYARD

JULY 29 AND 30, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (PPM)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (PPM)
BERYLLIUM	SD-01-04	1.50Q	1.0	0.2
	SD-02-04	3.00	1.0	0.2
	SD-03-04	2.30	1.0	0.2
	SD-04-04	2.00	1.0	0.2
	SD-05-04	2.30	1.0	0.2
	SD-06-04	1.40	1.0	0.2
	SD-07-04	1.80	1.0	0.2
	SD-08-04	2.60	1.0	0.2
	SD-09-04*	2.00	1.0	0.2
CADMIUM	SD-08-04	3.50	3.0	40.0
COPPER	SD-04-04	308.00	170.0	NA

Q = Qualitative Only
* = McLAREN/HART Duplicate Sample of SD-06-04
NA = Not Available

TOC, pH, Percent Moisture

Table 9-2 presents the TOC, pH, and percent moisture results for the sediment samples collected. Values observed for TOC ranged from 0.3 to 3.2 percent, with an average of 1.1 percent, and the pH ranged from 5.7 to 6.4, with and average of 6.2. Percent moisture ranged from 24 to 58 percent, with and average of 41 percent.

9.2.4 Interpretations/Discussion

Beryllium was detected in all sediment samples in concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels (see Table 9-1). Beryllium was detected in SD-01 as a qualitative concentration only. The source of the beryllium is not currently known; however, beryllium is naturally occurring in shallow water sediments in average concentration of 3 mg/kg (Salomons and Förstner, 1984). Further, principal sources of beryl, the ore of beryllium, are found in Maine and New Hampshire. The beryllium could therefore be a result of natural liquid and airborne deposition into the ponds, or naturally present in the clay which lines the ponds.

Cadmium and copper were detected in SD-08 and SD-04, respectively, in concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels. Cadmium was detected in several other sediment samples collected in concentrations less than New Jersey ECRA Guidance Values and proposed Federal Action Levels. Copper was detected in all other sediment samples in concentrations less than the New Jersey ECRA Guidance Value. The source of the metals is not currently known, but might be attributable to liquid and airborne deposition of these metals into the ponds, as a result of activities at the shipyard.

TABLE 9-2

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS

FRESH WATER PONDS SEDIMENT SAMPLES PORTSMOUTH NAVAL SHIPYARD

JULY 29 AND 30, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
SD-01-04	0.7	6.0	46
SD-02-04	3.2	6.3	54
SD-03-04	0.3	6.4	30
SD-04-04	1.9	6.4	58
SD-05-04	0.5	6.3	31
SD-06-04	1.6	6.0	40
SD-07-04	0.5	6.1	24
SD-08-04	0.3	6.2	32
SD-09-04*	1.1	5.7	52

* = McLAREN/HART Duplicate Sample of SD-06-04

9.3 Conclusions/Recommendations

The fresh water ponds do not appear to present a significant repository or source of contamination and thus should not require further analytical evaluations. However, recent data and information indicate the ponds do represent significant hydrologic features on the shipyard and, as such, warrant some research/investigation into their source(s) and construction. Such information could be critical in describing the hydrogeologic regime at the site and thus valuable in assessing potential contaminant migration pathways.

10.0 SOIL AND DEVELOPMENT/PURGE WATER DRUM SAMPLING

The following section describes the Phase IV sampling program for containerized soil and well development/purge water. The purpose of the sampling program was to provide representative samples of the containerized materials collected during field investigations for hazardous waste characterization analyses as outlined in 40 CFR Part 261.

10.1 Soil Drum Sampling

10.1.1 Sampling Procedures

Drilling of test borings at the JILF, DRMO, and former gas station from July 11, 1991 through July 26, 1991 produced auger cuttings. The auger cuttings were containerized in DOT-approved 55-gallon drums supplied by PNS. The drums were labeled with the boring locations from which the auger cuttings were generated and subsequently moved to and stored at the PNS Hazardous Waste Storage Area.

Ten composite soil samples were collected from the drums containing auger cuttings. In addition, one composite soil sample was collected from drum DRDECPS-11 (soil and sediment from the decontamination pad) and one composite sample was collected from DRJTP-01 (overpack drum from the JTP-01 excavation area). All soil samples were obtained using separate precleaned stainless-steel trowels. Each sample was placed in a precleaned stainless-steel bowl, homogenized, and transferred to a laboratory-supplied sample bottle. The sample bottles were labeled to correspond to the drums from which the samples were collected and then stored on ice in a cooler for hand delivery to CEIMIC.

10.1.2 Laboratory Analytical Results

The soil samples were analyzed for hazardous characteristics as defined under 40 CFR Parts 261.20-261.24. Such characteristics include ignitability, corrosivity, reactivity, and toxicity. The toxicity analysis employs the Toxicity Characteristic Leaching Procedure (TCLP), which includes specific volatile organic compounds (VOCs), semi-volatile organic compounds, metals, herbicides, and pesticides. A summary of the valid analytical results of the above discussed soil samples is provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

10.1.3 Interpretations/Discussion

None of the soil samples exhibited the hazardous characteristics of ignitability, corrosivity, reactivity, or VOC, semi-volatile, herbicide, and pesticide toxicity. However, three soil samples failed the test for metals toxicity. Soil samples DRJSB-16-01, DRJSB-18-01, and DRJSB-19-01-02 had leachable lead concentrations of 6.52 ppm (6520 ug/L), 10.30 ppm (10,300 ug/L), and 6.05 ppm (6050 ug/L), respectively. The toxicity characteristic regulatory level for leachable lead, above which the sample is considered toxic and thus hazardous, is 5.0 ppm. No other soil samples exhibited metal toxicity.

10.2 Development/Purge Water Drum Sampling

10.2.1 Sampling Procedures

Well development/purge water was generated from monitoring wells at the JILF, DRMO, Mercury Burial Sites, former gas station, and Fuel Oil Spillage Area during the Phase IV field investigation. The development/purge water was containerized in DOT approved 55 gallon drums supplied by PNS. Additional drums containing decontamination water were also generated and subsequently stored at the PNS Hazardous Waste Storage Area.

Twenty-two water samples were collected from development/purge water drums and ten water samples were collected from decontamination water drums. In addition, one water sample was collected from a drum previously sampled in an earlier phase of work. The labels on this drum had been painted over by PNS personnel. The resampled drum was labeled P3-UNK-01-03. The samples were collected using a new drum thief for each drum. The sample was transferred directly into laboratory-supplied sample bottles. The sample bottles were labeled to correspond to the drums from which the samples were collected and then stored on ice in a cooler for hand delivery to CEIMIC. All samples were delivered to CEIMIC within the acceptable holding periods outlined in SW846.

10.2.2 Laboratory Analytical Results

The well development/purge water samples were analyzed for hazardous characteristics as defined under 40 CFR Parts 261.20-261.24. Such characteristics include ignitability, corrosivity, reactivity, and toxicity. The toxicity analysis employs the Toxicity Characteristic Leaching Procedure (TCLP), which includes specific VOCs, semi-volatile organic compounds, metals, herbicides, and pesticides. A summary of the valid analytical results of the above discussed water samples is provided in Appendix III. Laboratory-supplied analytical data is provided in Appendix IV.

10.2.3 Interpretations/Discussion

None of the well development/purge water samples exhibited the hazardous characteristics of ignitability, corrosivity, reactivity, or toxicity.

10.3 Conclusions/Recommendations

Three soil samples collected from the drums exhibited hazardous characteristics as defined under 40 CFR Part 261.20-261.24. Soil samples DRJSB-16-01, DRJSB-18-01, and DRJSB-19-01-02 had leachable lead concentrations exceeding the maximum allowable leachable lead concentration. The drums corresponding to these samples should be labeled with the EPA hazardous waste number D008 and the containerized material should be handled, stored, and disposed as hazardous waste. All hazardous waste must be managed in compliance with the regulations outlined in 40 CFR Part 265.

Based on the hazardous characteristics analytical results, the remaining containerized non-hazardous soil and water should not require special procedures for disposal and may be disposed at any time. All disposal procedures must be in compliance with local and state regulations.

11.0 BACKGROUND SOIL, GROUNDWATER AND RIVER WATER SAMPLING

The purpose of this phase of sampling was to obtain background soil, groundwater and river water samples for comparison with the on-site investigatory samples collected. An attempt was made to collect soil samples and groundwater/river water samples from areas on the island that have not been influenced by shipyard industrial activities. All sampling locations shown on Figure 11-1 were determined through discussions with the Navy.

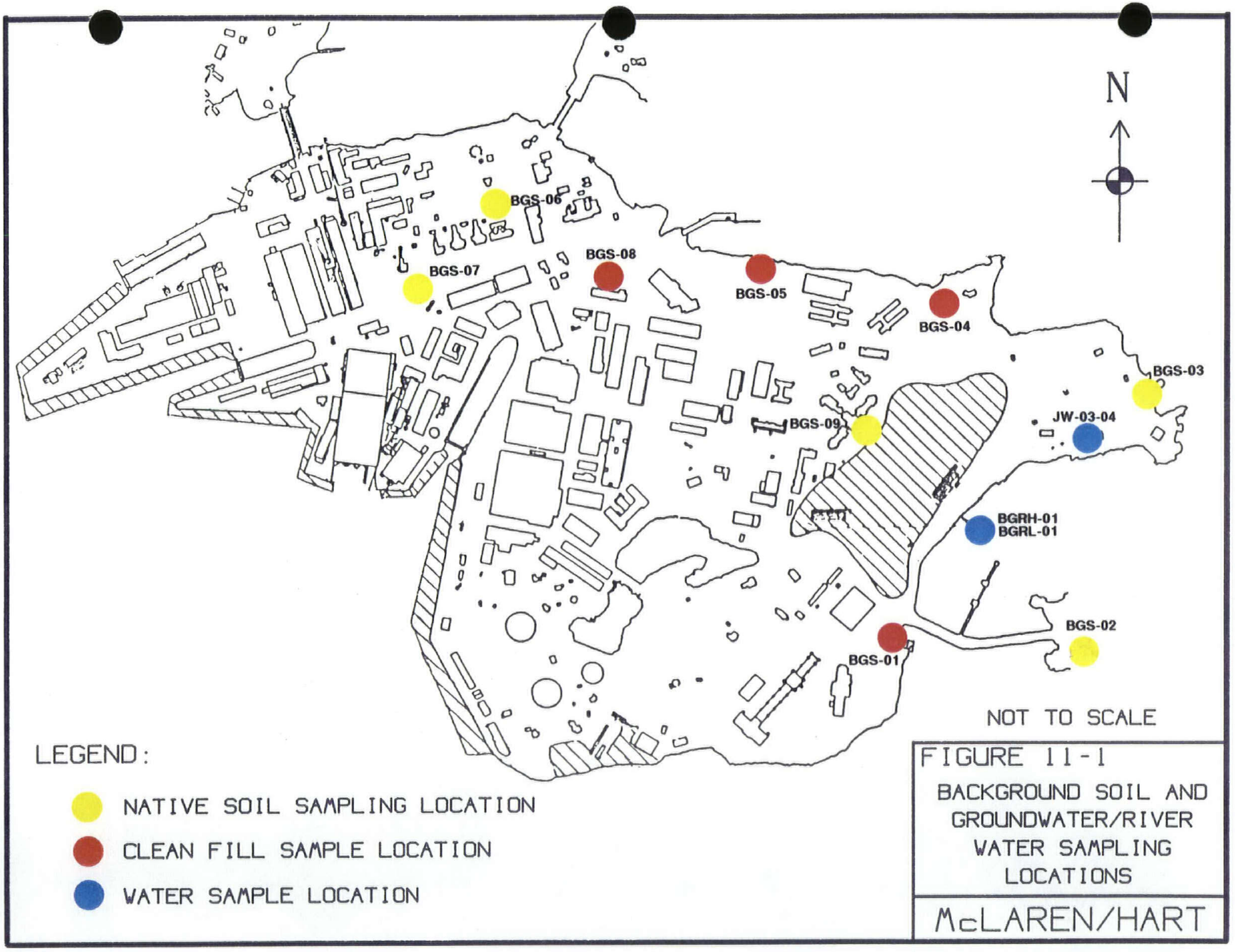
11.1 Background Soil Sampling

On August 12 and 13, 1991, background soil samples were collected from nine locations on the island, as shown on Figure 11-1. One duplicate sample, labeled BGS-11, collected from sample location BGS-01 and one equipment rinseate field blank (BGRB-16-04) were included in this soil sampling.

Four sample locations (BGS-01, BGS-04, BGS-05, and BGS-08) were selected in areas most likely to contain clean fill. The remaining five sample locations (BGS-02, BGS-03, BGS-06, BGS-07, and BGS-09) were selected in areas presumed to be native soil.

11.1.1 Sampling Procedures

Each soil sample was collected using a properly decontaminated hand auger and stainless-steel trowel after removing the upper six inches of grass and surface soil. A composite soil sample was then obtained from six inches to twenty-four inches or until refusal. The sample was placed in a precleaned stainless-steel mixing bowl, homogenized and transferred to the appropriate laboratory-supplied sample bottles. The sampling equipment was decontaminated prior to use at each location to prevent cross-contamination according to the protocol described in Table 2-1. All samples were stored on ice in a field cooler and delivered via courier to CEIMIC to be analyzed for TCL Organics, TAL


N
BGS-06
BGS-07
BGS-08
BGS-05
BGS-04
BGS-03
JW-03-04
BGS-09
BGRH-01
BGRL-01
BGS-02
BGS-01
NOT TO SCALE
LEGEND:
NATIVE SOIL SAMPLING LOCATION
CLEAN FILL SAMPLE LOCATION
WATER SAMPLE LOCATION
FIGURE 11-1
BACKGROUND SOIL AND GROUNDWATER/RIVER WATER SAMPLING LOCATIONS
McLAREN/HART

Inorganics, TOC, pH, and percent moisture. Two soil samples BGS-02 and BGS-04 were also selected for particle size analysis. All soil sample locations were measured from fixed points as identified in the field notebooks (Appendix II).

11.1.2 Findings

All soil samples collected were obtained by hand augering the upper twenty-four inches of the soil column or until refusal. Background soil sample descriptions and depth intervals are summarized below:

BGS-01: (0-1.8)	Top eighteen inches of soil column consists of light brown, fine to coarse sand, some gravel. Bottom four inches consists of black ash and melted glass.
BGS-02: (0-1.7)	Top twelve inches of soil column consists of brown loamy sand with roots. Bottom eight inches consists of grey to brown dense sand, some gravel and roots.
BGS-03: (0-2.0)	Brown loamy sand, trace of fine gravel and cobbles.
BGS-04: (0-1.3)	Brown, fine to coarse sand, silt, fine to coarse gravel and cobbles.
BGS-05: (0-1.2)	Dark brown, fine to coarse sand, cobbles, roots, trace of silty clay and gravel.
BGS-06: (0-1.0)	Brown, fine to medium sand, some silt and fine to coarse gravel, roots.
BGS-07: (0-1.7)	Brown, fine to coarse sand, some fine to coarse gravel, cobbles, rock fragments, trace of silt and clay, roots.
BGS-08: (0-1.4)	Brown, fine to coarse sand, some fine to coarse gravel, cobbles, rock fragments, trace of silt and clay, roots.
BGS-09: (0-1.8)	Top six inches of soil column consists of brown clayey silt, some fine to medium sand and roots. Bottom sixteen inches consists of light brown clayey silt, some fine sand, trace of fine to medium gravel, and occasional cobbles.

11.1.4 Laboratory Analytical Results

A total of nine soil samples were collected on the island, plus one duplicate sample and one equipment rinseate field blank (Figure 11-1). These samples were analyzed for TCL Organics, TAL Inorganics, TOC, pH, and percent moisture. Two of the samples BGS-02 and BGS-04 were also submitted for particle size analysis. A summary of valid soil sample results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

The State of Maine does not have published clean-up guidelines for contamination in soils, therefore, New Jersey ECRA Guidance Values and proposed Federal Action Levels are used for comparison purposes.

TCL Volatiles

Qualitative concentrations of methylene chloride were detected in samples BGS-01, BGS-02, BGS-04, and BGS-05. A qualitative concentration of 1,1-Dichloroethene was also detected in BGS-08. There were no volatile concentrations above New Jersey ECRA Guidance Values or proposed Federal Action Levels in any of the soil samples.

TCL Semi-Volatiles

Qualitative concentrations of semi-volatiles were found in all soil samples except for sample BGS-02. There were no semi-volatile concentrations above the New Jersey ECRA Guidance Value for total base neutrals or acid extractables. No proposed Federal Action Levels were available for total base neutrals and acid extractables, however, qualitative concentrations of bis(2-ethyhexyl)phthalate were found above the proposed Federal Action Level of 50 mg/kg in soil samples BGS-01 and BGS-06.

A review of chromatograms and the listed TICs indicate the presence of petroleum in all of the surface soil samples except for soil sample BGS-02. Since a petroleum ID analysis was not performed on the samples, a determination as to the type of petroleum cannot be accomplished.

TCL Pesticide/PCBs

Detectable pesticide concentrations were found in samples BGS-06, BGS-07, BGS-08, and BGS-09, however, none were above the proposed Federal Action Level for pesticides in soil. Pesticides are not listed under the New Jersey ECRA Guidance Values. There were no detectable PCB concentrations in any of the soil samples.

TAL Inorganics

There were no detectable cyanide concentrations in any of the soil samples. Detectable metal concentrations were found in all soil samples. Metal concentrations exceeding New Jersey ECRA Guidance Values and/or proposed Federal Action Levels are shown in Table 11-1. Qualitative concentrations of beryllium that may exceed the proposed Federal Action Level are also shown on Table 11-1.

TOC, pH, and Percent Moisture

The results for TOC, pH, and percent moisture analyses are shown in Table 11-2. The TOC values ranged from 0.6% to 5.3%, and pH ranged from 5.9 to 8.3. Percent moisture values ranged from 9% to 20%.

TABLE 11-1

SUMMARY OF METAL CONCENTRATIONS–SOIL EXCEEDING NEW JERSEY ECRA GUIDANCE VALUES AND/OR PROPOSED FEDERAL ACTION LEVELS

BACKGROUND SOIL SAMPLING PORTSMOUTH NAVAL SHIPYARD

AUGUST 12-13, 1991

PARAMETER	McLAREN/HART SAMPLE I.D.	CONCENTRATION (mg/kg)	NEW JERSEY ECRA GUIDANCE VALUE (PPM)	PROPOSED FEDERAL ACTION LEVEL (mg/kg)
ARSENIC	BGS-06	20.50J	20.0	80.0
	BGS-07	58.60J	20.0	80.0
BERYLLIUM	BGS-01	0.78Q	1.0	0.2
	BGS-02	1.10	1.0	0.2
	BGS-03	1.10	1.0	0.2
	BGS-04	0.54Q	1.0	0.2
	BGS-05	0.91	1.0	0.2
	BGS-06	0.79Q	1.0	0.2
	BGS-07	1.10	1.0	0.2
	BGS-08	0.85Q	1.0	0.2
	BGS-09	0.77Q	1.0	0.2
	BGS-11*	0.86Q	1.0	0.2
CADMIUM	BGS-11*	3.00	3.0	40.0
CHROMIUM	BGS-09	103.00	100.0	400.0
COPPER	BGS-07	232.00	170.0	NA
LEAD	BGS-06	543.00J	250-1,000	NA
	BGS-07	1,100.00	250-1,000	NA

Q = Qualitative Only
J = Qualitative and Semi-Quantitative
NA = Not Available
* = McLAREN/HART Duplicate Sample of BGS-01

TABLE 11-2

SUMMARY OF TOC, pH, AND PERCENT MOISTURE RESULTS

BACKGROUND SOIL SAMPLING
PORTSMOUTH NAVAL SHIPYARD

AUGUST 12-13, 1991

McLAREN/HART SAMPLE I.D.	TOC (%)	pH (SU)	PERCENT MOISTURE
BGS-01	5.3	7.8	18
BGS-02	0.6	8.3	15
BGS-03	1.3	7.0	16
BGS-04	0.7	7.1	9
BGS-05	3.9	6.9	13
BGS-06	3.1	7.1	20
BGS-07	2.6	5.9	20
BGS-08	1.6	6.5	13
BGS-09	3.9	6.6	13
BGS-11*	4.0	6.0	19

* =McLAREN/HART Duplicate Sample of BGS-01

Particle Size Analysis

A particle size analysis was conducted on surface soil samples BGS-01 and BGS-04. The particle size analysis results for BGS-01 is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		35%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		24%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	8%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	9%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	7%	
Silt size, 0.074 to 0.005 mm:		41%
Clay, smaller than 0.005 mm:		0%
Colloids, smaller than 0.001 mm:		0%

The particle size analysis results for BGS-04 is as follows:

Gravel, passing 3-inch and retained on No. 4 sieve:		41%
Sand, passing No. 4 sieve and retained on No. 200 sieve:		45%
a) Coarse sand, passing No. 4 sieve and retained on No. 10 sieve:	8%	
b) Medium sand, passing No. 10 sieve and retained on No. 60 sieve:	18%	
c) Fine sand, passing No. 60 sieve and retained on No. 200 sieve:	19%	
Silt size, 0.074 to 0.005 mm:		14%
Clay, smaller than 0.005 mm:		0%
Colloids, smaller than 0.001 mm:		0%

11.1.4 Interpretations/Discussion

Soil sample locations BGS-01, BGS-04, BGS-05, and BGS-08 were selected in areas most likely to contain clean fill. Sample locations BGS-02, BGS-03, BGS-06, BGS-07, and BGS-09 were selected in areas presumed to be native soil. The analytical results for background soil samples will be used as a comparison to results of soils from Phase IV sampling.

Qualitative concentrations of methylene chloride were detected in samples BGS-01, BGS-02, BGS-04, and BGS-05, however, methylene chloride is usually a common laboratory contaminant. Sample BGS-08 had a detectable concentration of 1,1-dichloroethene, which is not known to occur as a natural product, therefore, this location may have been impacted by industrial activities. The qualitative concentrations of methylene chloride and 1,1-dichloroethene were well below the New Jersey ECRA Guidance Values and proposed Federal Action Levels.

Qualitative concentrations of semi-volatiles were detected in all samples except for sample BGS-02. A review of chromatograms and the listed TICs indicate that a petroleum product exists in all samples except for sample BGS-02. Since none of the major components of gasoline (benzene, toluene, ethylbenzene, or xylene) were detected in the samples, there is a good possibility that the petroleum indicated in the chromatograms is not gasoline.

Detectable pesticide concentrations that are well below the proposed Federal Action Level were detected in soil samples BGS-06, BGS-07, BGS-08, and BGS-09. A source for pesticides may have been a former PNS controlled spraying program.

Detectable concentrations of beryllium were found in all soil samples ranging from 0.54 to 1.10 mg/kg. Three of the highest beryllium concentrations were found in areas of native soils. Beryllium is used as a neutron reflector and moderator in nuclear reactors. The beryllium concentrations detected in the soil samples may be due to fall out from emission sources at PNS or may be indicative of natural beryllium concentrations in soil.

All other metal concentrations detected above New Jersey ECRA Guidance Values (i.e., arsenic, cadmium, chromium, copper, and lead) were found in native soil samples, except for cadmium. The lead concentrations of 543 mg/kg and 1,100 mg/kg found in native soil samples BGS-06 and BGS-07, respectively, were significantly higher than other background soil sample locations. Lead concentrations in clean fill soil samples ranged from 77.8 mg/kg to 112 mg/kg while the remaining native soil samples ranged from 9.5 mg/kg to 40.1 mg/kg. The metal and petroleum concentrations observed may be associated with residual product from a former PNS controlled pesticide spraying program.

11.2 Background Groundwater/River Water Sampling

On August 13, 1991, a background groundwater sample JW-03-04 was collected from monitoring well JW-03. On August 13 and August 14, 1991, background river water samples BGRH-01 and BGRL-01 were sampled during high and low tide, respectively from the landing dock within Clark's Island Embayment. The sample locations are shown on Figure 11-1.

11.2.1 Sampling Procedures

Monitoring well JW-03 was sampled immediately following purging as previously described in Section 2.6.1. The stainless-steel bailer was decontaminated prior to use according to the protocol listed in Table 2-1.

The groundwater sample from the JILF monitoring well was analyzed for TCL Organics and TAL Inorganics (including dissolved and total metals). A summary of groundwater sampling and field parameter information is contained in Table 2-14.

Background river water samples were collected by placing the laboratory-supplied sample containers directly into the river water near the landing dock within Clark's Island Embayment.

The two river water samples were analyzed for TCL Organics and TAL Inorganics (total metals only). River water from both high and low tides were field analyzed for pH, temperature, specific conductivity, turbidity, and salinity prior to sampling. All of the field parameter measurements were recorded in field notebooks (Appendix II). Field parameter measurements are summarized below:

Sample I.D.	pH	Temp (°C)	Specific Conductivity (umhos/cm)	Turbidity (NTUs)	Salinity (c/oc)
BGRH-01	8.07	18.5	40,000	2.0	31.5
BGRL-01	7.97	17.2	38,000	3.1	27.5

Upon collection, all samples were placed in coolers which were kept chilled using ice. The sample cooler was then delivered via courier to CEIMIC within the appropriate holding times outlined in SW846.

11.2.2 Laboratory Analytical Results

One background groundwater sample was collected from the JILF monitoring well JW-03 and two background river water samples were collected at high and low tide from Clark's Island Embayment. A summary of valid groundwater and river water results are provided in Appendix III. Laboratory-supplied analytical results are provided in Appendix IV.

The State of Maine does not have published clean-up guidelines for contamination in groundwater, therefore, NPDWR and proposed Federal Action Levels are used to evaluate the analytical data.

TCL Volatiles

There were no detectable volatile concentrations above NPDWR or proposed Federal Action Levels. Only a qualitative concentration of acetone and a quantitative-qualitative concentration of carbon disulfide were found in river water samples BGRH-01 and BGRL-01. No volatiles were detected in groundwater sample JW-03.

TCL Semi-Volatiles

There were no detectable semi-volatile concentrations found in any of the samples.

A review of the chromatogram and the listed TICs indicate petroleum in the groundwater sample collected from JW-03. Since a petroleum identification was not performed on the sample, a determination as to the type of petroleum cannot be accomplished.

TCL Pesticide/PCBs

There were no detectable pesticide or PCB concentrations found in any of the samples.

TAL Inorganics

There were no detectable metal concentrations above NPDWR or proposed Federal Action Levels in any of the samples.

11.2.3 Interpretations/Discussion

Monitoring well JW-03 was selected as a background for fresh water wells and the two river samples were selected as a background for monitoring wells influenced by the river. These background groundwater and river water analytical results will be used as a comparison to results from Phase IV groundwater sampling.

There were no detectable volatile concentrations in groundwater sample JW-03-04. Background river water samples collected during high and low tide only had detectable acetone and carbon disulfide concentrations. According to Howard (1990), carbon disulfide is common along coastal areas where microbial reduction of sulfates in soil produces fluxes of carbon disulfide. Acetone can also be a naturally occurring volatile metabolite from vegetation and insects.

There were no semi-volatiles or pesticide/PCBs detected in any of the samples. However, a review of the chromatogram and the listed TICs for the JW-03-04 sample indicates the presence of petroleum. Since none of the main components of gasoline (benzene, toluene, ethylbenzene, or xylene) were detected in the sample, there is a good possibility that the petroleum indicated in the chromatogram is not gasoline. In any future sampling of monitoring well JW-03, a petroleum identification should be requested as part of the analyses to determine the type of petroleum present in the groundwater.

Both high and low tide river samples had detectable calcium, magnesium, manganese, potassium, and sodium concentrations. These metals are present in ocean waters and are not listed under NPDWR or proposed Federal Action Levels. Sample BGRH-01 (high tide) had a qualitative concentration of chromium at 6.0 ug/L. The chromium concentration was well below the NPDWR and the proposed Federal Action Level of 50 ug/L for chromium in water.

In addition to the metals detected in the river water samples, groundwater sample JW-03-04 had detectable concentrations of aluminum, barium, calcium, iron, and vanadium. The qualitative chromium concentration of 9 ug/L detected in sample JW-03-04 was well below the NPDWR and the proposed Federal Action Level. None of the other metals detected were listed under NPDWR or proposed Federal Action Levels.

Specific conductivity and salinity readings taken from the river water during high and low tide indicate a slight decrease in salinity at low tide. This could be an indication of a fresh/brackish water influence on an outgoing tide.

12.0 REFERENCES

Erskine, A.D., 1991, The Effect of Tidal Fluctuation on a Coastal Aquifer in the UK, Ground Water, Vol. 29, No. 4., pp. 556-562.

Ferris, J.G., 1951, Cyclic Fluctuations of Water Level as a Basis for Determining Aquifer Transmissibility. Intl. Assoc. Sci. Hydrology Publ. 33., pp. 148-155.

Howard, Philip H., (ed), 1990, Handbook of Environmental Fate and Exposure Data for Organic Chemicals, Lewis Publishers, Inc., 546 p.

Hvorslev, J. M., 1951, Time Lag and Soil Permeability in Ground-Water Observations. Bull. 36, 50 pp., U.S. Corps of Eng., Waterways Exp. Sta., Vicksburg, Miss..

Ingmanson, Dale E., and Wallace, William J., 1973, Oceanology: An Introduction, Wadsworth Publishing Company, Inc., 325 p.

Perket, Cary L., (ed), May 1986, Quality Control in Remedial Site Investigation: Hazardous and Industrial Solid Waste Testing, ASTM-STP 925, Fifth Volume, p. 37-38.

Salomons, W. and Förstner, U., 1984, Metals in the Hydrocycle: Springer-Verlag.

Serfes, Michael E., 1991, Determining the Mean Hydraulic Gradient of Ground Water Affected by Tidal Fluctuations, Ground Water, Vol. 29, No. 4., pp. 549-554.

Telford, W.M.; Geldart, L.P.; Sheriff, R.E. and Keys, D.A., 1976, Applied Geophysics: Cambridge University Press.

U.S.E.P.A. (1986, 3rd Ed.). Test Methods For Evaluating Solid Waste-Physical/Chemical Methods Field Manual, Vol. II: U.S. Government Printing Office, SW-846.

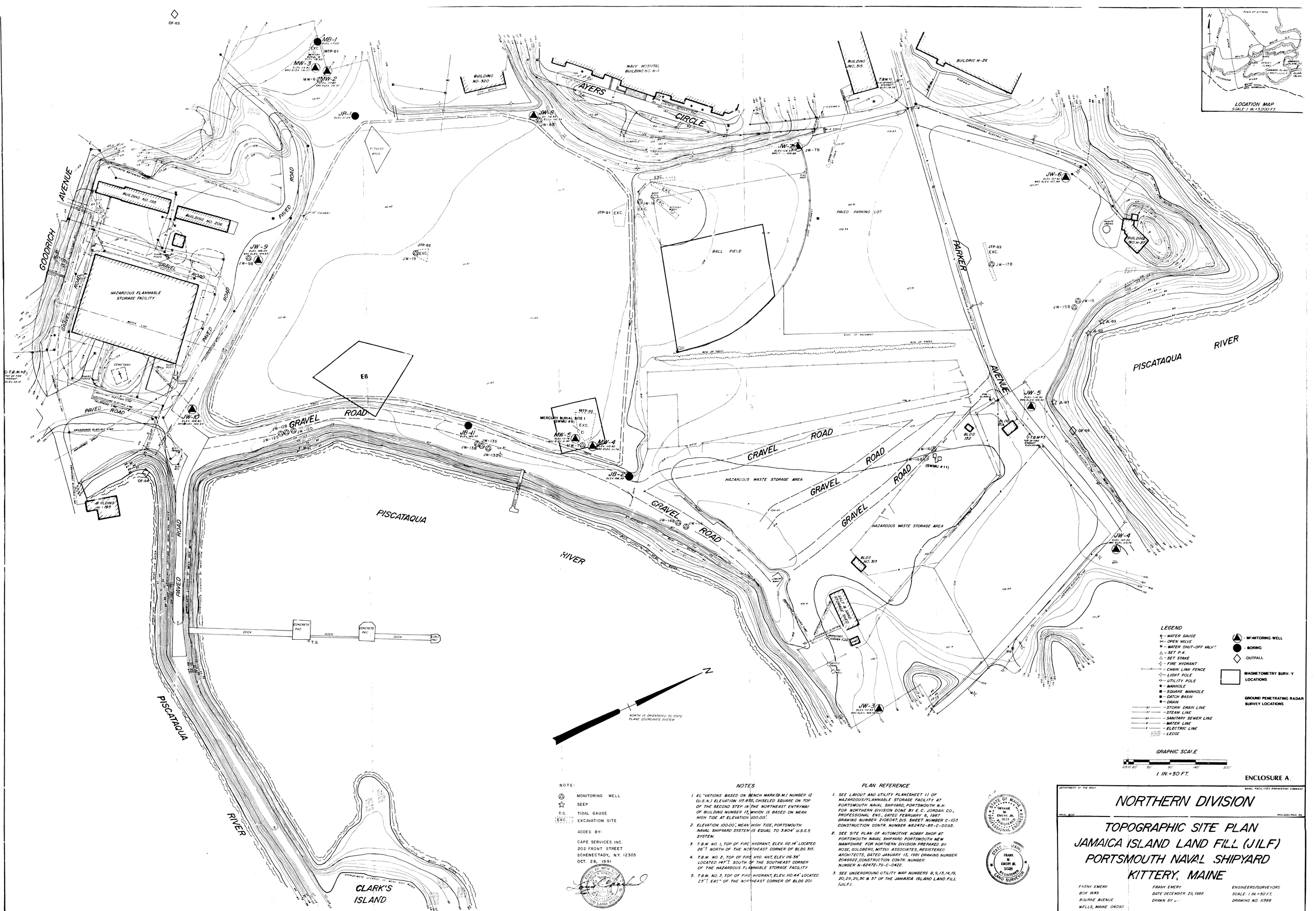
U.S.E.P.A., February 1988, Contract Laboratory Program, Statement of Work for Organics.

U.S.E.P.A., July 1988, Contract Laboratory Program, Statement of Work for Inorganics, SOW No. 788.

12.0 REFERENCES (CONTINUED)

U.S.E.P.A.--Region I, February 1, 1988, Laboratory Data Validation, Functional Guidelines for Evaluating Organics Analysis.

U.S.E.P.A.--Region I, June 13, 1988, Laboratory Data Validation, Functional Guidelines for Evaluating Inorganic Analysis.



NOTE:

- MONITORING WELL
- SEEP
- T.G. TIDAL GAUGE
- EXC. EXCAVATION SITE

ADDED BY:

CAPE SERVICES INC.
202 FRONT STREET
SCHENECTADY, N.Y. 12305
OCT. 28, 1991

NOTES

1. ELEVATIONS BASED ON BENCH MARK (B.M.) NUMBER 12 (U.S.N.) ELEVATION 115.855, CHISELED SQUARE ON TOP OF THE SECOND STEP IN THE NORTHEAST ENTRYWAY OF BUILDING NUMBER 13, WHICH IS BASED ON MEAN HIGH TIDE AT ELEVATION 100.00'.
2. ELEVATION 100.00', MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' U.S.C.S. SYSTEM.
3. T.B.M. NO. 1, TOP OF FIRE HYDRANT, ELEV. 112.14' LOCATED 28'± NORTH OF THE NORTHEAST CORNER OF BLDG. 315.
4. T.B.M. NO. 2, TOP OF FIRE HYD. ANT. ELEV. 116.38' LOCATED 142'± SOUTH OF THE SOUTHEAST CORNER OF THE HAZARDOUS FLAMMABLE STORAGE FACILITY
5. T.B.M. NO. 3, TOP OF FIRE HYDRANT, ELEV. 110.44' LOCATED 25'± EAST OF THE NORTHEAST CORNER OF BLDG 201.

PLAN REFERENCE

1. SEE LAYOUT AND UTILITY PLAN (SHEET 1) OF HAZARDOUS/FLAMMABLE STORAGE FACILITY AT PORTSMOUTH NAVAL SHIPYARD, PORTSMOUTH N.H. FOR NORTHERN DIVISION DONE BY E.C. JORDAN CO., PROFESSIONAL ENG., DATED FEBRUARY 6, 1987 DRAWING NUMBER 2106947, DIS. SHEET NUMBER C-103 CONSTRUCTION CONTR. NUMBER N62472-85-C-0093.
2. SEE SITE PLAN OF AUTOMOTIVE HOBBY SHOP AT PORTSMOUTH NAVAL SHIPYARD PORTSMOUTH NEW HAMPSHIRE FOR NORTHERN DIVISION PREPARED BY ROSE, GOLDBERG, MITSUI ASSOCIATES, REGISTERED ARCHITECTS, DATED JANUARY 13, 1981 DRAWING NUMBER 2048922, CONSTRUCTION CONTR. NUMBER NUMBER N-62472-79-C-0422.
3. SEE UNDERGROUND UTILITY MAP NUMBERS 8, 9, 13, 14, 19, 20, 24, 25, 36 & 37 OF THE JAMAICA ISLAND LAND FILL (JILF).

STATE OF MAINE FRANK M. EMERY, JR. 3613 REGISTERED PROFESSIONAL ENGINEER

STATE OF MAINE FRANK M. EMERY JR. 1028 REGISTERED LAND SURVEYOR

ENCLOSURE A.

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

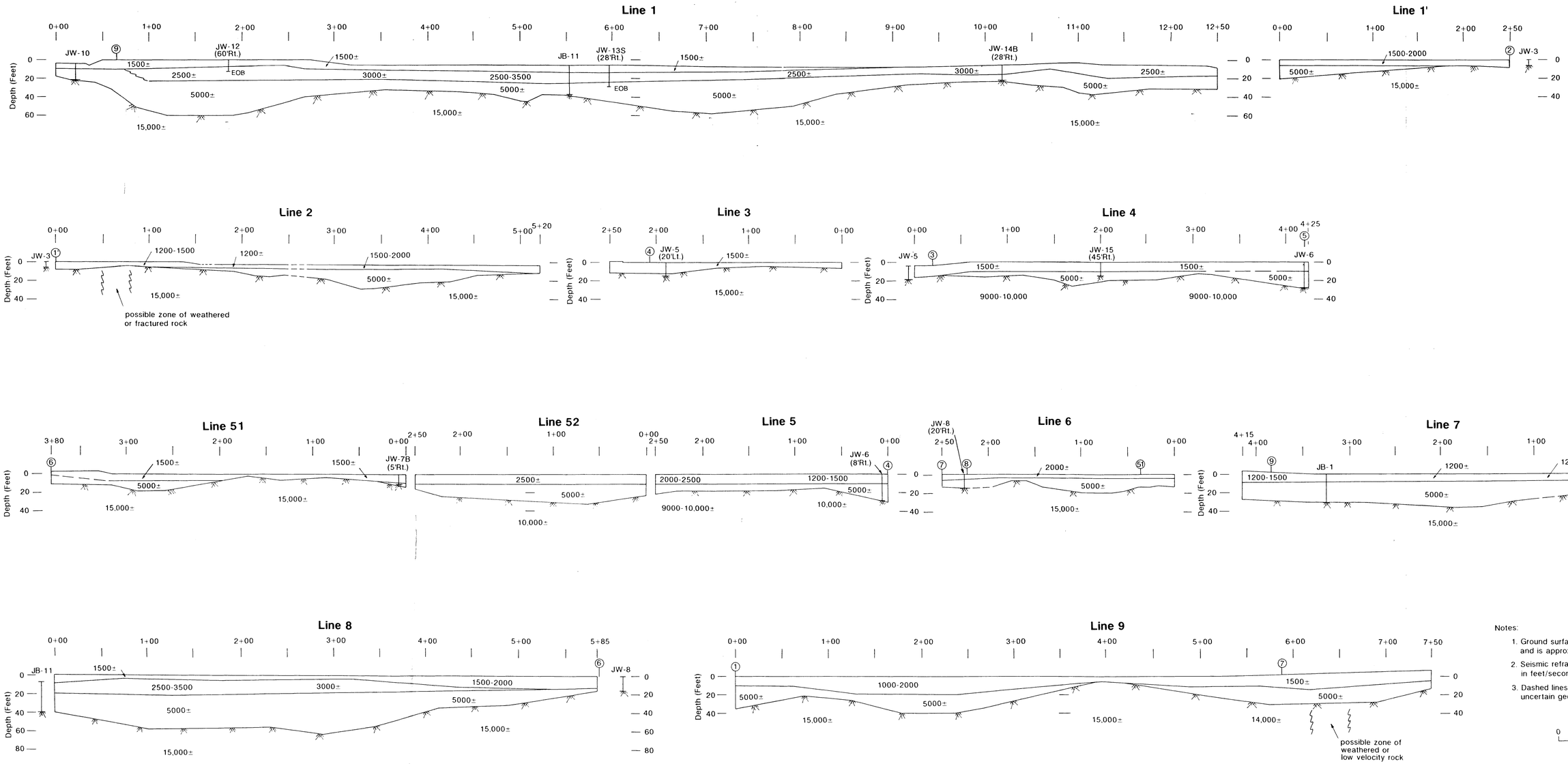
NORTHERN DIVISION

NAVAL BASE — PHILADELPHIA, PA.

TOPOGRAPHIC SITE PLAN JAMAICA ISLAND LAND FILL (JILF) PORTSMOUTH NAVAL SHIPYARD KITTERY, MAINE

FRANK EMERY	FRANK EMERY	ENGINEERS/SURVEYORS
BOX 1649	DATE: DECEMBER 29, 1988	SCALE: 1 IN.=50 FT.
BOURNE AVENUE	DRAWN BY:	DRAWING NO. 11388
WELLS, MAINE 04090		

REVISED: JANUARY 3, 1991 BY JJS



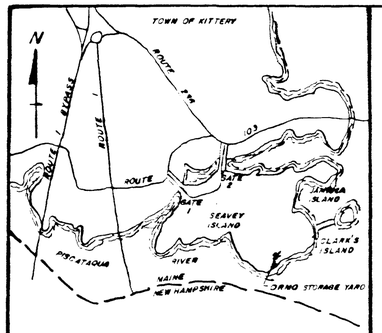
Notes:

1. Ground surface is based on field observations and is approximate.
2. Seismic refraction velocity values are shown in feet/second.
3. Dashed lines indicate velocity interfaces of uncertain geometries.

0 50 100
Scale in Feet

ENCLOSURE B

prepared by / checked by / reviewed by	SEISMIC REFRACTION INVESTIGATION PORTSMOUTH NAVEL SHIPYARD KITTERY, MAINE prepared for MCLAREN/HART	**Seismic Refraction Profiles** Weston Geophysical — Fig. 3



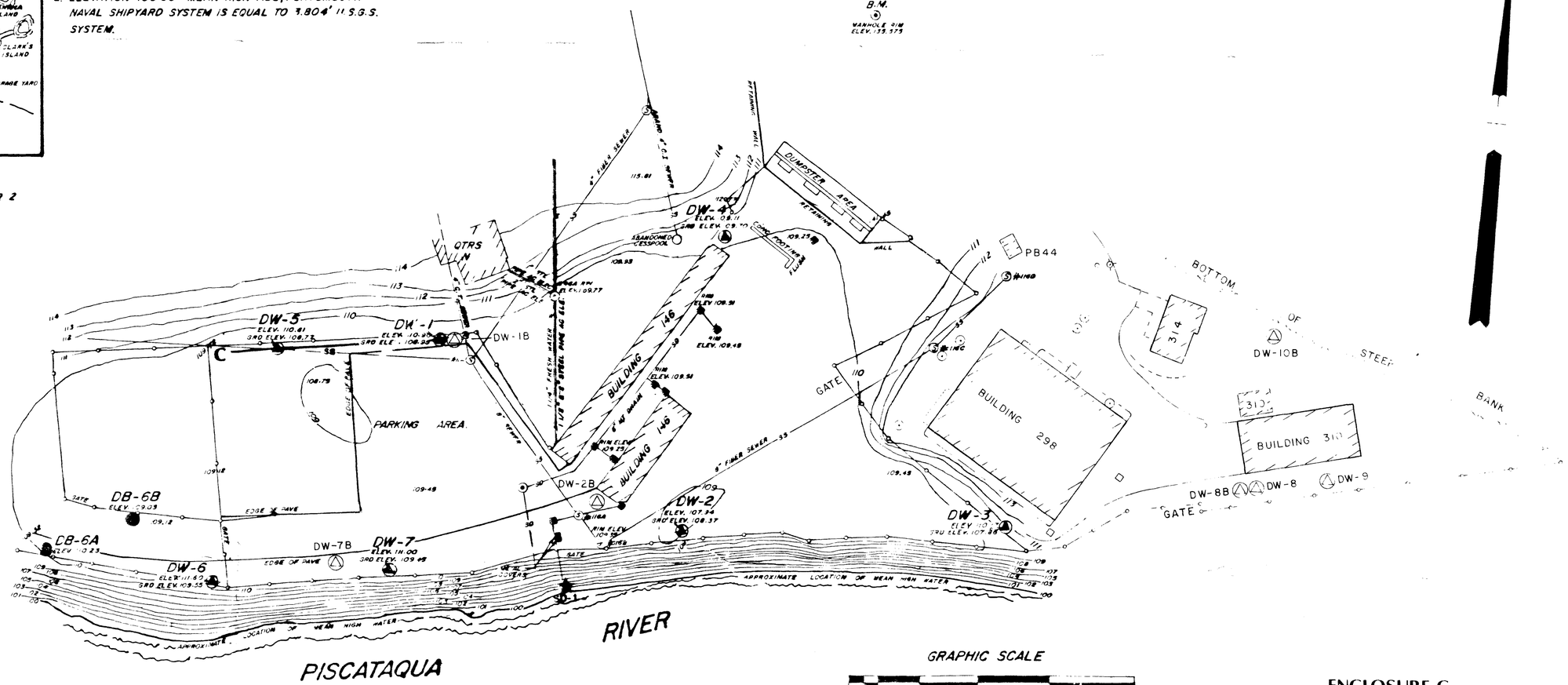
LOCATION MAP
SCALE: 1 IN.=3,000 FT.

NOTES

1. BENCH MARK (B.M.) TRANSFERRED FROM BENCH MARK NUMBER 12 (U.S.N.) ELEVATION 115.855, CHISELED SQUARE ON TOP OF THE SECOND STEP IN THE NORTHEAST ENTRYWAY OF BUILDING NUMBER 13, WHICH IS BASED ON MEAN HIGH TIDE AT ELEVATION.
2. ELEVATION 100.00' MEAN HIGH TIDE, PORTSMOUTH NAVAL SHIPYARD SYSTEM IS EQUAL TO 3.804' U.S.G.S. SYSTEM.

PLAN REFERENCE

SEE UNDERGROUND UTILITY MAP NUMBER 2 DRMO STORAGE YARD.



GRAPHIC SCALE

0 10' 20' 50' 90' 140' 200'

1 IN. = 50 FT.

LEGEND

- MANHOLE
- SEWER MANHOLE
- CATCH BASIN
- CHAIN LINK FENCE
- ELECTRIC LINE
- SANITARY SEWER LINE
- STORM DRAIN
- WATER LINE
- MONITORING WELL
- BORING
- OUTFALL SAMPLE

STATE OF MAINE
FRANK M. EMERY, JR.
3613
REGISTERED PROFESSIONAL ENGINEER

STATE OF MAINE
FRANK M. EMERY JR.
1028
REGISTERED LAND SURVEYOR

Frank M. Emery Jr.

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND

NORTHERN DIVISION

NAVAL BASE — PHILADELPHIA, PA.

TOPOGRAPHIC SITE PLAN
DRMO STORAGE YARD
PORTSMOUTH NAVAL SHIPYARD
KITTERY, MAINE

FRANK EMERY
BOX 1649
BOURNE AVENUE
WELLS, MAINE 04090

FRANK EMERY
DATE JANUARY 4, 1989
DRAWN BY JAS

ENGINEERS/SURVEYORS
SCALE: 1 IN. = 50 FT.
DRAWING NO. 11488

REVISED JANUARY 3, 1990 BY JAS

ENCLOSURE C

NOTE:

BUILDINGS PB44, 298, 314, 310

△ MONITORING WELL

ADDED BY:

CAPE SERVICES INC.
202 FRONT STREET
SCHENECTADY, N.Y. 12305
OCT. 28, 1991