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REMEDIAL INVESTIGATION REPORT

for

NAVAL WEAPONS STATION EARLE
Colts Neck, New Jersey

VOLUME IB - TEXT

Northern Division
Naval Facilities Engineering Command
Contract No. N62472-90-D-1298
Contract Task Order 0231

July 1996

BROWN & ROOT ENVIRONMENTAL

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TABLE OF CONTENTS

SECTION		PAGE
EXECUTIVE SUMMARY		**ES-1**
1.0	**INTRODUCTION**	**1-1**
1.1	PURPOSE AND SCOPE	1-1
1.2	FACILITY LOCATION	1-2
1.3	FACILITY MISSION	1-2
1.4	PREVIOUS INVESTIGATIONS	1-5
1.5	WETLANDS DELINEATION	1-5
1.6	SURVEY INFORMATION	1-5
2.0	**INVESTIGATION SUMMARY**	**2-1**
2.1	SUMMARY OF ACTIVITIES	2-1
2.1.1	Subsurface Investigations	2-2
2.1.2	Surface Soil Sampling	2-15
2.1.3	Surface Water Sampling	2-15
2.1.4	Sediment Sampling	2-15
2.1.5	Surveying	2-21
2.1.6	Sampling of Septic Tank Contents	2-21
2.1.7	Waste Handling	2-21
2.1.8	Floor Sweepings Sampling	2-22
2.1.9	General Sampling Operations	2-22
2.1.10	Sample Handling	2-25
2.2	NATURE AND EXTENT OF CONTAMINATION	2-27
2.3	FACILITY-WIDE CONTAMINANT FATE AND TRANSPORT	2-27
2.3.1	Physical and Chemical Properties	2-28
2.3.2	Contaminant Persistence	2-33
2.3.3	Contaminant Migration Routes	2-36
2.4	HUMAN HEALTH RISK ASSESSMENT APPROACH	2-37
2.4.1	Data Evaluation	2-39
2.4.2	Toxicity Assessment	2-44
2.4.3	Exposure Assessment	2-55
2.4.4	Risk Characterization	2-81
2.4.5	Risk Assessment Uncertainties	2-83
2.4.6	Amended Risk Assessment	2-91
2.5	QUALITY ASSURANCE/QUALITY CONTROL RESULTS	2-96
2.5.1	Field Quality Control Blanks	2-96
2.5.2	Discussion of Field Quality Control Blank Impact	2-96
2.5.3	Field Duplicate Precision	2-99
2.5.4	Laboratory Quality Control Analyses	2-99
2.5.5	Parameters	2-100
2.5.6	Summary of the Data Validation	2-103
2.6	ECOLOGICAL RISK ASSESSMENT APPROACH	2-106
2.6.1	Preliminary Problem Formulation and Ecological Effects Characterization	2-107
2.6.2	Preliminary Exposure Assessment and Risk Characterization	2-118
2.6.3	Uncertainties Analysis	2-124
2.6.4	Summary	2-127
2.7	ARARs or Criteria to Be Considered (TBCs)	2-128
REFERENCES		2-133

TABLE OF CONTENTS (continued)

SECTION		PAGE
3.0	**FACILITY-WIDE ENVIRONMENTAL SETTING**	**3-1**
3.1	CLIMATE AND METEOROLOGY	3-1
3.2	TOPOGRAPHY	3-1
3.3	SURFACE WATER HYDROLOGY	3-2
3.4	GENERAL GEOLOGY	3-2
3.4.1	Regional Geologic Setting	3-2
3.4.2	Surficial Deposits	3-3
3.4.3	Cretaceous to Miocene Coastal Plain Formations	3-7
3.5	SOILS	3-12
3.6	HYDROGEOLOGY	3-12
3.6.1	Aquifer Classification	3-18
3.6.2	Hydrogeologic Units	3-18
3.6.3	Hydraulic Conductivity	3-22
3.7	WATER SUPPLY	3-25
3.7.1	Private Wells	3-25
3.7.2	Municipal Water System	3-30
3.8	POPULATION AND LAND USE	3-30
3.8.1	Population	3-30
3.8.2	Surrounding Land Use	3-30
3.9	ECOLOGY	3-31
4.0	**SITE 1: ORDNANCE DEMILITARIZATION SITE**	**4-1**
4.1	SITE BACKGROUND AND PHYSICAL SETTING	4-1
4.2	PREVIOUS INVESTIGATIONS	4-1
4.2.1	Summary of Activities and Results	4-1
4.2.2	Summary of Conclusions	4-3
4.2.3	Data Gaps (Objectives of Remedial Investigation)	4-3
4.3	RI FIELD INVESTIGATIONS	4-3
4.3.1	Hydropunch Groundwater Sampling	4-4
4.3.2	Soil Borings and Subsurface Soil Sampling	4-4
4.3.3	Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling	4-8
4.3.4	Slug Testing	4-14
4.4	SITE CHARACTERISTICS	4-14
4.4.1	Geology	4-14
4.4.2	Hydrogeology	4-14
4.5	NATURE AND EXTENT OF CONTAMINATION	4-14
4.5.1	Subsurface Soil	4-14
4.5.2	Groundwater	4-26
4.6	CONTAMINANT FATE AND TRANSPORT	4-35
4.6.1	Detected Chemicals and Transport Potential	4-35
4.6.2	Contaminant Persistence	4-36
4.6.3	Observed Chemical Contaminant Trends	4-37
4.6.4	Conclusions	4-38
4.7	BASELINE RISK ASSESSMENT	4-39
4.7.1	Risk Characterization	4-39
4.7.2	Conclusions	4-55
4.8	ECOLOGICAL RISK	4-56
4.8.1	Preliminary Problem Formulation	4-56
4.8.2	Ecological Effects Assessment	4-60
4.8.3	Preliminary Exposure Assessment	4-60
4.8.4	Risk Characterization	4-60
4.8.5	Summary and Conclusion	4-63

TABLE OF CONTENTS (continued)

SECTION		PAGE
4.9	EVALUATION AND RECOMMENDATIONS	4-64
4.9.1	Evaluation Summary	4-64
4.9.2	Recommendations	4-64
5.0	**SITE 2: ACTIVE ORDNANCE DEMILITARIZATION SITE**	**5-1**
5.1	SITE BACKGROUND AND PHYSICAL SETTING	5-1
5.2	PREVIOUS INVESTIGATIONS	5-1
5.2.1	Summary of Activities and Results	5-1
5.2.2	Summary of Conclusions	5-3
5.2.3	Data Gaps	5-3
5.3	RI FIELD INVESTIGATIONS	5-3
5.3.1	Static-Water-Level Measurements and Groundwater Sampling	5-4
5.3.2	Surface Soil Sampling	5-4
5.4	SITE CHARACTERISTICS	5-7
5.4.1	Geology	5-7
5.4.2	Hydrogeology	5-7
5.5	NATURE AND EXTENT OF CONTAMINATION	5-10
5.5.1	Surface Soils	5-10
5.5.2	Groundwater	5-10
5.6	CONTAMINANT FATE AND TRANSPORT	5-28
5.6.1	Detected Chemicals and Transport Potential	5-29
5.6.2	Contaminant Persistence	5-29
5.6.3	Observed Chemical Contaminant Trends	5-30
5.6.4	Conclusions	5-31
5.7	BASELINE RISK ASSESSMENT	5-31
5.7.1	Risk Characterization	5-34
5.7.2	Conclusions	5-47
5.8	ECOLOGICAL RISK	5-50
5.8.1	Habitat Types and Ecological Receptors	5-50
5.8.2	Ecological Effects Assessment	5-51
5.8.3	Preliminary Exposure Assessment	5-52
5.8.4	Risk Characterization	5-52
5.8.5	Summary and Conclusions	5-52
5.9	EVALUATION AND RECOMMENDATIONS	5-56
5.9.1	Evaluation Summary	5-56
5.9.2	Recommendations	5-56
6.0	**SITE 3: LANDFILL SOUTHWEST OF "F" GROUP**	**6-1**
6.1	SITE BACKGROUND AND PHYSICAL SETTING	6-1
6.2	PREVIOUS INVESTIGATIONS	6-1
6.2.1	Summary of Activities and Results	6-1
6.2.2	Summary of Conclusions	6-3
6.2.3	Data Gaps	6-3
6.3	RI FIELD INVESTIGATIONS	6-3
6.3.1	Soil Gas Survey	6-4
6.3.2	Test Pit	6-4
6.3.3	Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling	6-7
6.3.4	Wetlands Surface Soil Sample	6-9
6.4	SITE CHARACTERISTICS	6-11

TABLE OF CONTENTS (continued)

SECTION		PAGE
6.4.1	Geology	6-11
6.4.2	Hydrogeology	6-11
6.5	NATURE AND EXTENT OF CONTAMINATION	6-14
6.5.1	Sediment	6-14
6.5.2	Groundwater	6-14
6.6	CONTAMINANT FATE AND TRANSPORT	6-25
6.6.1	Detected Chemicals and Transport Potential	6-25
6.6.2	Contaminant Persistence	6-26
6.6.3	Observed Chemical Contaminant Trends	6-27
6.6.4	Conclusions	6-27
6.7	BASELINE RISK ASSESSMENT	6-28
6.7.1	Risk Characterization	6-28
6.7.2	Conclusions	6-41
6.8	ECOLOGICAL RISKS	6-42
6.8.1	Habitat Types and Ecological Receptors	6-42
6.8.2	Ecological Effects Assessment	6-46
6.8.3	Preliminary Exposure Assessment	6-46
6.8.4	Risk Characterization	6-46
6.8.5	Summary and Conclusions	6-46
6.9	EVALUATION AND RECOMMENDATIONS	6-49
6.9.1	Evaluation Summary	6-49
6.9.2	Recommendations	6-50
7.0	**SITE 4: LANDFILL WEST OF "D" GROUP**	**7-1**
7.1	SITE BACKGROUND AND PHYSICAL SETTING	7-1
7.2	PREVIOUS INVESTIGATIONS	7-1
7.2.1	Summary of Activities and Results	7-1
7.2.2	Summary of Conclusions	7-3
7.2.3	Data Gaps	7-3
7.3	RI FIELD INVESTIGATIONS	7-4
7.3.1	Hydropunch Groundwater Sampling	7-4
7.3.2	Surface Water and Sediment Sampling	7-5
7.3.3	Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling	7-8
7.4	SITE CHARACTERISTICS	7-12
7.4.1	Geology	7-12
7.4.2	Hydrogeology	7-12
7.5	NATURE AND EXTENT OF CONTAMINATION	7-12
7.5.1	Sediment	7-12
7.5.2	Groundwater	7-22
7.5.3	Surface Water	7-29
7.6	CONTAMINANT FATE AND TRANSPORT	7-36
7.6.1	Detected Chemicals and Transport Potential	7-36
7.6.2	Contaminant Persistence	7-37
7.6.3	Observed Chemical Contaminant Trends	7-37
7.6.4	Conclusions	7-38
7.7	BASELINE RISK ASSESSMENT	7-39
7.7.1	Risk Characterization	7-39
7.7.2	Conclusions	7-55
7.8	ECOLOGICAL RISKS	7-58

TABLE OF CONTENTS (continued)

SECTION		PAGE
7.8.1	Preliminary Problem Formulation and Ecological Effects Characterization	7-58
7.8.2	Preliminary Exposure Assessment and Risk Characterization	7-60
7.8.3	Summary and Conclusions	7-60
7.8.4	Risk Characterization	7-60
7.8.5	Summary and Conclusions	7-60
7.9	EVALUATION AND RECOMMENDATIONS	7-64
7.9.1	Evaluation Summary	7-64
7.9.2	Recommendations	7-65
8.0	**SITE 5: LANDFILL WEST OF ARMY BARRICADES**	**8-1**
8.1	SITE BACKGROUND AND PHYSICAL SETTING	8-1
8.2	PREVIOUS INVESTIGATIONS	8-1
8.2.1	Summary of Activities and Results	8-1
8.2.2	Summary of Conclusions	8-3
8.2.3	Data Gaps	8-3
8.3	RI FIELD INVESTIGATIONS	8-3
8.3.1	Hydropunch Groundwater Sampling	8-4
8.3.2	Static-Water-Level Measurements and Groundwater Sampling	8-4
8.4	SITE CHARACTERISTICS	8-9
8.4.1	Geology	8-9
8.4.2	Hydrogeology	8-10
8.5	NATURE AND EXTENT OF CONTAMINATION	8-10
8.5.1	Groundwater	8-10
8.5.2	Organics in Groundwater	8-24
8.6	CONTAMINANT FATE AND TRANSPORT	8-24
8.6.1	Detected Chemicals and Transport Potential	8-24
8.6.2	Contaminant Persistence	8-25
8.6.3	Observed Chemical Contaminant Trends	8-25
8.6.4	Conclusions	8-26
8.7	BASELINE RISK ASSESSMENT	8-26
8.7.1	Risk Characterization	8-28
8.7.2	Conclusions	8-34
8.8	ECOLOGICAL RISK ASSESSMENT	8-37
8.8.1	Preliminary Problem Formulation and Ecological Effects Characterization	8-37
8.8.2	Ecological Effects Assessment	8-40
8.8.3	Preliminary Exposure Assessment	8-40
8.8.4	Risk Characterization	8-41
8.8.5	Summary and Conclusions	8-41
8.9	EVALUATION AND RECOMMENDATIONS	8-42
8.9.1	Evaluation Summary	8-42
8.9.2	Recommendations	8-42
9.0	**SITE 6: LANDFILL WEST OF NORMANDY ROAD**	**9-1**
9.1	SITE BACKGROUND AND PHYSICAL SETTING	9-1
9.2	PREVIOUS INVESTIGATIONS	9-1
9.2.1	Summary of Activities and Results	9-1
9.2.2	Summary of Conclusions	9-1
9.2.3	Data Gaps (Objectives of Remedial Investigation	9-1
9.3	RI FIELD INVESTIGATIONS	9-3
9.3.1	Surface Water Sampling	9-3
9.3.2	Sediment Sampling	9-4

TABLE OF CONTENTS (continued)

SECTION **PAGE**

9.3.3 Static-Water-Level Measurements and Groundwater Sampling 9-4
9.4 SITE CHARACTERISTICS 9-7
9.4.1 Geology 9-7
9.4.2 Hydrogeology 9-7
9.5 NATURE AND EXTENT OF CONTAMINATION 9-7
9.5.1 Sediment 9-7
9.5.2 Groundwater 9-19
9.5.3 Surface Water 9-27
9.6 CONTAMINANT FATE AND TRANSPORT 9-33
9.6.1 Detected Chemicals and Transport Potential 9-33
9.6.2 Contaminant Persistence 9-34
9.6.3 Observed Chemical Contaminant Trends 9-34
9.6.4 Conclusions 9-34
9.7 BASELINE RISK ASSESSMENT 9-35
9.7.1 Risk Characterization 9-35
9.7.2 Conclusions 9-52
9.8 ECOLOGICAL RISKS 9-53
9.8.1 Habitat Types and Ecological Receptors 9-53
9.8.3 Preliminary Exposure Assessment 9-57
9.8.4 Risk Characterization 9-57
9.8.5 Summary and Conclusion 9-58
9.9 EVALUATION AND RECOMMENDATIONS 9-59
9.9.1 Evaluation Summary 9-59
9.9.2 Recommendations 9-59

10.0 SITE 7: LANDFILL SOUTH OF "P" BARRICADES 10-1
10.1 SITE BACKGROUND AND PHYSICAL SETTING 10-1
10.2 PREVIOUS INVESTIGATIONS 10-1
10.2.1 Summary of Activities and Results 10-1
10.2.2 Summary and Conclusion 10-3
10.2.3 Data Gaps (Objectives of Remedial Investigation 10-3
10.3 RI FIELD INVESTIGATIONS 10-3
10.3.1 Static-Water-Level Measurements and Groundwater Sampling 10-4
10.3.2 Sediment Sampling 10-4
10.3.3 Surface Water Sample 10-7
10.4 SITE CHARACTERISTICS 10-7
10.4.1 Geology 10-7
10.4.2 Hydrogeology 10-7
10.5 NATURE AND EXTENT OF CONTAMINATION 10-10
10.5.1 Sediment 10-10
10.5.2 Groundwater 10-10
10.6 CONTAMINANT FATE AND TRANSPORT 10-23
10.6.1 Detected Chemicals and Transport Potential 10-23
10.6.2 Contaminant Persistence 10-24
10.6.3 Observed Chemical 10-24
10.6.4 Conclusion 10-25
10.7 BASELINE RISK ASSESSMENT 10-26
10.7.1 Risk Characterization 10-26
10.7.2 Conclusions 10-38
10.8 ECOLOGICAL RISKS 10-41

TABLE OF CONTENTS (continued)

SECTION		PAGE
10.8.1	Habitat Types and Ecological Receptors	10-41
10.8.2	Ecological Effects Assessment	10-42
10.8.3	Preliminary Exposure Assessment	10-43
10.8.4	Risk Characterization	10-43
10.8.5	Summary and Conclusion	10-43
10.9	EVALUATION AND RECOMMENDATIONS	10-46
10.9.1	Evaluation Summary	10-46
10.9.2	Recommendations	10-46
11.0	**SITE 9: LANDFILL SOUTH OF "P" BARRICADES**	**11-1**
11.1	SITE BACKGROUND AND PHYSICAL SETTING	11-1
11.2	PREVIOUS INVESTIGATIONS	11-1
11.2.1	Summary of Activities and Results	11-1
11.2.2	Summary and Conclusion	11-1
11.2.3	Data Gaps (Objectives of Remedial Investigation	11-2
11.3	REMEDIAL INVESTIGATION SAMPLING ACTIVITIES	11-3
11.3.1	Test Pits	11-3
11.3.2	Surface Water and Sediment Sampling	11-4
11.4	SITE CHARACTERISTICS	11-4
11.4.1	Geology	11-4
11.4.2	Hydrogeology	11-5
11.5	NATURE AND EXTENT OF CONTAMINATION	11-5
11.5.1	Sediment	11-5
11.5.2	Surface Water	11-5
11.6	QUALITATIVE RISK ASSESSMENT.	11-6
11.7	EVALUATION AND RECOMMENDATIONS	11-6
11.7.1	Evaluation Summary	11-6
11.7.2	Recommendations	11-6
12.0	**SITE 10: SCRAP METAL LANDFILL**	**12-1**
12.1	SITE BACKGROUND AND PHYSICAL SETTING	12-1
12.2	PREVIOUS INVESTIGATIONS	12-1
12.2.1	Summary of Activities and Results	12-1
12.2.2	Summary of Conclusion	12-3
12.2.3	Data Gaps (Objectives of Remedial Investigation	12-3
12.3	RI FIELD INVESTIGATIONS	12-4
12.3.1	Static-Water-Level Measurements and Groundwater Sampling	12-4
12.4	SITE CHARACTERISTICS	12-7
12.4.1	Geology	12-7
12.4.2	Hydrogeology	12-7
12.5	NATURE AND EXTENT OF CONTAMINATION	12-10
12.5.1	Groundwater	12-10
12.6	CONTAMINANT FATE AND TRANSPORT	12-10
12.6.1	Detected Chemicals and Transport Potential	12-18
12.6.2	Contaminant Persistence	12-18
12.6.3	Observed Chemical Contaminant Trends	12-18
12.6.4	Conclusions	12-19
12.7	BASELINE RISK ASSESSMENT	12-19
12.7.1	Risk Characterization	12-19
12.7.2	Conclusions	12-26
12.8	ECOLOGICAL RISK	12-27
12.8.1	Preliminary Problem Formulation	12-27

TABLE OF CONTENTS (continued)

SECTION		PAGE
12.8.2	Ecological Effects Assessment	12-29
12.8.3	Preliminary Exposure Assessment	12-29
12.8.4	Summary and Conclusion	12-30
12.9	EVALUATION AND RECOMMENDATIONS	12-31
12.9.1	Evaluation Summary	12-31
12.9.2	Recommendations	12-31
13.0	**SITE 11: CONTRACT ORDNANCE DISPOSAL AREA**	**13-1**
13.1	SITE BACKGROUND AND PHYSICAL SETTING	13-1
13.2	PREVIOUS INVESTIGATIONS	13-1
13.2.1	Summary of Activities and Results	13-1
13.2.2	Summary of Conclusions	13-3
13.2.3	Data Gaps	13-3
13.3	RI FIELD INVESTIGATIONS	13-3
13.3.1	Static-Water-Level Measurements and Groundwater Sampling	13-3
13.4	SITE CHARACTERISTICS	13-4
13.4.1	Geology	13-4
13.4.2	Hydrogeology	13-7
13.5	NATURE AND EXTENT OF CONTAMINATION	13-7
13.5.1	Groundwater	13-7
13.6	CONTAMINANT FATE AND TRANSPORT	13-15
13.6.1	Detected Chemicals and Transport Potential	13-15
13.6.2	Contaminant Persistence	13-15
13.6.3	Observed Chemical Contaminant Trends	13-16
13.6.4	Conclusions	13-16
13.7	BASELINE RISK ASSESSMENT	13-17
13.7.1	Risk Characterization	13-17
13.8	ECOLOGICAL RISKS	13-24
13.8.1	Preliminary Problem Formulation	13-24
13.8.2	Summary and Conclusions	13-27
13.9	EVALUATION AND RECOMMENDATIONS	13-27
13.9.1	Evaluation Summary	13-27
13.9.2	Recommendations	13-28
14.0	**SITE 12: BATTERY STORAGE AREA**	**14-1**
14.1	SITE BACKGROUND AND PHYSICAL SETTING	14-1
14.2	PREVIOUS INVESTIGATIONS	14-1
14.2.1	Summary of Activities and Results	14-1
14.2.2	Summary of Conclusions	14-3
4.2.3	Data Gaps	14-3
14.3	RI FIELD INVESTIGATIONS	14-3
14.3.1	Surface Soil Sampling	14-3
14.3.2	Sediment Sampling	14-4
14.4	SITE CHARACTERISTICS	14-4
14.4.1	Geology	14-4
14.4.2	Hydrogeology	14-4
14.5	NATURE AND EXTENT OF CONTAMINATION	14-5
14.5.1	Surface Soils	14-5
14.5.2	Sediment	14-12

TABLE OF CONTENTS (continued)

SECTION		PAGE
14.6	CONTAMINANT FATE AND TRANSPORT	14-12
14.6.1	Detected Chemicals and Transport Potential	14-18
14.6.2	Contaminant Persistence	14-18
14.6.3	Observed Chemical Contaminant Trends	14-19
14.6.4	Conclusions	14-19
14.7	BASELINE RISK ASSESSMENT	14-20
14.7.1	Risk Characterization	14-20
14.7.2	Conclusions	14-29
14.8	ECOLOGICAL RISKS	14-32
14.8.1	Preliminary Problem Formulation and Ecological Effects	14-32
14.8.2	Preliminary Exposure Assessment and Risk Characterization	14-36
14.8.3	Summary and Conclusions	14-39
14.9	EVALUATION AND RECOMMENDATIONS	14-40
15.0	**SITE 13: DEFENSE PROPERTY DISPOSAL OFFICE YARD**	**15-1**
15.1	SITE BACKGROUND AND PHYSICAL SETTING	15-1
15.2	PREVIOUS INVESTIGATIONS	15-1
15.3	RI FIELD INVESTIGATIONS	15-3
15.3.1	Test Pits	15-4
15.3.2	Surface Water Sampling	15-4
15.3.3	Sediment Sampling	15-4
15.3.4	Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling	15-5
15.3.5	Slug Tests	15-9
15.4	SITE CHARACTERISTICS	15-9
15.4.1	Geology	15-9
15.4.2	Hydrogeology	15-9
15.5	NATURE AND EXTENT OF CONTAMINATION	15-11
15.5.1	Sediment	15-11
15.5.2	Groundwater	15-22
15.5.3	Surface Water	15-32
15.6	CONTAMINANT FATE AND TRANSPORT	15-38
15.6.1	Detected Chemicals and Transport Potential	15-38
15.6.2	Contaminant Persistence	15-39
15.6.3	Observed Chemical Contaminant Trends	15-40
15.6.4	Conclusions	15-41
15.7	BASELINE RISK ASSESSMENT	15-42
15.7.1	Risk Characterization	15-42
15.7.2	Conclusions	15-63
15.8	ECOLOGICAL RISKS	15-66
15.8.1	Preliminary Problem Formulation	15-66
15.8.2	Ecological Effects Assessment	15-68
15.8.3	Preliminary Exposure Assessment	15-68
15.8.4	Risk Characterization	15-68
15.8.5	Summary and Conclusions	15-71
15.9	EVALUATION AND RECOMMENDATIONS	15-72
15.9.1	Evaluation Summary	15-72
15.9.2	Recommendations	15-73
16.0	**SITE 14: MERCURY SPILL**	**16-1**
16.1	SITE BACKGROUND AND PHYSICAL SETTING	16-1
16.2	PREVIOUS INVESTIGATIONS	16-1

TABLE OF CONTENTS (continued)

SECTION		PAGE
16.3	REMEDIAL INVESTIGATION SAMPLING ACTIVITIES	16-1
16.3.1	Floor Sweepings	16-1
16.4	SITE CHARACTERISTICS	16-3
16.4.1	Geology	16-3
16.4.2	Hydrogeology	16-3
16.5	NATURE AND EXTENT OF CONTAMINATION	16-3
16.5.1	Floor Sweepings	16-3
16.5.2	Inorganics	16-3
16.5.3	Miscellaneous Parameters	16-4
16.5.4	Conclusions	16-4
16.6	EVALUATION AND RECOMMENDATIONS	16-4
16.6.1	Evaluation Summary	16-4
16.6.2	Recommendations	16-4
17.0	**SITE 15: SLUDGE DISPOSAL SITE**	**17-1**
17.1	SITE BACKGROUND AND PHYSICAL SETTING	17-1
17.2	PREVIOUS INVESTIGATIONS	17-1
17.2.1	Summary of Activities and Results	17-1
17.2.2	Summary of Conclusions	17-1
17.2.3	Data Gaps	17-3
17.3	RI FIELD INVESTIGATIONS	17-3
17.3.1	Surface Water Sampling	17-3
17.3.2	Sediment Sampling	17-4
17.3.3	Surface Soil Sampling	17-4
17.3.4	Subsurface Soil Sampling (Hand Augering)	17-4
17.4	SITE CHARACTERISTICS	17-5
17.4.1	Geology	17-5
17.4.2	Hydrogeology	17-5
17.5	NATURE AND EXTENT OF CONTAMINATION	17-5
17.5.1	Surface Soils	17-5
17.5.2	Subsurface Soils	17-8
17.5.3	Sediment	17-21
17.5.4	Surface Water	17-31
17.6	CONTAMINANT FATE AND TRANSPORT	17-31
17.6.1	Detected Chemicals and Transport Potential	17-36
17.6.2	Contaminant Persistence	17-36
17.6.3	Observed Chemical Contaminant Trends	17-37
17.6.4	Conclusions	17-37
17.7	BASELINE RISK ASSESSMENT	17-38
17.7.1	Risk Characterization	17-43
17.7.2	Conclusions	17-65
17.8	ECOLOGICAL RISKS	17-65
17.8.1	Preliminary Problem Formulation	17-65
17.8.2	Ecological Effects Assessment	17-69
17.8.3	Preliminary Exposure Assessment	17-69
17.8.4	Risk Characterization	17-69
17.8.5	Summary and Conclusions	17-73
17.9	EVALUATION AND RECOMMENDATIONS	17-77
17.9.1	Evaluation Summary	17-77

TABLE OF CONTENTS (continued)

SECTION		PAGE
18.0	**SITE 16: EPIC SITE F (ROUNDHOUSE SITE)**	**18-1**
18.1	SITE BACKGROUND AND PHYSICAL SETTING	18-1
18.2	PREVIOUS INVESTIGATIONS	18-3
18.3	RI FIELD INVESTIGATIONS	18-4
18.3.1	Soil Gas Survey	18-4
18.3.2	Soil Borings and Subsurface Soil Sampling	18-11
18.3.3	Surface Soil Sampling	18-12
18.3.4	Sediment Sampling	18-12
18.3.5	Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling	18-16
18.3.6	Slug Tests	18-20
18.4	SITE CHARACTERISTICS	18-20
18.4.1	Geology	18-20
18.4.2	Hydrogeology	18-20
18.5	NATURE AND EXTENT OF CONTAMINATION	18-24
18.5.1	Surface Soils	18-24
18.5.2	Subsurface Soils	18-33
18.5.3	Sediment	18-60
18.5.4	Groundwater	18-69
18.6	CONTAMINANT FATE AND TRANSPORT	18-82
18.6.1	Detected Chemicals and Transport Potential	18-82
18.6.2	Contaminant Persistence	18-84
18.6.3	Observed Chemical Contaminant Trends	18-84
18.6.4	Conclusions	18-85
18.7	BASELINE RISK ASSESSMENT	18-86
18.7.1	Risk Characterization	18-86
18.7.2	Conclusions	18-104
18.8	ECOLOGICAL RISK ASSESSMENT	18-109
18.8.1	Preliminary Problem Formulation	18-109
18.8.2	Preliminary Exposure Assessment and Risk Characterization	18-112
18.8.3	Summary and Conclusions	18-113
18.9	EVALUATION AND RECOMMENDATIONS	18-117
18.9.1	Evaluation Summary	18-117
18.9.2	Recommendations	18-118
19.0	**SITE 17: LANDFILL**	**19-1**
19.1	SITE BACKGROUND AND PHYSICAL SETTING	19-1
19.2	PREVIOUS INVESTIGATIONS	19-1
19.2.1	Summary of Activities and Results	19-1
19.2.2	Summary of Conclusions	19-1
19.2.3	Data Gap (Objectives of RI)	19-3
19.3	RI FIELD INVESTIGATIONS	19-3
19.3.1	Surface Water Sampling	19-4
19.3.2	Sediment Sampling	19-4
19.3.3	Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling	19-5
19.3.4	Surface Soil Sampling	19-7
19.4	SITE CHARACTERISTICS	19-7
19.4.1	Geology	19-7
19.4.2	Hydrogeology	19-9

TABLE OF CONTENTS (continued)

SECTION **PAGE**

19.5 NATURE AND EXTENT OF CONTAMINATION 19-9
19.5.1 Surface Soils 19-9
19.5.2 Sediment 19-16
19.5.3 Groundwater 19-27
19.5.4 Surface Water 19-27
19.6 CONTAMINANT FATE AND TRANSPORT 19-34
19.6.1 Detected Chemicals and Transport Potential 19-34
19.6.2 Contaminant Persistence 19-39
19.6.3 Observed Chemical Contaminant Trends 19-40
19.6.4 Conclusions 19-40
19.7 BASELINE RISK ASSESSMENT 19-41
19.7.1 Risk Characterization 19-41
19.7.2 Conclusions 19-64
19.8 ECOLOGICAL RISKS 19-65
19.8.1 Habitat Types and Ecological Receptors 19-65
19.8.2 Ecological Effects Assessment 19-69
19.8.3 Preliminary Exposure Assessment 19-69
19.8.4 Risk Characterization 19-69
19.8.5 Summary and Conclusion 19-74
19.9 EVALUATION AND RECOMMENDATIONS 19-78
19.9.1 Evaluation Summary 19-78
19.9.2 Recommendations 19-78

20.0 SITE 19: PAINT CHIP AND SLUDGE DISPOSAL AREA 20-1
20.1 SITE BACKGROUND AND PHYSICAL SETTING 20-1
20.2 PREVIOUS INVESTIGATIONS 20-1
20.2.1 Summary of Activities and Results 20-1
20.2.2 Summary of Conclusions 20-3
20.2.3 Data Gaps 20-3
20.3 RI FIELD INVESTIGATIONS 20-3
20.3.1 Surface Water Sampling 20-4
20.3.2 Sediment Sampling 20-4
20.3.3 Surface and Subsurface Soil Sampling 20-4
20.3.4 Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling 20-6
20.4 SITE CHARACTERISTICS 20-10
20.4.1 Geology 20-10
20.4.2 Hydrogeology 20-10
20.5 NATURE AND EXTENT OF CONTAMINATION 20-10
20.5.1 Subsurface Soils 20-10
20.5.2 Sediment 20-20
20.5.3 Groundwater 20-29
20.5.4 Surface Water 20-33
20.6 CONTAMINANT FATE AND TRANSPORT 20-33
20.6.1 Detected Chemicals and Transport Potential 20-33
20.6.2 Contaminant Persistence 20-39
20.6.3 Observed Chemical Contaminant Trends 20-39
20.6.4 Conclusions 20-40
20.7 BASELINE RISK ASSESSMENT 20-41
20.7.1 Risk Characterization 20-46
20.7.2 Conclusions 20-48

TABLE OF CONTENTS (continued)

SECTION		PAGE
20.8	ECOLOGICAL RISK ASSESSMENT	20-69
20.8.1	Preliminary Problem Formulation	20-69
20.8.2	Preliminary Exposure Assessment	20-59
20.9	EVALUATION AND RECOMMENDATIONS	20-76
20.9.1	Evaluation Summary	20-76
20.9.2	Recommendations	20-77
21.0	**SITE 20: GRIT BLASTING AREA AT BUILDING 544**	**21-1**
21.1	SITE BACKGROUND AND PHYSICAL SETTING	21-1
21.2	PREVIOUS INVESTIGATIONS AND REMOVAL ACTION	21-1
21.2.1	Summary of Activities and Results	21-1
21.2.2	Summary of Conclusions	21-3
21.2.3	Data Gaps	21-3
21.3	RI FIELD INVESTIGATIONS	21-3
21.3.1	Subsurface Soil Sampling	21-4
21.3.2	Surface Soil Sampling	21-4
21.3.3	Sediment Sampling	21-4
21.3.4	Septic Tank Sample	21-7
21.4	SITE CHARACTERISTICS	21-7
21.4.1	Geology	21-7
21.4.2	Hydrogeology	21-8
21.5	NATURE AND EXTENT OF CONTAMINATION	21-8
21.5.1	Surface Soils	21-8
21.5.2	Subsurface Soils	21-14
21.5.3	Sediment	21-14
21.5.4	Aqueous Water	21-26
21.6	CONTAMINANT FATE AND TRANSPORT	21-27
21.6.1	Detected Chemicals and Transport Potential	21-27
21.6.2	Contaminant Persistence	21-27
21.6.3	Observed Chemical Contaminant Trends	21-28
21.6.4	Conclusions	21-29
21.7	BASELINE RISK ASSESSMENT	21-30
21.7.1	Risk Characterization	21-30
21.7.2	Conclusions	21-47
21.8	ECOLOGICAL RISKS	21-48
21.8.1	Preliminary Problem Formulation	21-48
21.8.2	Summary and Conclusion	21-51
21.9	EVALUATION AND RECOMMENDATIONS	21-51
21.9.1	Evaluation Summary	21-51
21.9.2	Recommendations	21-52
22.0	**SITE 22: PAINT CHIP DISPOSAL AREA**	**22-1**
22.1	SITE BACKGROUND AND PHYSICAL SETTING	22-1
22.2	PREVIOUS INVESTIGATIONS	22-1
22.2.1	Summary of Activities and Results	22-1
22.2.2	Summary of Conclusions	22-3
22.2.3	Data Gaps (Objectives of Remedial Investigation)	22-3
22.3	REMEDIAL INVESTIGATION SAMPLING ACTIVITIES	22-3
22.4	SITE CHARACTERISTICS	22-4
22.4.1	Geology	22-4
22.4.2	Hydrogeology	22-4
22.5	NATURE AND EXTENT OF CONTAMINATION	22-4

TABLE OF CONTENTS (continued)

SECTION **PAGE**

22.5.1 Subsurface Soil 22-4
22.5.2 Sediment 22-13
22.6 CONTAMINANT FATE AND TRANSPORT 22-19
22.6.1 Detected Chemicals and Transport Potential 22-20
22.6.2 Contaminant Persistence 22-20
22.6.3 Observed Chemical Contaminant Trends 22-21
22.6.4 Conclusions 22-21
22.7 BASELINE RISK ASSESSMENT 22-22
22.7.1 Risk Characterization 22-22
22.7.2 Conclusions 22-34
22.8 ECOLOGICAL RISKS 22-34
22.8.1 Preliminary Problem Formulation 22-34
22.8.2 Ecological Effects Assessment 22-38
22.8.3 Preliminary Problem Formulation 22-38
22.8.4 Risk Characterization 22-39
22.8.5 Summary and Conclusions 22-39
22.9 EVALUATION AND RECOMMENDATIONS 22-44
22.9.1 Evaluation Summary 22-44
22.9.2 Recommendations 22-44

23.0 SITE 23: PAINT DISPOSAL AREA 23-1
23.1 SITE BACKGROUND AND PHYSICAL SETTING 23-1
23.2 PREVIOUS INVESTIGATIONS 23-1
23.2.1 Summary of Activities and Results 23-1
23.2.2 Summary of Conclusions 23-3
23.2.3 Data Gaps (Objectives of Remedial Investigation) 22-3
23.3 RI FIELD INVESTIGATIONS 23-3
23.3.1 Soil Borings and Subsurface Soil Sampling 23-4
23.3.2 Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling 23-5
23.3.3 Slug Tests 23-10
23.3.4 Surface Water Sampling 23-10
23.3.5 Sediment Sampling 23-10
23.4 SITE CHARACTERISTICS 23-12
23.4.1 Geology 23-12
21.4.2 Hydrogeology 23-12
23.5 NATURE AND EXTENT OF CONTAMINATION 23-14
23.5.1 Subsurface Soils 23-14
23.5.2 Sediment 23-26
23.5.3 Groundwater 23-26
23.5.4 Surface Water 23-32
23.6 CONTAMINANT FATE AND TRANSPORT 23-42
23.6.1 Detected Chemicals and Transport Potential 23-42
23.6.2 Contaminant Persistence 23-43
23.6.3 Observed Chemical Contaminant Trends 23-43
23.6.4 Conclusions 23-44
23.7 BASELINE RISK ASSESSMENT 23-45
23.7.1 Risk Characterization 23-45
23.7.2 Conclusions 23-75
23.8 ECOLOGICAL RISKS 23-76

TABLE OF CONTENTS (continued)

SECTION		PAGE
23.8.1	Habitat Types and Ecological Receptors	23-76
23.8.2	Ecological Effects Assessment	23-80
23.8.3	Preliminary Problem Formulation	23-80
23.8.4	Risk Characterization	23-80
23.8.5	Summary and Conclusions	23-80
23.9	EVALUATION AND RECOMMENDATIONS	23-84
23.9.1	Evaluation Summary	23-84
23.9.2	Recommendations	23-85
24.0	**SITES 24/25: CLOSED PISTOL RANGES**	**24-1**
24.1	SITE BACKGROUND AND PHYSICAL SETTING	24-1
24.2	PREVIOUS INVESTIGATIONS	24-1
24.2.1	Summary of Activities and Results	21-1
24.2.2	Summary of Conclusions	24-1
24.2.3	Data Gaps	24-3
24.3	RI FIELD INVESTIGATIONS	24-3
24.3.1	Soil Borings and Subsurface Soil Sampling	24-3
24.4	SITE CHARACTERISTICS	24-6
24.4.1	Geology	24-6
24.4.2	Hydrogeology	24-6
24.5	NATURE AND EXTENT OF CONTAMINATION - SITE 4	24-6
24.5.1	Subsurface Soils	24-6
24.5.2	Subsurface Soils - Site 25	24-12
24.6	CONTAMINANT FATE AND TRANSPORT	24-12
24.6.1	Detected Chemicals and Transport Potential	24-12
24.6.2	Contaminant Persistence	24-18
24.6.3	Observed Chemical Contaminant Trends	24-18
24.6.4	Conclusions	24-18
24.7	BASELINE RISK ASSESSMENT	24-19
24.7.1	Risk Characterization	24-19
24.7.2	Conclusions	24-32
24.8	ECOLOGICAL RISKS	24-32
24.8.1	Preliminary Problem Formulation	24-32
24.8.2	Summary and Conclusions	24-35
24.9	EVALUATION AND RECOMMENDATIONS	24-36
24.9.1	Evaluation Summary	24-36
24.9.2	Recommendations	24-36
25.0	**SITE 26: EXPLOSIVE "D" WASHOUT AREA**	**25-1**
25.1	SITE BACKGROUND AND PHYSICAL SETTING	25-1
25.2	PREVIOUS INVESTIGATIONS	25-1
25.2.1	Summary of Activities and Results	25-1
25.2.2	Summary of Conclusions	25-3
25.2.3	Data Gaps	25-3
25.3	RI FIELD INVESTIGATIONS	25-3
25.3.1	Soil Gas Survey	25-4
25.3.2	Soil Borings and Subsurface Soil Sampling	25-7
25.3.3	Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling	25-96
25.4	SITE CHARACTERISTICS	25-13
25.4.1	Geology	25-13
25.4.2	Hydrogeology	25-13

TABLE OF CONTENTS (continued)

SECTION		PAGE
25.5	NATURE AND EXTENT OF CONTAMINATION	25-13
25.5.1	Subsurface Soils	25-13
25.5.2	Groundwater	25-18
25.6	CONTAMINANT FATE AND TRANSPORT	25-30
25.6.1	Detected Chemicals and Transport Potential	25-30
25.6.2	Contaminant Persistence	25-31
25.6.3	Observed Chemical Contaminant Trends	25-31
25.6.4	Conclusions	25-32
25.7	BASELINE RISK ASSESSMENT	25-32
25.7.1	Risk Characterization	25-35
25.7.2	Conclusions	25-53
25.8	ECOLOGICAL RISK ASSESSMENT	25-54
25.8.1	Preliminary Problem Formulation	25-54
25.8.2	Summary and Conclusions	25-58
25.9	EVALUATION AND RECOMMENDATIONS	25-59
25.9.1	Evaluation Summary	25-59
25.9.2	Recommendations	25-60
26.0	**SITE 27: PROJECTILE REFURBISHING AREA**	**26-1**
26.1	SITE BACKGROUND AND PHYSICAL SETTING	26-1
26.2	PREVIOUS INVESTIGATIONS	26-1
26.2.1	Summary of Activities and Results	26-1
26.2.2	Summary of Conclusions	26-2
26.3	REMEDIAL INVESTIGATION SAMPLING ACTIVITIES	26-3
26.3.1	Soil Borings and Subsurface Soil Sampling	26-3
26.3.2	Subsurface Soil Sampling (Hand Augering)	26-4
26.4	SITE CHARACTERISTICS	26-4
26.4.1	Geology	26-4
26.4.2	Hydrogeology	26-5
26.5	NATURE AND EXTENT OF CONTAMINATION	26-5
26.5.1	Subsurface Soils	26-5
26.6	CONTAMINANT FATE AND TRANSPORT	26-17
26.6.1	Detected Chemicals and Transport Potential	26-17
26.6.2	Contaminant Persistence	26-18
26.6.3	Observed Chemical Contaminant Trends	26-18
26.6.4	Conclusions	26-19
26.7	BASELINE RISK ASSESSMENT	26-19
26.7.1	Risk Characterization	26-21
26.7.2	Conclusions	26-24
26.8	ECOLOGICAL RISK	26-28
26.8.1	Preliminary Problem Formulation	26-28
26.8.2	Ecological Effects Assessment	26-31
26.8.3	Preliminary Exposure Assessment	26-31
26.8.4	Risk Characterization	26-32
26.8.5	Conclusions	26-32
26.9	EVALUATION AND RECOMMENDATIONS	26-34
26.9.1	Evaluation Summary	26-34
26.9.2	Recommendations	26-34
17.0	**SITE 29: PCB SPILL SITE**	**27-1**
27.1	SITE BACKGROUND AND PHYSICAL SETTING	27-1
27.2	PREVIOUS INVESTIGATIONS	27-1

TABLE OF CONTENTS (continued)

SECTION		PAGE
27.2.1	Summary of Activities and Results	27-1
27.2.2	Summary of Conclusions	27-3
27.2.3	Data Gaps (Objectives of RI)	27-3
27.3	RI FIELD INVESTIGATIONS	27-3
27.3.1	Soil Borings and Subsurface Soil Sampling	27-4
27.3.2	Permanent Monitoring Wells, Static-Water-Level Measurements, and Groundwater Sampling	27-4
27.4	SITE CHARACTERISTICS	27-9
27.4.1	Geology	27-9
27.4.2	Hydrogeology	27-9
27.5	NATURE AND EXTENT OF CONTAMINATION	27-10
27.5.1	Subsurface Soil	27-10
27.5.2	Groundwater	27-10
27.6	CONTAMINANT FATE AND TRANSPORT	27-21
27.6.1	Detected Chemicals and Transport Potential	27-21
27.6.2	Contaminant Persistence	27-22
27.6.3	Observed Chemical Contaminant Trends	27-22
27.6.4	Conclusions	27-23
27.7	BASELINE RISK ASSESSMENT	27-24
27.7.1	Risk Characterization	27-24
27.7.2	Conclusions	27-39
27.8	ECOLOGICAL RISK	27-40
27.8.1	Preliminary Problem Formulation	27-40
27.8.2	Summary and Conclusions	27-43
27.9	EVALUATION AND RECOMMENDATIONS	27-44
27.9.1	Evaluation Summary	27-44
27.9.2	Recommendations	27-44
28.0	**EPIC SITE L: MSC VAN PARKING LOT**	**28-1**
28.1	SITE BACKGROUND AND PHYSICAL SETTING	28-1
28.2	PREVIOUS INVESTIGATIONS	28-1
28.2.1	Summary of Activities and Results	28-1
28.2.2	Summary of Conclusions	28-1
28.2.3	Data Gaps	28-1
28.3	RI FIELD INVESTIGATIONS	28-1
28.4	SITE CHARACTERISTICS	28-4
28.4.1	Geology	28-4
28.4.2	Hydrogeology	28-4
28.5	NATURE AND EXTENT OF CONTAMINATION	28-5
28.5.1	Surface Soils	28-5
28.6	CONTAMINANT FATE AND TRANSPORT	28-17
28.7	BASELINE RISK ASSESSMENT	28-17
28.7.1	Risk Characterization	28-17
28.7.2	Conclusions	28-26
28.8	ECOLOGICAL RISK	28-26
28.8.1	Preliminary Problem Formulation	28-26
28.8.2	Preliminary Exposure Assessment	28-30
28.8.3	Risk Characterization	28-30
28.8.4	Summary and Conclusions	28-35
28.9	EVALUATION AND RECOMMENDATION	28-36
28.9.1	Evaluation Summary	28-36
28.9.2	Recommendations	28-36

TABLE OF CONTENTS (continued)

SECTION		PAGE
29.0	**EPIC SITE Q: FIRE FIGHTING SCHOOL**	**29-1**
29.1	SITE BACKGROUND AND PHYSICAL SETTING	29-1
28.2	PREVIOUS INVESTIGATIONS	29-1
29.2.1	Summary of Activities and Results	29-1
29.2.2	Summary of Conclusions	29-1
29.2.3	Data Gaps	29-1
29.3	RI FIELD INVESTIGATIONS	29-3
29.3.1	Hydropunch Groundwater Sampling	29-3
29.3.2	Sediment Sampling	29-6
29.3.3	Soil Boring and Sampling	29-6
29.4	SITE CHARACTERISTICS	29-6
29.4.1	Geology	29-6
29.4.2	Hydrogeology	29-7
29.5	NATURE AND EXTENT OF CONTAMINATION	29-7
29.5.1	Subsurface Soils	29-7
29.5.2	Sediment	29-12
29.6	CONTAMINANT FATE AND TRANSPORT	29-12
29.6.1	Detected Chemicals and Transport Potential	29-12
29.6.2	Contaminant Persistence	29-18
29.6.3	Observed Chemical Contaminant Trends	29-19
29.6.4	Conclusions	29-20
29.7	BASELINE RISK ASSESSMENT	29-21
29.7.1	Risk Characterization	29-21
29.7.2	Conclusions	29-31
29.8	ECOLOGICAL RISK	29-31
29.8.1	Preliminary Problem Formulation	29-31
29.8.2	Ecological Effects Assessment	29-34
29.8.3	Preliminary Exposure Assessment	29-34
29.8.4	Risk Characterization	29-34
29.8.5	Summary and Conclusions	29-36
29.9	EVALUATION AND RECOMMENDATIONS	29-36
29.9.1	Evaluation Summary	29-36
29.9.2	Recommendations	29-37
30.0	**WATERSHED SITES**	30-1
30.1	WATERSHED SAMPLING	30-1
30.1.1	Mainside	30-1
30.1.2	Waterfront	30-8
30.2	NATURE AND EXTENT OF CONTAMINATION - WATERSHED SAMPLES	30-8
30.2.1	Sediment	30-8
30.2.2	Surface Water	30-28
30.3	CONTAMINANT FATE AND TRANSPORT - WATERSHED SAMPLES	30-53
30.3.1	Detected Chemicals and Transport Potential	30-53
30.3.2	Contaminant Persistence	30-55
30.3.3	Observed Chemical Contaminant Trends	30-56
30.3.4	Conclusions	30-57
30.4	BASELINE RISK ASSESSMENT - WATERSHED SAMPLES	30-58
3.5	ECOLOGICAL RISK ASSESSMENT	30-58
30.5.1	Pine Brook Watershed Assessment	30-59
30.5.2	Shark River Watershed Assessment	30-64
30.5.3	Hockhockson Brook Watershed Assessment	30-69

TABLE OF CONTENTS (continued)

SECTION		PAGE
30.5.4	Mingamahone Brook Watershed Assessment	30-74
30.5.5	Mine Brook Watershed Assessment	30-79
30.5.6	Ware Creek Watershed Assessment	30-84
30.5.7	Wagner Creek Watershed Assessment	30-90
31.0	**BACKGROUND**	**31-1**
31.1	BACKGROUND SAMPLING	31-1
31.1.1	Background Sample Location 1	31-1
31.1.2	Background Sample Location 2	31-6
31.1.3	Background Sample Location 3	31-9
31.1.4	Background Sample Location 4	31-11
31.2	BACKGROUND WELL GEOLOGY	31-13
31.3	BACKGROUND GROUNDWATER STATISTICAL ANALYSIS	31-14
31.4	BACKGROUND SURFACE SOIL STATISTICAL ANALYSIS	31-16
31.5	BACKGROUND SUBSURFACE SOIL STATISTICAL ANALYSIS	31-16

TABLES

NUMBER		PAGE
1-1	Wetland Legend	1-6
2-1	Soil Gas Sampling Summary	2-4
2-2	Soil Borings and Subsurface Soil Sampling	2-6
2-3	Hand Auger Locations and Subsurface Soil sampling Summary	2-7
2-4	Permanent Monitoring Wells and Groundwater Sampling Summary	2-11
2-5	Hydropunch and Groundwater Sampling Summary	2-14
2-6	Surface Soil Sampling Summary	2-16
2-7	Surface Water Sampling Summary	2-17
2-8	Watershed Surface Water Sediment Sampling Summary	2-18
2-9	Sediment Sampling Summary	2-20
2-10	Summary of Physical and Chemical Data for Chemicals of Potential Concern	2-29
2-11	Dose-Response Parameters - Potential Chemicals of Concern (Organics)	2-45
2-12	EPA Weight of Evidence - Carcinogenic Classifications	2-48
2-13	ARARS - Chemicals of Potential Concern (Organics)	2-49
2-14	Exposure Input Parameters - Soil Ingestion	2-63
2-15	Exposure Input Parameters - Soil Dermal	2-65
2-16	Exposure Input Parameters - Soil Dust Inhalation	2-67
2-17	Exposure Input Parameters - Sediment Ingestion	2-69
2-18	Exposure Input Parameters - Dermal Contact with Sediment	2-70
2-19	Exposure Input Parameters - Groundwater Ingestion	2-72
2-20	Exposure Input Parameters - Dermal Contact with Groundwater	2-74
2-21	Exposure Input Parameters - Groundwater Inhalation	2-77
2-22	Exposure Input Parameters - Surface Water Ingestion	2-79
2-23	Exposure Input Parameters - Dermal Contact with Surface Water	2-80
2-24	Decision Sequence for the Amended Risk Assessment	2-92
2-25	Summary of Rejected Data	2-93
2-26	Summary of Field Quality Control Blank Results	2-98
2-27	Sediment Ecotox Threshold Values	2-104
2-28	Surface Soil Ecotox Threshold Values	2-114
2-29	Terrestrial Plant Ecotox Threshold Values	2-116
2-30	Surface Soil Ecotox Threshold Values	2-119
2-31	Terrestrial Plant Ecotox Threshold Values	2-122
2-32	ARARs - Chemicals or Potential Concern (Organics)	2-129
3-1	New Jersey Coastal Plan Geologic and Hydrogeologic Units	3-4
3-2	Site-Specific Geologic Formations	3-5
3-3	Prevalent Soils Series	3-13
3-4	Site-Specific Soils	3-14
3-5	Summary of Estimated Hydraulic Conductivities by Well	3-16
3-6	Summary of Hydraulic Conductivities by Formation	3-17
3-7	Summary of Estimated Hydraulic Conductivities by Well	3-23
3-8	Summary of Estimated Hydraulic Conductivities by Well	3-26
3-9	Summary of Estimated Conductivities by Formation	3-27
4-1	HP GW Characteristics Summary	4-5
4-2	Hydropunch Groundwater Analytical Results	4-6
4-3	Soil Boring Characteristics	4-9
4-4	Monitoring Well Characteristics	4-11
4-5	State Water-Level Measurements	4-13
4-6	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 1	4-17
4-6a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs- Site 1	4-18
4-6b	Comparison of Subsurface Soil Explosives and Miscellaneous Parameters Data to ARARs and TBCs - Site 1	4-23

TABLES (continued)

NUMBER		PAGE
4-7	Occurrence and Distribution of Inorganics in Groundwater at Site 1	4-28
4-7a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 1	4-30
4-7b	Comparison of Groundwater Explosives and Miscellaneous Parameters Data to ARARs and TBCs - Site 1	4-33
4-8	Occurrence and Distribution of Organics in Groundwater at Site 1	4-29
4-9	Representative Concentration and Statistical Distribution of COPCs - Site 1, Subsurface Soil	4-40
4-10	Representative Concentration and Statistical Distribution of COPCs - Site 1, Groundwater	4-41
4-11	Carcinogenic Risk to Future Industrial Receptors - Site 1, Subsurface Soil	4-43
4-12	Noncarcinogenic HQS, Future Industrial Receptors - Site 1, Subsurface Soil	4-44
4-13	Carcinogenic Risk to Future Industrial Receptors - Site 1, Groundwater	4-45
4-13a	Central Tendency Carcinogenic Risk to Future Industrial Receptors - Site 1, Groundwater	4-46
4-14	Noncarcinogenic HQS, Future Industrial Receptors - Site 1, Groundwater	4-47
4-15	Carcinogenic Risk to Future Residential Receptors - Site 1, Subsurface Soil	4-48
4-16	Noncarcinogenic HQS, Future Residential Receptors - Site 1, Subsurface Soil	4-49
4-17	Carcinogenic Risk to Future Residential Receptors - Site 1, Groundwater	4-50
4-17a	Central Tendency Carcinogenic Risk to Future Residential Receptor	4-51
4-18	Noncarcinogenic HQS, Future Residential Receptors - Site , Groundwater	4-52
4-18a	Central Tendency Carcinogenic Risk to Future Industrial Receptors - Site 1, Groundwater	4-53
4-19	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 1	4-57
4-19a	Summary of Central Tendency Cancer Risk and Noncarcinogenic HIs - Site 1	4-58
4-20	Surface Soil Contaminants of Potential Concern	4-61
4-21	Terrestrial Plant Contaminants of Potential Concern	4-62
5-1	Static-Water-Level Measurements	5-5
5-1a	Monitoring Well Characteristics Summary	5-6
5-2	Occurrence and Distribution of Inorganics in Surface Soil at Site 2	5-11
5-3	Occurrence and Distribution of Organics in Surface Soil at Site 2	5-12
5-2a	Comparison of Surface Soil Analytical Data to ARARs and TBCs - Site 2	5-13
5-2b	Comparison of Surface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 2	5-16
5-3	Occurrence and Distribution of Organics in Surface Soil at Site 2	5-12
5-4	Occurrence and Distribution of Inorganics in Groundwater at Site 2	5-19
5-5	Occurrence and Distribution of Organics in Groundwater at Site 2	5-20
5-4a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 2	5-21
5-4b	Comparison of Groundwater Explosives Data to ARARs and TBCs - Site 2	5-26
5-6	Representative Concentration and Statistical Distribution of COPCs - Site 2, Surface Soil	5-32
5-7	Representative Concentration and Statistical Distribution of COPCs - Site 2, Groundwater	5-33
5-8	Carcinogenic Risk to Current Industrial Receptors - Site 2, Surface Soil	5-35
5-9	Noncarcinogenic HQS, Current Industrial Receptors - Site 2, Surface Soil	5-36
5-10	Carcinogenic Risk to Future Industrial Receptors - Site 2, Groundwater	5-37
5-11	Noncarcinogenic HQS, Future Industrial Receptors - Site 2, Groundwater	5-38
5-11a	Central Tendency Noncarcinogenic HQS, Future Industrial Receptors - Site 2,	5-39
5-12	Carcinogenic Risk to Future Residential Receptors - Site 2, Surface Soil	5-41
5-13	Noncarcinogenic HQS, Future Residential Receptors - Site 2, Surface Soil	5-42
5-14	Carcinogenic Risk to Future Residential Receptors - Site 2, Groundwater	5-43
5-15	Noncarcinogenic HQS, Future Residential Receptors - Site 2, Groundwater	5-44
5-15a	Central Tendency Noncarcinogenic HQS, Future Industrial Receptors - Site 2,	5-45
5-16	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 2	5-48

TABLES (continued)

NUMBER		PAGE
5-16a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies, - Site 2,	5-49
5-17	Surface Soil Contaminants of Potential Concern Site 2	5-53
5-18	Terrestrial Plant Contaminants of Potential Concern Site 2	5-54
6-1	Soil Gas Sample Analysis Summary	6-6
6-2	Monitoring Well Characteristics Summary	6-8
6-3	Static-Water-Level Measurements Summary	6-10
6-4	Occurrence and Distribution of Inorganics in Sediment at Site 3	6-15
6-5	Occurrence and Distribution of Organics in Sediment at Site 3	6-16
6-4a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 3	6-17
6-6	Occurrence and Distribution of Inorganics in Groundwater at Site 3	6-21
6-7	Occurrence and Distribution of Organics in Groundwater at Site 3	6-22
6-6a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 3	6-23
6-8	Representative Concentration and Statistical Distribution of COPCs - Site 3, Sediment	6-29
6-9	Representative Concentration and Statistical Distribution of COPCs - Site 3, Groundwater	6-30
6-10	Carcinogenic Risk to Future Industrial Receptors - Site 3, Groundwater	6-32
6-11	Noncarcinogenic HQS, Future Industrial Receptors - Site 3, Groundwater	6-33
6-12	Carcinogenic Risk to Future Residential Receptors - Site 3, Groundwater	6-34
6-12a	Central Tendency Carcinogenic Risk to Future Residential Receptors - Site 3	6-35
6-13	Noncarcinogenic HQS, Future Residential Receptors - Site 3, Groundwater	6-36
6-13a	Central Tendency Carcinogenic Risk to Future Residential Receptors - Site 3	6-37
6-14	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 3, Sediment	6-38
6-15	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 3, Sediment	6-39
6-16	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 3	6-43
6-16a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 3	6-44
6-17	Sediment Contaminants of Potential Concern - Site 3	6-47
7-1	Hydropunch Groundwater Characteristics Summary	7-6
7-2	Landfill West of "D" Group	7-7
7-3	Monitoring Well Characteristics Summary	7-9
7-4	Static-Water-Level Measurements Summary	7-11
7-5	Occurrence and Distribution of Inorganics in Sediment at Site 4	7-15
7-6	Occurrence and Distribution of Organics in Sediment at Site 4	7-16
7-5a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 4	7-17
7-5b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site 4	7-19
7-7	Occurrence and Distribution of Inorganics in Groundwater at Site 4	7-23
7-8	Occurrence and Distribution of Organics in Groundwater at Site 4	7-24
7-7a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 4	7-25
7-7b	Comparison of Groundwater Miscellaneous Parameters Data to ARARs and TBCs - Site 4	7-27
7-9	Occurrence and Distribution of Inorganics in Surface Water at Site 4	7-30
7-10	Occurrence and Distribution of Organics in Surface Water at Site 4	7-31
7-9a	Comparison of Surface Water Analytical Data to ARARs and TBCs - Site 4	7-32
7-9b	Comparison of Surface Water Miscellaneous Parameters Data to ARARs and TBCs - Site 4	7-34
7-11	Representative Concentration and Statistical Distribution of COPCs - Site 4, Sediment	7-40
7-12	Representative Concentration and Statistical Distribution of COPCs - Site 4, Groundwater	7-41
7-13	Representative Concentration and Statistical Distribution of COPCs - Site 4, Surface Water	7-42

TABLES (continued)

NUMBER		PAGE
7-14	Carcinogenic Risk to Future Industrial Receptors - Site 4, Groundwater	7-43
7-15	Noncarcinogenic HQS, Future Industrial Receptors - Site 4, Groundwater	7-44
7-16	Carcinogenic Risk to Future Residential Receptors - Site 4, Groundwater	7-46
7-16a	Central Tendency Carcinogenic Risk to Future Residential Receptors	7-47
7-17	Noncarcinogenic HQS, Future Residential Receptors - Site 4, Groundwater	7-48
7-18	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 4, Sediment	7-50
7-19	Noncarcinogenic HQS, Future Recreational Receptors - Site 4, Sediment	7-51
7-20	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 4, Surface Water	7-52
7-21	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 4, Surface Water	7-53
7-22	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 4	7-56
7-22a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 4	7-57
7-23	Surface Water Contaminants of Potential Concern - Site 4	7-61
7-24	Sediment Contaminants of Potential Concern - Site 4	7-62
8-1	Hydropunch Groundwater Characteristics Summary	8-5
8-2	Landfill West of Army Barricades	8-6
8-3	Static-Water-Level Measurements Summary	8-7
8-3a	Monitoring Wells Characteristics Summary	8-8
8-4	Occurrence and Distribution of Inorganics in Groundwater at Site 5	8-13
8-5	Occurrence and Distribution of Organics in Groundwater at Site 5	8-14
8-4a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 5	8-15
8-4b	Comparison of Groundwater Miscellaneous Parameters Data to ARARs and TBCs - Site 5	8-20
8-6	Representative Concentration and Statistical Distribution of COPCs - Site 5, Groundwater	8-27
8-7	Carcinogenic Risk to Future Industrial Receptors - Site 5, Groundwater	8-29
8-8	Noncarcinogenic HQS, Future Industrial Receptors - Site 5, Groundwater	8-30
8-9	Carcinogenic Risk to Future Residential Receptors - Site 5, Groundwater	8-31
8-9a	Central Tendency Carcinogenic Risk to Future Residential Receptors	8-35
8-10	Noncarcinogenic HQS, Future Residential Receptors - Site 5, Groundwater	8-32
8-10a	Central Tendency Carcinogenic Risk to Future Residential Receptors	8-36
8-11	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 5	8-38
8-11a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 5	8-39
9-1	Static-Water-Level Measurements	9-5
9-1a	Monitoring Wells Characteristics Summary	9-6
9-2	Occurrence and Distribution of Inorganics in Sediment at Site 6	9-10
9-2a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 6	9-12
9-2b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site 6	9-16
9-3	Occurrence and Distribution of Organics in Sediment at Site 6	9-11
9-4	Occurrence and Distribution of Inorganics in Groundwater at Site 6	9-20
9-4a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 6	9-22
9-4b	Comparison of Groundwater Miscellaneous Parameters Data to ARARs and TBCs - Site 6	9-24
9-5	Occurrence and Distribution of Organics in Groundwater at Site 6	9-21
9-6	Occurrence and Distribution of Inorganics in Surface Water at Site 6	9-28
9-6a	Comparison of Surface Water Analytical Data to ARARs and TBCs - Site 6	9-29
9-6b	Comparison of Surface Water Miscellaneous Parameters Data to ARARs and TBCs - Site 6	
9-7	Representative Concentration and Statistical Distribution of COPCs - Site 6, Sediment	9-36
9-8	Representative Concentration and Statistical Distribution of COPCs - Site 6, Groundwater	9-37

TABLES (continued)

NUMBER		PAGE
9-9	Representative Concentration and Statistical Distribution of COPCs - Site 6, Surface Water	9-38
9-10	Carcinogenic Risk to Future Industrial Receptors - Site 6, Groundwater	9-40
9-10a	Central Noncarcinogenic HQS, Future Industrial Receptors - Site 6, Groundwater	9-41
9-11	RME Noncarcinogenic HQS, Future Industrial Receptors - Site 6, Groundwater	9-42
9-12	Carcinogenic Risk to Future Residential Receptors - Site 6, Groundwater	9-43
9-12a	Central Tendency Carcinogenic Risk to Future Industrial Receptors - Site 6	9-44
9-13	RME Noncarcinogenic HQS, Future Residential Receptors - Site 6, Groundwater	9-45
9-13a	Central Tendency Carcinogenic Risk to Future Industrial Receptors - Site 6	9-46
9-14	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 6, Sediment	9-47
9-15	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 6, Sediment	9-48
9-16	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 6, Surface Water	9-49
9-17	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 6, Surface Water	9-50
9-18	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 6	9-54
9-18a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 6	9-55
10-1	Static-Water-Level Measurements	10-5
10-1a	Monitoring Wells Characteristics	10-6
10-2	Occurrence and Distribution of Inorganics in Sediment at Site 7	10-11
10-2a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 7	10-12
10-2b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site 7	10-14
10-3	Occurrence and Distribution of Inorganics in Groundwater at Site 7	10-17
10-3a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 7	10-19
10-3b	Comparison of Groundwater Miscellaneous Parameters Data to ARARs and TBCs - Site	10-21
10-4	Occurrence and Distribution of Organics in Groundwater at Site 7	10-18
10-5	Representative Concentration and Statistical Distribution of COPCs - Site 7, Sediment	10-27
10-6	Representative Concentration and Statistical Distribution of COPCs - Site 7, Groundwater	10-28
10-7	Carcinogenic Risk to Future Industrial Receptors - Site 7, Groundwater	10-30
10-8	Noncarcinogenic HQS, Future Industrial Receptors - Site 7, Groundwater	10-31
10-9	Carcinogenic Risk to Future Residential Receptors - Site 7, Groundwater	10-32
10-10	Noncarcinogenic HQS, Future Residential Receptors - Site 7, Groundwater	10-33
10-10a	Central Tendency Noncarcinogenic HQS, Future Residential Receptors	10-34
10-11	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 7, Sediment	10-35
10-12	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 7, Sediment	10-36
10-13	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 7	10-39
10-13a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 7	10-40
10-14	Sediment Contaminants of Potential concern -Site 7	10-44
12-1	Site 10 Static-Water-Level Measurement Summary	12-5
12-1a	Monitoring Wells Characteristics	12-6
12-2	Occurrence and Distribution of Inorganics in Groundwater at Site 10	12-11
12-2a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 10	12-12
12-2b	Comparison of Groundwater Miscellaneous Parameters Data to ARARs and TBCs - Site 10	12-15
12-3	Representative Concentration and Statistical Distribution of COPCs - Site 10, Groundwater	12-20
12-4	Carcinogenic Risk to Future Industrial Receptors - Site 10, Groundwater	12-22
12-5	Noncarcinogenic HQS, Future Industrial Receptors - Site 10, Groundwater	12-23
12-6	Carcinogenic Risk to Future Residential Receptors - Site 10, Groundwater	12-24
12-7	Noncarcinogenic HQS, Future Residential Receptors - Site 10, Groundwater	12-25
12-8	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 10	12-28
13-1	Static-Water-Level Measurements	13-5
13-1a	Monitoring Wells Characteristics	13-6

TABLES (continued)

NUMBER		PAGE
13-2	Occurrence and Distribution of Inorganics in Groundwater at Site 11	13-10
13-3	Occurrence and Distribution of Organics in Groundwater at Site 11	13-11
13-2a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 11	13-12
13-4	Representative Concentration and Statistical Distribution of COPCs - Site 11, Groundwater	13-18
13-5	Carcinogenic Risk to Future Industrial Receptors - Site 11, Groundwater	13-19
13-6	Noncarcinogenic HQS, Future Industrial Receptors - Site 11, Groundwater	13-20
13-7	Carcinogenic Risk to Future Residential Receptors - Site 11, Groundwater	13-22
13-8	Noncarcinogenic HQS, Future Residential Receptors - Site 11, Groundwater	13-23
13-9	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 11	13-25
14-1	Occurrence and Distribution of Inorganics in Surface Soil at Site 12	14-6
14-2	Occurrence and Distribution of Organics in Surface Soil at Site 12	14-7
14-1a	Comparison of Surface Soil Analytical Data to ARARs and TBCs - Site 12	14-8
14-3	Occurrence and Distribution of Inorganics in Sediment at Site 12	14-13
14-3a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 12	14-15
14-4	Occurrence and Distribution of Organics in Sediment at Site 12	14-14
14-5	Representative Concentration and Statistical Distribution of COPCs - Site 12, Surface Soil	14-21
14-6	Representative Concentration and Statistical Distribution of COPCs - Site 12, Sediment	14-22
14-7	Carcinogenic Risk to Current Industrial Receptors - Site 12, Surface Soil	14-24
14-8	Noncarcinogenic HQS, Current Industrial Receptors - Site 12, Surface Soil	14-25
14-9	Carcinogenic Risk to Future Residential Receptors - Site 12, Surface Soil	14-26
14-10	Noncarcinogenic HQS, Future Residential Receptors - Site 12, Surface Soil	14-27
14-10a	Central Tendency Noncarcinogenic HQS, Future Residential Receptors - Site 12	14-28
14-11	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 12, Sediment	14-30
14-12	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 12, Sediment	14-31
14-13	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 12	14-33
14-13a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 12	14-34
14-14	Sediment Contaminants of Potential Concern - Site 12	14-37
15-1	Monitoring Well Characteristics	15-6
15-2	Static-Water-Level Measurements	15-8
15-3	Groundwater Sampling Summary	15-10
15-4	Occurrence and Distribution of Inorganics in Sediment at Site 13	15-14
15-4a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 13	15-16
15-4b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site 13	15-19
15-5	Occurrence and Distribution of Organics in Sediment at Site 13	15-15
15-6	Occurrence and Distribution of Inorganics in Groundwater at Site 13	15-23
15-6a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 13	15-25
15-6b	Comparison of Groundwater Miscellaneous Parameters Data to ARARs and TBCs - Site 13	15-30
15-7	Occurrence and Distribution of Organics in Groundwater at Site 13	15-24
15-8	Occurrence and Distribution of Inorganics in Surface Water at Site 13	15-33
15-8a	Comparison of Surface Water Analytical Data to ARARs and TBCs - Site 13	15-34
15-8b	Comparison of Surface Water Miscellaneous Parameters Data to ARARs and TBCs - Site 13	15-36
15-9	Representative Concentration and Statistical Distribution of COPCS Sediment - Site 13	15-43
15-10	Representative Concentration and Statistical Distribution of COPCs - Site 13, Groundwater	15-44
15-11	Representative Concentration and Statistical Distribution of COPCs - Site 13, Surface Water	15-45

TABLES (continued)

NUMBER		PAGE
15-12	Carcinogenic Risk to Future Industrial Receptors - Site 13, Groundwater	15-46
15-13	Noncarcinogenic HQS, Future Industrial Receptors - Site 13, Groundwater	15-48
15-13a	Central Tendency Noncarcinogenic HQS, Future Industrial Receptors - Site 13, Groundwater	15-49
15-14	Carcinogenic Risk to Future Residential Receptors - Site 13, Groundwater	15-51
15-14a	Central Tendency Carcinogenic Risk to Future Residential Receptors - Site 13, Groundwater	15-52
15-15	Noncarcinogenic HQS, Future Residential Receptors - Site 13, Groundwater	15-53
15-15a	Central Tendency Noncarcinogenic HQS, Future Residential Receptors - Site 13, Groundwater	15-55
15-16	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 13, Sediment	15-57
15-17	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 13 Sediment	15-58
15-18	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 13, Surface Water	15-59
15-19	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 13 Surface Water	15-60
15-20	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 13	15-64
15-20a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 13	15-65
15-21	Surface Water Contaminants of Potential Concern - Site 13	15-69
15-22	Sediment Contaminants of Potential Concern - Site 13	15-70
17-1	Occurrence and Distribution of Inorganics in Surface Soil at Site 15	17-6
17-1a	Comparison of Surface Soil Analytical Data to ARARs and TBCs - Site 15	17-9
17-1b	Comparison of Surface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 15	17-12
17-2	Occurrence and Distribution of Organics in Surface Soil at Site 15	17-7
17-3	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 15	17-14
17-3a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 15	17-16
17-3b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 15	17-18
17-4	Occurrence and Distribution of Organics in Subsurface Soil at Site 15	17-15
17-5	Occurrence and Distribution of Inorganics in Sediment at Site 15	17-22
17-5a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 15	17-24
17-5b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site 15	17-28
17-6	Occurrence and Distribution of Organics in Sediment at Site 15	17-23
17-7	Occurrence and Distribution of Inorganics in Surface Water at Site 15	17-32
17-7a	Comparison of Surface Water Analytical Data to ARARs and TBCs - Site 15	17-34
17-8	Occurrence and Distribution of Organics in Surface Water at Site 15	17-33
17-9	Representative Concentration and Statistical Distribution of COPCs - Site 15, Surface Soils	17-39
17-10	Representative Concentration and Statistical Distribution of COPCs - Site 15, Subsurface Soils	17-40
17-11	Representative Concentration and Statistical Distribution of COPCs - Site 15, Sediment	17-41
17-12	Representative Concentration and Statistical Distribution of COPCs - Site 15, Surface Water	17-42
17-13	Carcinogenic Risk to Current Industrial Receptors - Site 15, Surface Soil	17-44
17-14	Noncarcinogenic HQS, Current Industrial Receptors - Site 15, Surface Soil	17-45
17-15	Carcinogenic Risk to Future Industrial Receptors - Site 15, Subsurface Soil	17-47
17-16	Noncarcinogenic HQS, Future Industrial Receptors - Site 15, Subsurface Soil	17-48
17-17	Carcinogenic Risk to Future Residential Receptors - Site 15, Surface Soils	17-49
17-18	Noncarcinogenic HQS, Future Residential Receptors - Site 15, Surface Soils	17-50
17-18a	Central Tendency Noncarcinogenic HQS, Future Residential Receptors - Site 15, Surface Soils	17-52
17-19	Carcinogenic Risk to Future Residential Receptors - Site 15, Subsurface Soils	17-54

TABLES (continued)

NUMBER		PAGE
17-20	Noncarcinogenic HQS, Future Residential Receptors - Site 15, Subsurface Soils	17-55
17-20a	Central Tendency Noncarcinogenic HQS, Future Residential Receptors - Site 15, Subsurface Soils	17-57
17-21	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 15, Sediment	17-60
17-22	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 15, Sediment	17-62
17-23	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 15, Surface Water	17-62
17-24	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 15 Surface Water	17-63
17-25	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 15	17-66
17-25a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 15	17-67
17-26	Surface Water Contaminants of Potential Concern - Site 15	17-70
17-27	Sediment Contaminants of Potential Concern - Site 15	17-71
17-28	Surface Soil Contaminants of Potential Concern - Site 15	17-74
17-29	Terrestrial Plant Contaminants of Potential Concern - Site 15	17-15
18-1	Soil Gas Results	18-7
18-2	Soil Boring Characteristics Summary	18-13
18-3	Monitoring Well Characteristics Summary	18-17
18-4	Static-Water-Level Measurements	18-19
18-5	Preliminary Analytical Results Site No. 1/Roundhouse	18-21
18-6	Occurrence and Distribution of Inorganics in Surface Soil at Site 16	18-25
18-7	Occurrence and Distribution of Organics in Surface Soil at Site 16	18-26
18-6a	Comparison of Surface Soil Analytical Data to ARARs and TBCs - Site 16	18-27
18-6b	Comparison of Surface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 16	18-30
18-8	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 16	18-34
18-9	Occurrence and Distribution of Organics in Subsurface Soil at Site 16	18-35
18-8a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 1618	18-36
18-8b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 16	18-55
18-10	Occurrence and Distribution of Inorganics in Sediment at Site 16	18-61
18-11	Occurrence and Distribution of Organics in Sediment at Site 16	18-62
18-10a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 16	18-63
18-10b	Comparison of Sediment Miscellaneous\Parameters Data to ARARs and TBCs - Site 16	18-66
18-12	Occurrence and Distribution of Inorganics in Groundwater at Site 16	18-70
18-13	Occurrence and Distribution of Organics in Groundwater at Site 16	18-71
18-12a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 16	18-72
18-12b	Comparison of Groundwater Miscellaneous Parameters Data to ARARs and TBCs - Site 16	18-79
18-14	Representative Concentration and Statistical Distribution of COPCs - Site 16, Surface Soil	18-87
18-15	Representative Concentration and Statistical Distribution of COPCs - Site 16, Subsurface Soil	18-88
18-16	Representative Concentration and Statistical Distribution of COPCs - Site 16, Sediment	18-89
18-17	Representative Concentration and Statistical Distribution of COPCs - Site 16, Groundwater	18-90
18-18	Carcinogenic Risk to Current Industrial Receptors - Site 16, Surface Soil	18-92
18-19	Noncarcinogenic HQS, Current Industrial Receptors - Site 16, Surface Soil	18-93
18-20	Carcinogenic Risk to Future Industrial Receptors - Site 16, Subsurface Soil	18-94
18-21	Noncarcinogenic HQS, Future Industrial Receptors - Site 16, Subsurface Soil	18-95
18-22	Carcinogenic Risk to Future Industrial Receptors - Site 16, Groundwater	18-97
18-23	Noncarcinogenic HQS, Future Industrial Receptors - Site 16, Groundwater	18-98

TABLES (continued)

NUMBER		PAGE
18-24	Carcinogenic Risk to Future Residential Receptors - Site 16, Surface Soils	18-100
18-25	Noncarcinogenic HQS, Future Residential Receptors - Site 16, Surface Soils	18-101
18-26	Carcinogenic Risk to Future Residential Receptors - Site 16, Groundwater	18-102
18-27	Noncarcinogenic HQS, Future Residential Receptors - Site 16, Groundwater	18-103
18-28	Carcinogenic Risk to Future Residential Receptors - Site 16, Subsurface Soils	18-105
18-29	Noncarcinogenic HQS, Future Residential Receptors - Site 16, Subsurface Soils	18-106
18-30	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 16, Sediment	18-107
18-31	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 16, Sediment	18-108
18-32	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 16	18-110
18-33	Sediment Contaminants of Potential Concern - Site 16	18-114
19-1	Monitoring Well Characteristics Summary	19-6
19-2	Static-Water-Level Measurements Summary	19-8
19-3	Occurrence and Distribution of Inorganics in Surface Soil at Site 17	19-12
19-4	Occurrence and Distribution of Organics in Surface Soil at Site 17	19-13
19-3a	Comparison of Surface Soil Analytical Data to ARARs and TBCs - Site 17	19-14
19-5	Occurrence and Distribution of Inorganics in Sediment at Site 17	19-17
19-6	Occurrence and Distribution of Organics in Sediment at Site 17	19-18
19-5a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 17	19-20
19-5b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site 17	19-24
19-7	Occurrence and Distribution of Inorganics in Groundwater at Site 17	19-28
19-7a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 17	19-29
19-7b	Comparison of Groundwater Miscellaneous Parameters Data to ARARs and TBCs - Site 12	19-31
19-8	Occurrence and Distribution of Inorganics in Surface Water at Site 17	19-33
19-8a	Comparison of Surface Water Analytical Data to ARARs and TBCs - Site 17	19-357
19-8b	Comparison of Surface Water Miscellaneous Parameters Data to ARARs and TBCs - Site 17	19-37
19-9	Representative Concentration and Statistical Distribution of COPCs - Site 17, Surface Soil	19-42
19-10	Representative Concentration and Statistical Distribution of COPCs - Site 17, Sediment	19-43
19-11	Representative Concentration and Statistical Distribution of COPCs - Site 17, Groundwater	19-44
19-12	Representative Concentration and Statistical Distribution of COPCs - Site 17, Surface Water	19-45
19-13	Carcinogenic Risk to Current Industrial Receptors - Site 17, Surface Soil	19-47
19-14	Noncarcinogenic HQS, Current Industrial Receptors - Site 17, Surface Soil	19-48
19-15	Carcinogenic Risk to Future Industrial Receptors - Site 17, Groundwater	19-49
19-15a	Central Tendency Central Tendency Carcinogenic Risk to Future Residential Receptors - Site 17, Groundwater	19-50
19-16	Noncarcinogenic HQS, Future Industrial Receptors - Site 17, Groundwater	19-51
19-17	Carcinogenic Risk to Future Residential Receptors - Site 17, Surface Soils	19-53
19-18	Noncarcinogenic HQS, Future Residential Receptors - Site 17, Surface Soils	19-54
19-19	Carcinogenic Risk to Future Residential Receptors - Site 17, Groundwater	19-55
19-19a	Central Tendency Carcinogenic Risk to Future Residential Receptors - Site 17, Groundwater	19-56
19-20	Noncarcinogenic HQS, Future Residential Receptors - Site 17, Groundwater	19-57
19-20a	Central Tendency Noncarcinogenic HQs, Future Residential Receptors	19-58
19-21	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 17, Sediment	19-59
19-22	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 17, Sediment	19-60
19-23	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 17, Surface Water	19-61

TABLES (continued)

NUMBER		PAGE
19-24	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 17, Surface Water	19-62
19-25	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 17	19-66
19-25a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 17	19-67
19-26	Surface Water Contaminants of Potential Concern - Site 17	19-70
19-27	Sediment Contaminants of Potential Concern - Site	19-71
19-28	Surface Soil Contaminants of Potential Concern - Site 17	19-75
19-29	Terrestrial Plant Contaminant of Potential Concern - Site 17	19-76
20-1	Surface and Subsurface Soil Sampling Summary	20-5
20-2	Monitoring Well Characteristics	20-7
20-3	Static-Water-Level Measurements	20-9
20-4	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 19	20-13
20-5	Occurrence and Distribution of Organics in Subsurface Soil at Site 19	20-14
20-4a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 19	20-15
20-4b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 19	20-18
20-6	Occurrence and Distribution of Inorganics in Sediment at Site 19	20-20
20-7	Occurrence and Distribution of Organics in Sediment at Site 19	20-23
20-6a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 19	20-24
20-6b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site 19	20-27
20-8	Occurrence and Distribution of Inorganics in Groundwater at Site 19	20-30
20-8a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 19	20-31
20-9	Occurrence and Distribution of Inorganics in Surface Water at Site 19	20-34
20-10	Occurrence and Distribution of Organics in Surface Water at Site 19	20-35
20-9a	Comparison of Surface Water Analytical Data to ARARs and TBCs - Site 19	20-36
20-11	Representative Concentration and Statistical Distribution of COPCs - Site 19, Subsurface Soil	20-42
20-12	Representative Concentration and Statistical Distribution of COPCs - Site 19, Sediment	20-43
20-13	Representative Concentration and Statistical Distribution of COPCs - Site 19, Groundwater	20-44
20-14	Representative Concentration and Statistical Distribution of COPCs - Site 19, Surface Water	20-45
20-15	Carcinogenic Risk to Future Industrial Receptors - Site 19, Subsurface Soils	20-48
20-16	Noncarcinogenic HQS, Future Industrial Receptors - Site 19, Subsurface Soils	20-49
20-17	Carcinogenic Risk to Future Industrial Receptors - Site 19, Groundwater	20-50
20-18	Noncarcinogenic HQS, Future Industrial Receptors - Site 19, Groundwater	20-51
20-18a	Central Tendency Noncarcinogenic HQs, Future Industrial Receptors	20-52
20-19	Carcinogenic Risk to Future Residential Receptors - Site 19, Subsurface Soils	20-53
20-20	Noncarcinogenic HQS, Future Residential Receptors - Site 19, Subsurface Soils	20-54
20-21	Carcinogenic Risk to Future Residential Receptors - Site 19, Groundwater	20-55
2-21a	Central Tendency Carcinogenic Risk to Future Residential	20-56
20-22	Noncarcinogenic HQS, Future Residential Receptors - Site 19, Groundwater	20-57
20-22a	Central Tendency Noncarcinogenic HQs Future Residential Receptors	20-59
20-23	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 19, Sediment	20-63
20-24	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 19, Sediment	20-64
20-25	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 19, Surface Water	20-65

TABLES (continued)

NUMBER		PAGE
20-26	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 19, Surface Water	20-66
20-27	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 19	20-70
20-27a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 1	20-71
20-28	Sediment containments of Potential Concern	20-75
21-1	Surface Soil Sampling Summary	21-6
21-2	Occurrence and Distribution of Inorganics in Surface Soil at Site 20	21-9
21-2a	Comparison of Surface Soil Analytical Data to ARARs and TBCs - Site 20	21-10
21-3	Occurrence and Distribution of Organics in Surface Soil at Site 20	21-10
21-2b	Comparison of Surface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 20	21-13
21-4	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 20	21-15
21-5	Occurrence and Distribution of Organics in Subsurface Soil at Site 20	21-16
21-4a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 20	21-17
21-6	Occurrence and Distribution of Inorganics in Sediment at Site 20	21-19
21-7	Occurrence and Distribution of Organics in Sediment at Site 20	21-20
21-6a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 20	21-21
21-6b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site 20	21-24
21-8	Representative Concentration and Statistical Distribution of COPCs - Site 20, Surface Soil	21-31
21-9	Representative Concentration and Statistical Distribution of COPCs - Site 20, Subsurface Soil	21-32
21-10	Representative Concentration and Statistical Distribution of COPCs - Site 20, Sediment	21-33
21-11	Carcinogenic Risk to Current Industrial Receptors - Site 20, Surface Soil	21-35
21-12	Noncarcinogenic HQS, Current Industrial Receptors - Site 20, Surface Soil	21-36
21-13	Carcinogenic Risk to Future Industrial Receptors - Site 20, Subsurface Soil	21-37
21-14	Noncarcinogenic HQS, Future Industrial Receptors - Site 20, Subsurface Soil	21-38
21-15	Carcinogenic Risk to Future Residential Receptors - Site 20, Surface Soil	21-39
21-16	Noncarcinogenic Risk to Future Residential Receptors - Site 20, Surface Soil	21-40
21-17	Carcinogenic Risk to Future Residential Receptors - Site 20, Subsurface Soil	21-43
21-18	Noncarcinogenic HQs Risk to Future Residential Receptors - Site 20, Subsurface Soil	21-44
21-19	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 20, Sediment	21-45
21-20	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 20, Sediment	21-46
21-21	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 20	21-49
22-1	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 22	22-5
22-2	Occurrence and Distribution of Organics in Subsurface Soil at Site 22	22-6
22-1a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 22	22-7
22-3	Occurrence and Distribution of Inorganics in Sediment at Site 22	22-14
22-4	Occurrence and Distribution of Organics in Sediment at Site 22	22-15
22-3a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 22	22-16
22-5	Representative Concentration and Statistical Distribution of COPCs - Site 22, Subsurface Soil	22-23
22-6	Representative Concentration and Statistical Distribution of COPCs - Site 22, Sediment	22-24
22-7	Carcinogenic Risk to Future Industrial Receptors - Site 22, Subsurface Soil	22-26
22-8	Noncarcinogenic HQs, Future Industrial Receptors - Site 22, Subsurface Soil	22-27
22-9	Carcinogenic Risk to Future Residential Receptors - Site 22, Subsurface Soil	22-28
22-9a	Central Tendency Carcinogenic Risk to Future Residential Receptors - Site 22	22-29
22-10	Noncarcinogenic HQs, Future Residential Receptors - Site 22, Subsurface Soil	22-30
22-11	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 22, Sediment	22-31

TABLES (continued)

NUMBER		PAGE
22-12	Noncarcinogenic Risk, Wading, Future Recreational Receptors - Site 22, Sediment	22-32
22-13	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 22	22-36
22-13a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies - Site 22	22-37
22-14	Sediment Contaminants of Potential Concern	22-40
22-15	Surface Soil Contaminants of Potential Concern	22-42
23-1	Soil Boring Characteristics Summary	23-6
23-2	Monitoring Well Characteristics Summary	23-7
23-3	Static-Water-Level Measurements Summary	23-9
23-4	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 23	23-15
23-5	Occurrence and Distribution of Organics in Subsurface Soil at Site 23	23-16
23-4a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 23	23-17
23-4b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 23	23-22
23-6	Occurrence and Distribution of Inorganics in Sediment at Site 23	23-27
23-7	Occurrence and Distribution of Organics in Sediment at Site 23	23-28
23-6a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site 23	23-29
23-8	Occurrence and Distribution of Inorganics in Groundwater at Site 23	23-33
23-9	Occurrence and Distribution of Organics in Groundwater at Site 23	23-34
23-8a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 23	23-35
23-10	Occurrence and Distribution of Inorganics in Surface Water at Site 23	23-38
23-11	Occurrence and Distribution of Organics in Surface Water at Site 23	23-39
23-10a	Comparison of Surface Water Analytical Data to ARARs and TBCs - Site 23	23-40
23-12	Representative Concentration and Statistical Distribution of COPCs - Site 23, Subsurface Soil	23-46
23-13	Representative Concentration and Statistical Distribution of COPCs - Site 23,	23-47
	Sediment	23-41
23-14	Representative Concentration and Statistical Distribution of COPCs - Site 23,	23-48
	Groundwater	23-42
23-15	Representative Concentration and Statistical Distribution of COPCs - Site 23, Surface Water	23-49
23-16	Carcinogenic Risk to Future Industrial Receptors - Site 23, Subsurface Soil	23-50
23-61a	Central Tendency Carcinogenic Risk to Future Industrial Receptors	23-51
23-17	Noncarcinogenic HQS, Future Industrial Receptors - Site 23, Subsurface Soil	23-52
23-18	Carcinogenic Risk to Future Industrial Receptors - Site 23, Groundwater	23-54
23-18a	Central Tendency Carcinogenic Risk to Future Industrial Receptors	23-55
23-19	Noncarcinogenic HQS, Future Industrial Receptors - Site 23, Groundwater	23-56
23-19a	Central Tendency Noncarcinogenic HQS, Future Industrial Receptors - Site	23-57
23-20	Carcinogenic Risk to Future Residential Receptors - Site 23, Subsurface Soil	23-58
23-20a	Central Tendency Carcinogenic Risk to Future Industrial Receptors	23-59
23-21	Noncarcinogenic HQS, Future Residential Receptors - Site 23, Subsurface Soil	23-60
23-21a	Central Tendency Noncarcinogenic HQS, Future Industrial Receptors - Site	23-61
23-22	Carcinogenic Risk to Future Residential Receptors - Site 23, Groundwater	23-62
23-22a	Central Tendency Carcinogenic Risk to Future Industrial Receptors	23-63
23-23	Noncarcinogenic HQS, Future Residential Receptors - Site 23, Groundwater	23-64
23-23a	Central Tendency Noncarcinogenic HQS, Future Industrial Receptors - Site	23-66
23-24	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 23, Sediment	23-68
23-25	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 23, Sediment	23-69
23-26	Carcinogenic Risk, Wading, Future Recreational Receptors - Site 23, Surface Water	23-70
23-27	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site 23, Surface Water	23-71
23-28	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 23	23-77
23-28a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies	23-78

TABLES (continued)

NUMBER		PAGE
23-29	Surface Water Contaminants of Potential Concern - Site 23	23-81
23-30	Sediment Contaminants of Potential Concern - site 23	23-82
24-1	Sites 24 and 25 Slug Cont Summary	24-4
24-2	Sites 24 and 25 Subsurface Soil Sampling Summary	24-5
24-2a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 24	24-8
24-2b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 24	
24-3	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 24	24-7
24-3a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 24	24-8
24-3b	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 24	24-10
24-4	Occurrence and Distribution of Organics in Subsurface Soil at Site 24	24-13
24-4a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 25	24-14
24-4b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 25	24-16
24-5	Representative Concentration and Statistical Distribution of COPCs - Site 24, Subsurface Soil	24-20
24-6	Representative Concentration and Statistical Distribution of COPCs - Site 25, Subsurface Soil	24-21
24-7	Carcinogenic Risk to Future Industrial Receptors - Site 24, Subsurface Soil	24-22
24-8	Noncarcinogenic HQS, Future Industrial Receptors - Site 24, Subsurface Soil	24-23
24-9	Carcinogenic Risk to Future Residential Receptors - Site 24, Subsurface Soil	24-25
24-10	Noncarcinogenic HQS, Future Residential Receptors - Site 24, Subsurface Soil	24-26
24-11	Carcinogenic Risk to Future Industrial Receptors - Site 25, Subsurface Soil	24-27
24-12	Noncarcinogenic HQS, Future Industrial Receptors - Site 25, Subsurface Soil	24-28
24-13	Carcinogenic Risk to Future Residential Receptors - Site 25, Subsurface Soil	24-30
24-14	Noncarcinogenic HQS, Future Residential Receptors - Site 25, Subsurface Soil	24-31
24-15	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 24	24-33
24-16	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 25	24-34
25-1	Soil Gas Results Explosive "D" Washout Area	25-6
25-2	Soil Boring Characteristics	25-8
25-3	Monitoring Well Characteristics	25-11
25-4	Static-Water-Level Measurements	25-12
25-5	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 26	25-16
25-6	Occurrence and Distribution of Organics in Groundwater at Site 26	25-17
25-5a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 26	25-19
25-5b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 26	25-22
25-7	Occurrence and Distribution of Inorganics in Groundwater at Site 26	25-26
25-8	Occurrence and Distribution of Organics in Groundwater at Site 26	25-27
25-7a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 26	25-28
25-9	Representative Concentration and Statistical Distribution of COPCs - Site 26, Subsurface Soil	25-33
25-10	Representative Concentration and Statistical Distribution of COPCs - Site 26, Groundwater	25-34
25-11	Carcinogenic Risk to Future Industrial Receptors - Site 26, Subsurface Soil	25-37
25-12	Noncarcinogenic HQS, Future Industrial Receptors - Site 26, Subsurface Soil	25-38
25-13	Carcinogenic Risk to Future Industrial Receptors - Site 26, Groundwater	25-39
25-14	Noncarcinogenic HQS, Future Industrial Receptors - Site 26, Groundwater	25-40
25-14a	Central Tendency Noncarcinogenic HWQs, Future Industrial Receptor - Site 26	25-41
25-15	Carcinogenic Risk to Future Residential Receptors - Site 26, Subsurface Soil	25-42

TABLES (continued)

NUMBER		PAGE
25-15a	Central Tendency Carcinogenic Risk to Future Residential Receptor	25-43
25-16	Noncarcinogenic HQS, Future Residential Receptors - Site 26, Subsurface Soil	25-44
25-17	Carcinogenic Risk to Future Residential Receptors - Site 26, Groundwater	25-45
25-17a	Central Tendency Carcinogenic Risk to Future Residential Receptor	25-46
25-18	Noncarcinogenic HQS, Future Residential Receptors - Site 26, Groundwater	25-47
25-18a	Central Tendency Noncarcinogenic HWQs, Future Industrial Receptor - Site 26	25-49
25-19	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 26	25-55
25-19a	Summary of Central Tendency Carcinogenic Risk to Future Residential Receptor	25-56
26-1	Occurrence and Distribution of Inorganics in Subsurface Soil at Site 27	26-6
26-2	Occurrence and Distribution of Organics in Groundwater at Site 27	26-7
26-1a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 27	26-8
26-1b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 27	26-13
26-3	Representative Concentration and Statistical Distribution of COPCs - Site 27, Subsurface Soil	26-20
26-4	Carcinogenic Risk to Future Industrial Receptors - Site 27, Subsurface Soil	26-22
26-5	Noncarcinogenic HQS, Future Industrial Receptors - Site 27, Subsurface Soil	26-23
26-6	Carcinogenic Risk to Future Residential Receptors - Site 27, Subsurface Soil	26-25
24-6a	Central Tendency Carcinogenic Risk to Future Residential Receptors	26-26
26-7	Noncarcinogenic HQS, Future Residential Receptors - Site 27, Subsurface Soil	26-27
26-8	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site 27	26-29
26-8a	Central Tendency Carcinogenic Risk to Future Residential Receptors	26-30
27-1	Soil Boring Characteristics Summary	27-5
27-2	Monitoring Well Characteristics Summary	27-7
27-3	Static-Water-Level Measurements Summary	27-8
27-4	Occurrence and Distribution of Organics in Subsurface Soil at Site 29	27-11
27-4a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site 29	27-12
27-4b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site 29	27-14
27-5	Occurrence and Distribution of Inorganics in Groundwater at Site 29	27-17
27-6	Occurrence and Distribution of Organics in Groundwater at Site 29	27-18
27-5a	Comparison of Groundwater Analytical Data to ARARs and TBCs - Site 29	27-19
27-7	Representative Concentration and Statistical Distribution of COPCs - Site 29, Subsurface Soil	27-25
27-8	Representative Concentration and Statistical Distribution of COPCs - Site 29, Groundwater	27-26
27-9	Carcinogenic Risk to Future Industrial Receptors - Site 29, Subsurface Soil	27-28
27-10	Noncarcinogenic HQS, Future Industrial Receptors - Site 29, Subsurface Soil	27-29
27-11	Carcinogenic Risk to Future Industrial Receptors - Site 29, Groundwater	27-30
27-12	Noncarcinogenic HQS, Future Industrial Receptors - Site 29, Groundwater	27-31
27-12a	Central Tendency Noncarcinogenic HQs, Future Industrial Receptors - Site 29	27-32
27-13	Carcinogenic Risk to Future Residential Receptors - Site 29, Subsurface Soil	27-33
27-14	Noncarcinogenic HQS, Future Residential Receptors - Site 29, Subsurface Soil	27-34
27-15	Carcinogenic Risk to Future Residential Receptors - Site 29, Groundwater	27-36
27-16	Noncarcinogenic HQS, Future Residential Receptors - Site 29, Groundwater	27-37
27-16a	Central Tendency Noncarcinogenic HQs, Future Residential Receptors - Site 29	27-38
27-17	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies	27-41
28-1	Sampling Locations and Rationale	28-3
28-2	Occurrence and Distribution of Inorganics in Surface Soil at Site L	28-6
28-3	Occurrence and Distribution of Organics in Surface Soil at Site L	28-7
28-2a	Comparison of Surface Soil Analytical Data to ARARs and TBCs - Site L	28-8

TABLES (continued)

NUMBER		PAGE
28-2b	Comparison of Surface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site L	28-15
28-4	Representative Concentration and Statistical Distribution of COPCs - Site L, Surface Soil	28-18
28-5	Carcinogenic Risk to Current Industrial Receptors - Site L, Surface Soil	28-20
28-6	Noncarcinogenic HQS, Current Industrial Receptors - Site L, Surface Soil	28-21
28-7	Carcinogenic Risk to Future Industrial Receptors - Site L, Surface Soil	28-22
28-8	Noncarcinogenic HQS, Future Industrial Receptors - Site L, Surface Soil	28-23
28-7a	Central Tendency Carcinogenic Risk To Future Residential Receptors - Site L	28-25
28-9	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site L	28-27
28-9a	Summary of Central Tendency Cancer Risks and Noncarcinogenic Hazard Indicies Site L	28-28
28-10	Surface Soil Contaminants of Potential Concern - EPIC Site L	28-31
28-11	Terrestrial Plan Contaminant of Potential Concern - EPIC Site L	28-34
29-1	Site Q Hydropunch Characteristic Summary	29-4
29-2	Hydropunch Groundwater Analysis Results	29-5
29-3	Occurrence and Distribution of Organics in Subsurface Soil at Site Q	29-8
29-3a	Comparison of Subsurface Soil Analytical Data to ARARs and TBCs - Site Q	29-9
29-3b	Comparison of Subsurface Soil Miscellaneous Parameters Data to ARARs and TBCs - Site Q	29-10
29-4	Occurrence and Distribution of Organics in Sediment at Site Q	29-13
29-4a	Comparison of Sediment Analytical Data to ARARs and TBCs - Site Q	29-14
29-4b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Site Q	29-16
29-5	Representative Concentration and Statistical Distribution of COPCs - Site Q, Subsurface Soil	29-22
29-6	Representative Concentration and Statistical Distribution of COPCs - Site Q, Sediment	29-23
29-7	Carcinogenic Risk to Future Industrial Receptors - Site Q, Subsurface Soil	29-25
29-8	Noncarcinogenic HQS, Future Industrial Receptors - Site Q, Subsurface Soil	29-26
29-9	Carcinogenic Risk to Future Residential Receptors - Site Q, Subsurface Soil	29-27
29-10	Noncarcinogenic HQS, Future Residential Receptors - Site Q, Subsurface Soil	29-28
29-11	Carcinogenic Risk, Wading, Future Recreational Receptors - Site Q, Sediment	29-29
29-12	Noncarcinogenic HQS, Wading, Future Recreational Receptors - Site Q, Sediment	29-30
29-13	Summary of Estimated Cancer Risks and Noncarcinogenic Hazard Indicies - Site Q	29-32
29-14	Sediment Contaminants of Potential Concern - EPIC Site Q	29-35
30-1	Watershed Surface Water and Sediment Sampling	30-4
30-2	Occurrence and Distribution of Inorganics in Watershed Samples (Sediment)	30-9
30-3	Occurrence and Distribution of Organics in Watershed Samples (Sediment)	30-10
30-2a	Comparison of Sediment Analytical Data to ARARs and TBCs - Watershed Area	30-11
30-2b	Comparison of Sediment Miscellaneous Parameters Data to ARARs and TBCs - Watershed Area	30-21
30-4	Occurrence and Distribution of Inorganics in Watershed Samples (Surface Water)	30-29
30-5	Occurrence and Distribution of Organics in Watershed Samples (Surface Water)	30-30
30-4a	Comparison of Surface Water Analytical Data to ARARs and TBCs - Watershed Area	30-32
30-4b	Comparison of Surface Water Explosives and Miscellaneous Parameters Data to ARARS and TBCs - Watershed Area	30-45
30-6	Surface Water Contaminants of Potential Concern - Pine Brook Watershed	30-62
30-7	Sediment Contaminants of Potential Concern - Pine Brook Watershed	30-63
30-8	Surface Water Contaminants of Potential Concern - Shark River Watershed	30-67

TABLES (continued)

NUMBER		PAGE
30-9	Sediment Contaminants of Potential Concern - Shark River Watershed	30-68
30-10	Surface Water Contaminants of Potential Concern - Hockhockson Brook Watershed	30-72
30-11	Sediment Contaminants of Potential Concern - Hockhockson Brook Watershed	30-73
30-12	Surface Water Contaminants of Potential Concern - Mingamahone Brook Watershed	30-77
30-13	Sediment Contaminants of Potential Concern - Mingamahone Brook Watershed	30-78
30-14	Sediment Contaminants of Potential Concern - Mine Brook Watershed	30-82
30-15	Sediment Contaminants of Potential Concern - Mine Brook Watershed	30-83
30-16	Surface Water Contaminants of Potential Concern - Ware Creek Watershed	30-88
30-17	Sediment Contaminants of Potential Concern - Ware Brook Watershed	30-89
30-18	Surface Water Contaminants of Potential Concern - Ware Creek Watershed	30-93
30-19	Sediment Contaminants of Potential Concern - Wagner Creek Watershed	30-94
31-1	Background Monitoring Well Characteristics Summary	31-3
31-2	Background Static-Water-Level Measurement Summary	31-5
31-3	Background Wells and Upgradient Wells Grouped by Interpreted Aquifer	31-15
31-4	Statistical Evaluation of Background Groundwater Metals Data - Cohansey Sand, Kirkwood, and Vincentown Formations	31-17
31-5	Statistical Evaluation of Background Groundwater Metals Data - Red Bank and Navesink Formation	31-18
31-6	Statistical Evaluation of Background Groundwater Metals Data - Fill and Englishtown Formation	31-19
31-7	Statistical Evaluation of Background Surface Soil Metals Data - CTO 231	31-20
31-8	Statistical Evaluation of Background Surface Soil Metals Data - CTO 231	31-21

FIGURES

NUMBER		PAGE
1-1	Mainside Site Locations	1-3
1-2	Waterfront Site Locations	1-4
2-1	Conceptual Model NWS Earle	2-56
2-2	Steps in the Ecological Risk Assessment Process	2-108
2-3	Conceptual Site Model	2-113
3-1	Surficial Deposits in Mainside Area	3-6
3-2	Geologic Map for the Mainside Facility	3-8
3-3	Geologic Map for the Waterfront and Chapel Hill Area	3-9
3-4	Generalized Hydrogeologic Cross-Section for the Mainside Area	3-20
3-5	Generalized Hydrogeologic Cross-Section for the Waterfront Area	3-21
3-6	Public Non Community Wells within 1 Mile of N.W.S. Earle	3-28
3-7	Domestic Wells within 1 Mile of N.W.S. Earle	3-29
4-1	Sample Locations Site 1	4-2
4-2	Groundwater Contour Map August 7, 1995 Site 1	4-15
4-3	Groundwater Contour Map October 17, 1995 Site 1	4-16
4-4	Concentrations Above Screening Levels Site 1	4-27
5-1	Sample Locations Site 2	5-2
5-2	Groundwater Contour Map August 7, 1995 Site 2	5-8
5-3	Groundwater Contour Map October 17, 1995 Site 2	5-9
5-4	Concentrations Above Screening Levels Site 1	5-18
6-1	Sample Locations Site 3	6-2
6-2	Soil Gas and Test Pit Locations	6-5
6-3	Groundwater Contour Map August 7, 1995 Site 3	6-12
6-4	Groundwater Contour Map October 17, 1995 Site 3	6-13
6-5	Concentrations Above Screening Levels Sites	6-20
7-1	Sample Locations Site 4	7-2
7-2	Groundwater Contour August 7, 1995 Site 4	7-13
7-3	Groundwater Contours October 17, 1995 Site 4	7-14
7-4	Concentrations Above Screening Levels Site 4	7-21
8-1	Sample Locations Site 5	8-2
8-2	Groundwater Contour Map August 7, 1995 Site 5	8-11
8-3	Groundwater Contour Map October 17, 1995 Site 5	8-12
8-4	Concentrations Above Screening Levels Site 5	8-23
9-1	Sample Locations Site 6	9-2
9-2	Groundwater Contour Map August 7, 1995 Site 6	9-8
9-3	Groundwater Contour Map October 17, 1995 Site 6	9-9
9-4	Concentrations Above Surface Water and Sediment Screening Levels Site 6	9-18
9-5	Concentrations Above Groundwater Screening Levels Site 10	9-26
10-1	Sample Locations - Site 7	10-2
10-2	Groundwater Contour Map August 7, 1995 Site 7	10-8
10-3	Groundwater Contour Map October 17, 1995 Site 7	10-9
10-4	Concentrations Above Screening Levels Site 7	10-16
11-1	Sample Locations Site 9	11-2
12-1	Sample Locations Site 10	12-2
12-2	Groundwater Contour Map August 7, 1995 Site 10	12-8
12-3	Groundwater Contour Map October 17, 1995 Site 10	12-9
12-4	Concentrations Above Screening Levels Site 10	12-17
13-1	Sample Locations Site 11	13-2
13-2	Groundwater Contour Map August 7, 1995 Site 11	13-8
13-3	Groundwater Contour Map October 17, 1995 Site 11	13-9

FIGURES (continued)

NUMBER		PAGE
13-4	Concentrations Above Screening Levels Site 11	13-14
14-1	Sample Locations Site 12	14-2
14-2	Concentrations Above Screening Levels Site 12	14-11
15-1	Sample Locations Site 13	15-2
15-2	Groundwater Contour Map August 7, 1995 Site 13	15-12
15-3	Groundwater Contour Map October 17, 1995 Site 13	15-13
15-4	Concentrations Above Screening Levels Site 13	15-21
16-1	Sample Locations Site 14	16-2
17-1	Sample Locations Site 15	17-2
17-2	Concentrations Above Subsurface and Surface Soils Screening Levels Site 15	17-20
17-3	Concentrations Above Surface Water and Sediment Screening Levels Site 15	17-30
18-1	Sample Locations Site 16	18-2
18-2	Soil Gas Sample Points and ID Bumper	18-5
18-2a	Soil Gas Sample Locations and Results	18-6
18-3	Groundwater Contour Map August 7, 1995 Site 16	18-22
18-4	Groundwater Contour Map October 17, 1995 Site 16	18-23
18-5	Concentrations Above Surface Soil and Sediment Screening Levels Site 16	18-31
18-6	Concentrations Above Subsurface Soil Screening Levels Site 16	18-58
18-7	Concentrations Above Sediment Screening Levels Site 16	18-68
18-8	Concentrations Above Groundwater Screening Levels Site 16	18-81
19-1	Sample Locations Site 17	19-2
19-2	Groundwater Contour Map August 7, 1995 Site 17	19-10
19-3	Groundwater Contour Map October 17, 1995 Site 17	19-11
19-4	Concentrations Above Screening Levels Site 17	19-16
20-1	Sample Locations Site 19	20-2
20-2	Groundwater Contour Map August 7, 1995 Site 19	20-11
20-3	Groundwater Contour Map October 17, 1995 Site 19	20-12
20-4	Concentrations Above Screening Levels Site 19	20-18
20-5	Lead Distribution in Site 19	20-67
21-1	Sample Locations Site 20	21-2
21-2	Concentrations Above Screening Levels Site 19	21-5
22-1	Sample Locations Site 22	22-2
22-2	Concentrations Above Screening Levels Site 20	22-12
22-14	Sediment Contaminants of Potential Concern -Site 22	22-40
22-15	Surface Soil Contaminants of Potential Concern -Site 22	22-42
23-1	Sample Locations Site 23	23-2
23-2	Groundwater Contour Map August 7, 1995 Sites 23	23-11
23-3	Groundwater Contour Map October 17, 1995 Sites 23	23-13
23-4	Concentrations Above Screening Levels Site 23	23-25
24-1	Sample Locations Sites 24/25	24-2
25-1	Sample Location Site 26	25-2
25-2	Soil Gas Sample Locations Site 26	25-5
25-3	Groundwater Contour Map August 7, 1995 Site 26	25-14
25-4	Groundwater Contour Map October 17, 1995 Site 26	25-15
25-5	Concentrations Above Screening Levels Site 26	25-25
26-1	Sample Locations Site 27	26-3
26-2	Concentrations Above Screening Levels Site 27	26-16
27-1	Sample Locations Site 29	27-2
27-2	Concentrations Above Screening Levels Site 29	27-16
28-1	Sample Locations Epic Site L	28-2

FIGURES (continued)

NUMBER		PAGE
28-2	Concentrations Above Screening Levels Site L	28-16
29-1	Sample Locations Epic Site Q	29-2
29-2	Concentrations Above Screening Levels Epic Site Q	29-11
30-1	Mainside Wetlands and Drainage Basins Map	30-2
30-2	Waterfront Background Sample Locations	30-3
30-3	Concentrations Above Screening Levels Chapel Hill Area	30-25
30-4	Concentrations Above Screening Levels Mainside Facility	30-26

18.0 SITE 16: SITE 16 AND EPIC SITE F

18.1 SITE BACKGROUND AND PHYSICAL SETTING

Site 16 and EPIC Site F are discussed as one site due to the relative proximity and overlap of the two sites. The 8-acre combined site consists of a heavy equipment storage yard and two railroad car storage yards that have been active since the late 1940s. Figure 18-1 is a map of the combined site. Groundwater generally flows to the north-northeast based on groundwater-level measurements.

Site 16 is located north of Building C-19, the forklift maintenance and repair shop. EPIC Site F includes two former diesel tank areas around Building C-50, an oil-water separator and leach field east of Building C-50, an oil-stained portion of tracks north of Building C-50, a drainage ditch northeast of Building C-50, and a locomotive wash area and leach field north of Building C-19. Building C-50 is known as the Roundhouse and is used for maintenance and repair of locomotives and rail cars. Investigations at these areas have been concerned with petroleum hydrocarbon contamination of soil, groundwater, surface water, and sediment.

An underground fuel line was used to transport diesel fuel from an UST located at the northeastern corner of Building C-18 to a dispensing station approximately 100 feet north of Building C-50. A leak in the fuel line was discovered in 1977, and use of the pipeline was discontinued after the leak was discovered and excavated. Part or all of the former underground diesel transfer line is still in place. This portion of the site was investigated during the 1992 SI field activities.

Waste oils from locomotive maintenance were stored in a holding tank at the southeastern side of Building C-50. This tank was removed under the UST program. Water from locomotive steam cleaning operations in the past may have discharged to sewer drains and to an oil-water separator near Building C-50. Water discharge from this oil-water separator was reportedly sent to a drainage ditch along the western side of the railroad tracks. No evidence of a suspected leach field, thought to be present near the oil-water separator, has been found. In 1989, the oil-water separator failed and the ditch on the side of Building C-50 was excavated. Excavated material was disposed as hazardous waste. In the south-west corner, inside of Building C-50, there was a locomotive engine cleaning tank (vat). The vat was approximately 10 feet by 16 feet and was 6 feet deep. The vat was used for soaking locomotive engines, and potentially other oversize parts. An unknown solvent was used in the vat for cleaning. The spent solvent was directed to a leach field via two holding tanks located west of the southwest corner of Building C-50. The operation was discontinued several years ago and the holding tanks and vat were cleaned. The vat was filled with concrete and the holding tanks and associated leach field were left in place.

The center of the railroad tracks north of Building C-50 is stained with thick oil, possibly from leaky locomotives awaiting maintenance.

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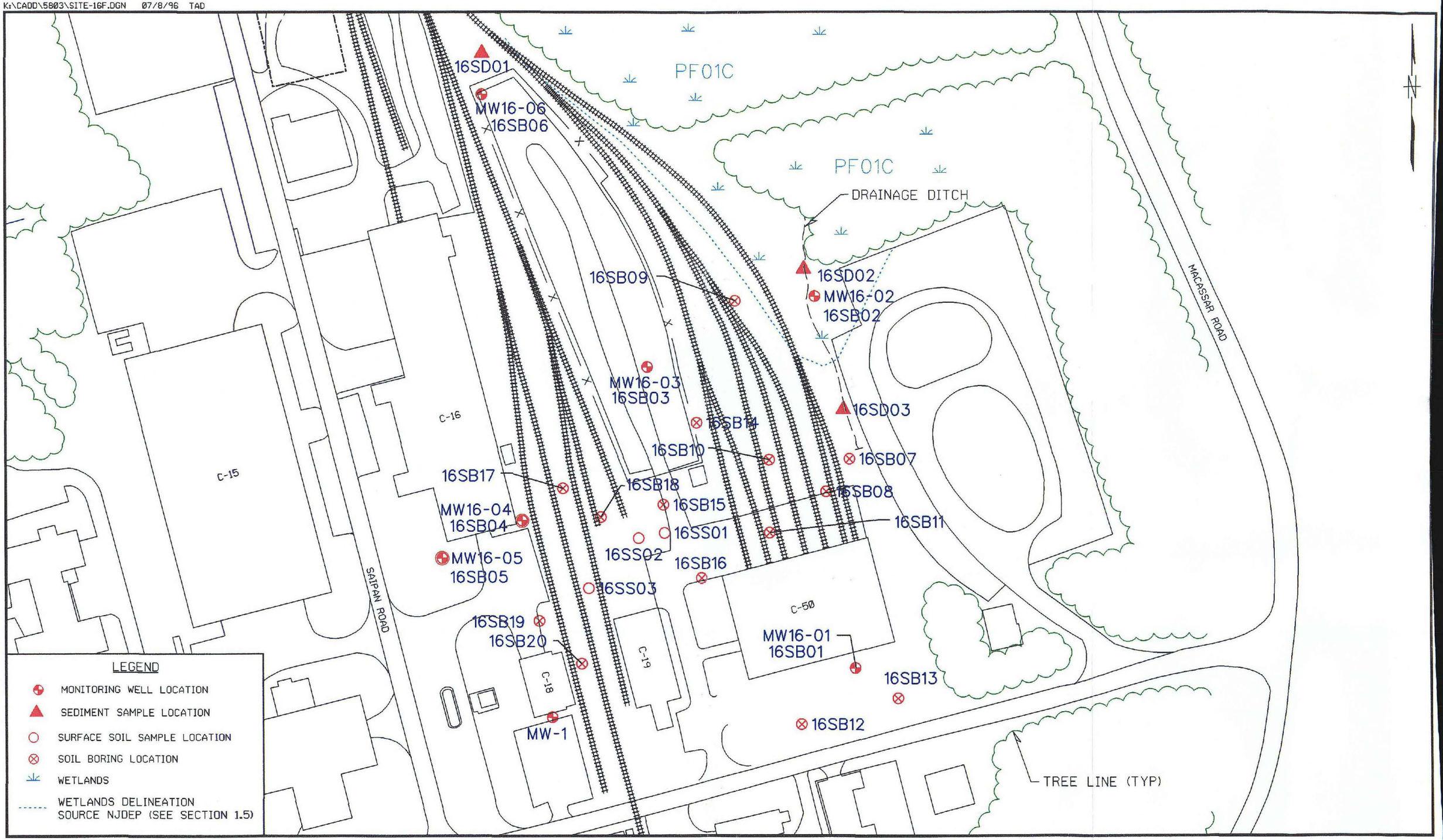

SAMPLE LOCATIONS
SITE 16 AND EPIC SITE F

0 100 200
SCALE IN FEET

FIGURE 18-1

Brown & Root Environmental

Building C-19 is used as a forklift maintenance and repair facility behind which batteries may have been stored. The railroad yard west of Building C-19 is used for rail car and heavy equipment storage.

18.2 PREVIOUS INVESTIGATIONS

18.2.1 Summary of Activities and Results

The 1983 IAS consisting of interviews, concluded minimal impact because the leak was discovered quickly and the amount of fuel lost was estimated to be minimal (less than 50 gallons). The site was not recommended for confirmation study.

The PA Addendum in 1992, consisting of interviews and aerial photo analysis, indicated that the site has been an active rail yard for many years.

As part of the 1992 SI field activities, five soil borings were completed in the area north of Building C-18, the reported location of the underground fuel-line leak. Each soil boring was completed to the water table, and one sample was collected approximately 8 feet bgs, below the level of the fuel pipeline and above the water table. All soil samples contained elevated levels of TPH ranging from 4,700 mg/kg to 22,000 mg/kg. Low levels of semivolatiles were also detected. A geophysical survey of the area during the SI indicated a number of buried lines at the site; however, the exact location of the leaking fuel line was not determined.

18.2.2 Summary of Conclusions

Hydrocarbon contamination was found in all of the subsurface soil samples. No conclusion was reached regarding the extent of impact. Review of site drawings identified a tile drainage field which served building C-50.

18.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations, follow-up remedial investigation activities were developed to meet the following objectives:

- Determine areal extent of soil contamination.
- Identify any other source areas.
- Compare data to background levels and risk based criteria.

- Determine whether wetlands, surface water or groundwater has been impacted.

18.3 RI FIELD INVESTIGATIONS

Between June and October 1995, B&R Environmental conducted the following field investigation activities at Site 16/F:

- Soil gas survey and analysis at 96 locations (Section 18.3.1)
- Sampling and analysis of subsurface soil samples from 20 soil borings (Section 18.3.2)
- Sampling and analysis of surface soil (Section 18.3.3)
- Sampling and analysis of sediment (Section 18.3.4)
- Drilling and installation of six shallow permanent monitoring wells (Section 18.3.5)
- Sampling and analysis of groundwater from the wells (Section 18.3.5)
- Measurement of static-water levels in the wells (Section 18.3.5)
- Performance of slug tests in three of the wells (Section 18.3.6)

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the soil gas grid corners, soil boring locations, surface soil samples, sediment samples, and the newly installed monitoring wells. Surveying notes are provided in Appendix F.

18.3.1 Soil Gas Survey

B&R Environmental performed a soil gas survey in June 1995 as a site screening tool to identify impacts to soil and groundwater by volatile organics and to aid in locating soil borings and monitoring wells. Figure 18-2 shows soil gas sampling points and ID numbers. Figure 18-2a shows soil gas sample locations and unvalidated analytical results. Table 18-1 lists the unvalidated analytical results by sample ID. Because the soil gas results were used for screening purposes only, data validation was not performed.

B&R Environmental installed 96 soil gas points at Site 16 and collected one soil gas sample at each. The samples were representative of soil and groundwater conditions near the soil/water interface. The samples were collected at depths ranging from 1 to 8 feet below grade. Samples were to have been collected from approximately 1 foot above the soil/water interface.

The 96 soil gas samples 16 SG 01 through 16 SG 99 (with the exception of 16 SG 62, 16 SG 88 and 16 SG 90) plus 10 field duplicates were submitted to EFS's on-site Photovac 10S plus field GC laboratory for BTEX, TCE, and PCE analysis (see Appendix B). No samples were collected at

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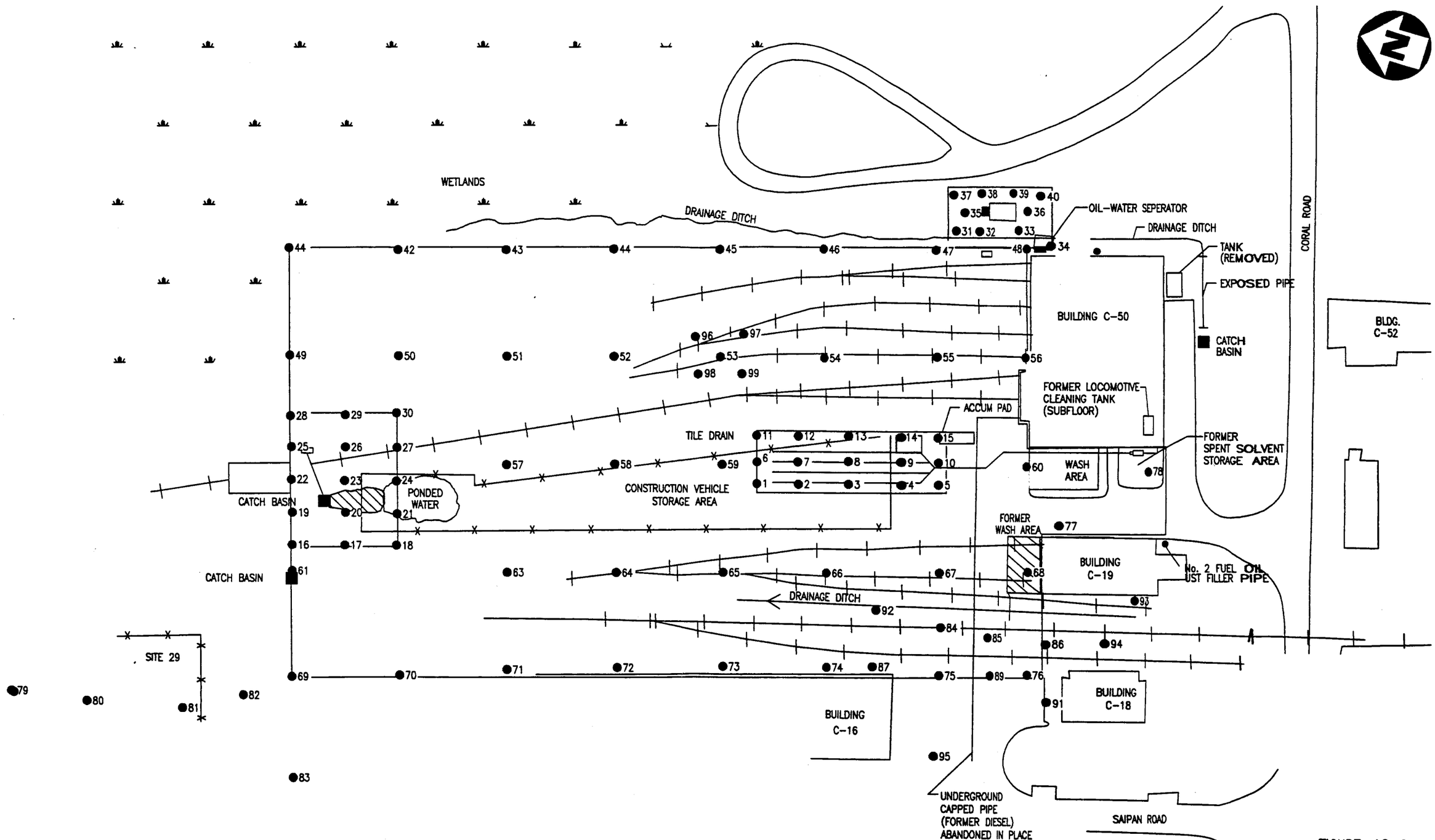

FIGURE 18-2

SITE 16/EPIC SITE F
SOIL GAS SAMPLE POINTS AND ID NUMBERS
NWS EARLE, COLTS NECK, NEW JERSEY

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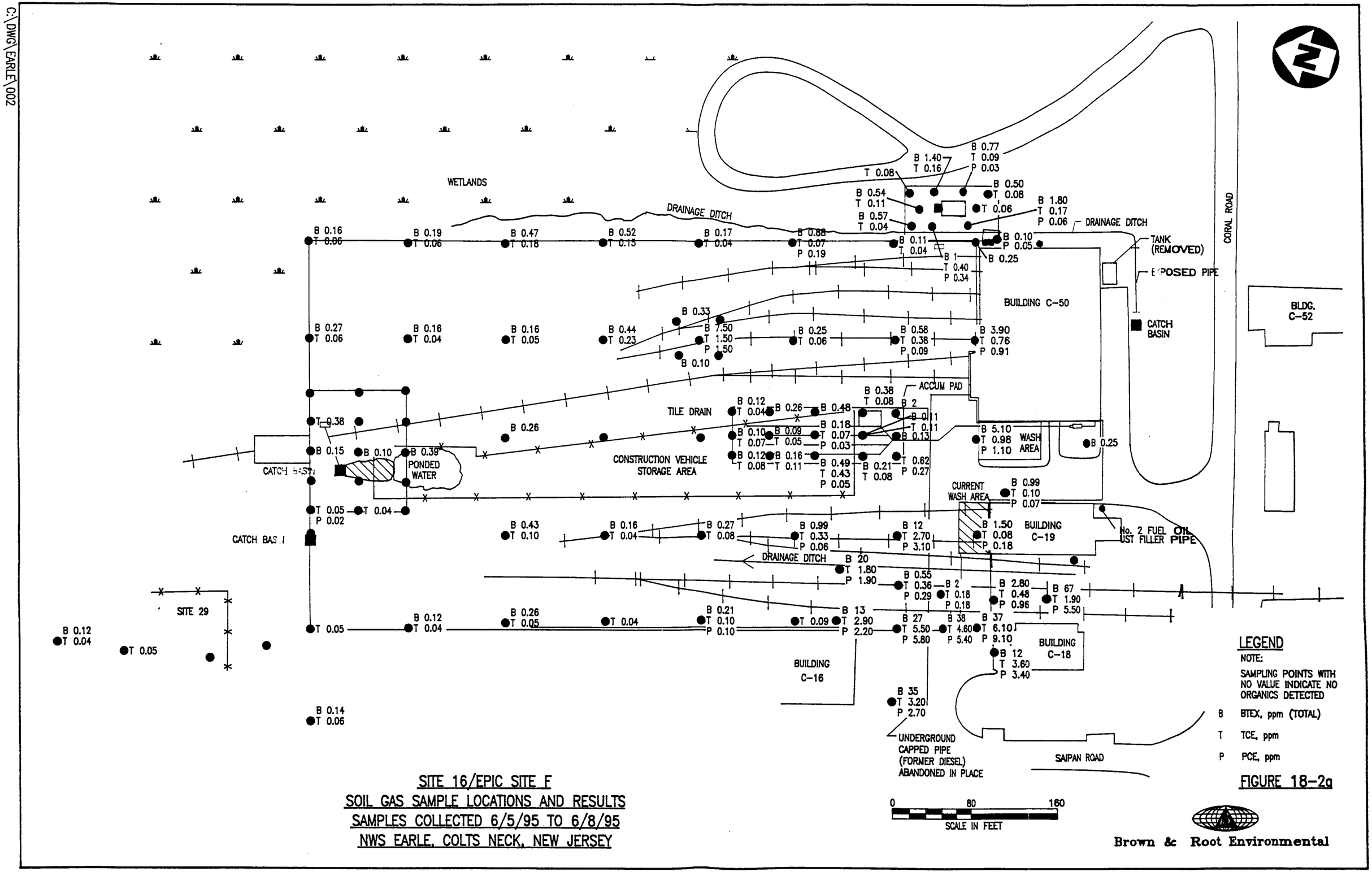


SITE 16/EPIC SITE F
SOIL GAS SAMPLE LOCATIONS AND RESULTS
SAMPLES COLLECTED 6/5/95 TO 6/8/95
NWS EARLE, COLTS NECK, NEW JERSEY

FIGURE 18-2a

Table 18-1
Soil Gas Results (not validated)
Site 16/F, Samples Collected June 5, 1995 to June 8, 1995
NWS Earle, Colts Neck, New Jersey

Sample I.D.	Depth of Sample (feet)	Total BTEX (ppm)	TCE (ppm)	PCE (ppm)
16 SG 01	7	0.12	0.078	ND
16 SG 02	7	0.16	0.11	ND
16 SG 03	8	0.49	0.43	0.048
16 SG 04	8	0.21	0.082	ND
16 SG 05	8	ND	0.62	0.27
16 SG 06	8	0.1	0.073	ND
16 SG 07	8	0.09	0.047	ND
16 SG 08	7	0.18	0.071	0.034
16 SG 09	7	0.1	0.11	ND
16 SG 10	7	0.13	ND	ND
16 SG 11	5	0.12	0.04	ND
16 SG 12	5	0.26	ND	ND
16 SG 13	6	0.48	ND	ND
16 SG 14	6	0.38	0.081	ND
16 SG 15	7	2	ND	ND
16 SG 16	3	ND	0.046	0.019
16 SG 17	3	ND	0.044	ND
16 SG 18	3	ND	ND	ND
16 SG 19	1.5	ND	ND	ND
16 SG 20	1.5	ND	ND	ND
16 SG 21	1.5	ND	ND	ND
16 SG 22	1.5	0.15	ND	ND
16 SG 23	1.5	0.1	ND	ND
16 SG 24	1.5	0.39	ND	ND
16 SG 25	3	ND	0.38	ND
16 SG 26	3	ND	ND	ND
16 SG 27	2	ND	ND	ND
16 SG 28	1.5	ND	ND	ND

Table 18-1 (continued)
Soil Gas Results (not validated)
Site 16/F, Samples Collected 6/5/95 to 6/8/95
NWS Earle, Colts Neck, New Jersey
Page 2 of 4

Sample I.D.	Depth of Sample (feet)	Total BTEX (ppm)	TCE (ppm)	PCE (ppm)
16 SG 29	1.5	ND	ND	ND
16 SG 30	1.5	ND	ND	ND
16 SG 31	3	0.57	0.04	ND
16 SG 32	4	1	0.4	0.34
16 SG 33	5	1.8	0.17	0.062
16 SG 34	5	0.1	ND	0.047
16 SG 35	3	0.54	0.11	ND
16 SG 36	5	ND	0.062	ND
16 SG 37	3	ND	0.078	ND
16 SG 38	3	1.4	0.16	ND
16 SG 39	3	0.77	0.086	0.03
16 SG 40	5	0.5	0.082	ND
16 SG 41	1	0.16	0.062	ND
16 SG 42	1.5	0.19	0.057	ND
16 SG 43	1.5	0.47	0.18	ND
16 SG 44	1.5	0.52	0.15	ND
16 SG 45	1.5	0.17	0.041	ND
16 SG 46	1.5	0.88	0.074	0.19
16 SG 47	2.5	0.11	0.043	ND
16 SG 48	5	0.25	ND	ND
16 SG 49	1	0.27	0.056	ND
16 SG 50	1	0.16	0.04	ND
16 SG 51	1.5	0.16	0.05	ND
16 SG 52	3.5	0.44	0.23	ND
16 SG 53	4	7.5	1.5	1.5
16 SG 54	4	0.25	0.062	ND
16 SG 55	4	0.58	0.38	0.086

Table 18-1
Soil Gas Results (not validated)
Site 16/F, Samples Collected 6/5/95 to 6/8/95
NWS Earle, Colts Neck, New Jersey
Page 3 of 4

Sample I.D.	Depth of Sample (feet)	Total BTEX (ppm)	TCE (ppm)	PCE (ppm)
16 SG 56	5	3.9	0.76	0.91
16 SG 57	2.5	0.26	ND	ND
16 SG 58	4.5	ND	ND	ND
16 SG 59	7	ND	ND	ND
16 SG 60	5	5.1	0.98	1.1
16 SG 61	2	ND	ND	ND
16 SG 63	4	0.43	0.095	ND
16 SG 64	4	ND	0.042	ND
16 SG 65	5	0.27	0.079	ND
16 SG 66	5	0.99	0.33	0.059
16 SG 67	5	12	2.7	3.1
16 SG 68	5	1.5	0.075	0.18
16 SG 69	3	ND	0.052	ND
16 SG 70	3	0.12	0.041	ND
16 SG 71	4	0.26	0.045	ND
16 SG 72	4	ND	0.039	ND
16 SG 73	5	0.21	0.1	0.1
16 SG 74	5	ND	0.093	ND
16 SG 75	5	27	5.5	5.8
16 SG 76	5	37	6.1	9.1
16 SG 77	5	0.99	0.1	0.071
16 SG 78	5	0.25	ND	ND
16 SG 79	4	0.12	0.044	ND
16 SG 80	4	ND	0.048	ND
16 SG 81	4	ND	ND	ND
16 SG 82	4	0.17	0.054	ND
16 SG 83	4	0.14	0.062	ND

Table 18-1
Soil Gas Results (not validated)
Site 16/F, Samples Collected 6/5/95 to 6/8/95
NWS Earle, Colts Neck, New Jersey
Page 4 of 4

Sample I.D.	Depth of Sample (feet)	Total BTEX (ppm)	TCE (ppm)	PCE (ppm)
16 SG 84	4	0.55	0.36	0.29
16 SG 85	4	2	0.18	0.18
16 SG 86	4	2.8	0.48	0.96
16 SG 87	4	13	2.9	2.2
16 SG 89	4	38	4.6	5.4
16 SG 91	4	12	3.6	3.4
16 SG 92	4	20	1.8	1.9
16 SG 93	4	ND	ND	ND
16 SG 94	4	67	1.9	5.5
16 SG 95	4	35	3.2	2.7
16 SG 96	4	0.33	ND	ND
16 SG 97	3	ND	ND	ND
16 SG 98	3	0.1	ND	ND
16 SG 99	3	ND	ND	ND

locations 62, 88, and 90. QA/QC samples (blanks) were collected at various times to ensure that the system was clean of outside influences, and 10 percent of the samples were duplicated.

The results of the soil gas survey, along with other historical data, were used to determine the final location of the planned monitoring wells, soil borings, and other RI samples. Plans for well and soil boring installation were adjusted to account for the suspected diesel leak(s) from the former underground transfer line, based on the analytical results. Two additional monitoring wells were added to the planned RI program to help cover the several areas of concern highlighted by the soil gas results. Elevated soil gas VOC concentrations were encountered south of Building 16, north of the Building C-50 wash area (within the fenced vehicle storage yard), and northwest of Building C-50 in the area of a former (and present) fueling station. RI field sampling activities were biased toward these locations and downgradient (generally to the north based on measured groundwater elevations) to investigate potential source areas, floating product, or dissolved plume.

18.3.2 Soil Borings and Subsurface Soil Sampling

B&R Environmental drilled 20 soil borings (six of which were converted into monitoring wells), MW16-01 through MW16-06 and 16 SB 07 through 16 SB 20, in July 1995 to investigate subsurface soil conditions. The borings were drilled using hollow-stem auger drilling techniques and 4.25-inch I.D augers. The borings ranged in depth from 8 to 20 feet bgs. Saturated conditions were encountered in the borings from 6 to 11 feet below grade. Subsurface soil samples were collected continuously to the water table by driving a 3-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description.

One subsurface soil sample was collected from the soil boring interval that showed the highest level of contamination, based on visual observations or HNu readings, in the following soil borings: MW16-01, 16 SB 07, 16 SB 08, 16 SB 11, 16 SB 14, 16 SB 15, and 16 SB 16. Stains and odors were not observed in these soil borings. The maximum HNu readings in the borings ranged from 0 to 5 ppm or less than 10 ppm action level. Two subsurface soil samples (one sample from the interval that showed the highest level of contamination based on visual observations or HNu readings and one sample from the soil/water interface) were collected from the remaining soil borings: MW16-02, MW16-03, MW16-04, MW16-05, MW16-06, 16 SB 09, 16 SB 10, 16 SB 12, 16 SB 13, 16 SB 17, 16 SB 18, 16 SB 19, and 16 SB 20. Staining was not observed in these borings, however, hydrocarbon odors were noted in MW16-05, 16 SB 10, and 16 SB 12. HNu readings were greater than 10 ppm action level in all borings of the group. Maximum HNu readings ranged from 14 to 120 ppm, with the highest reading located in the 0-2 feet interval in 16 SB 09. All subsurface soil samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL PCBs, TAL metals, and TPH analyses. Three field duplicates were collected (DUP-08 collected with 16 SB 17-04; DUP-09 collected with 16 SB 16-06; and DUP-10 collected with 16 SB 04-08). Extra volume was collected at 16 SB 14-04 and submitted as a matrix spike/matrix spike duplicate.

Sample log sheets are presented in Appendix D. Soil boring characteristics and sample information are summarized in Table 18-2.

18.3.3 Surface Soil Sampling

Three surface soil samples (16 SS 01 through 16 SS 03) were collected in July 1995 to determine if wash activities have impacted the soils (Figure 18-1). The samples were collected from 0 to 6 inches bgs using stainless-steel trowels and placed directly into the appropriate bottleware. The surface vegetation was removed before sampling. The work plan stated there would be four surface soil samples; however, it was determined, based on field observations, that only three surface soil samples were necessary. The surface soil samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, moisture, pH, and TPH analyses. The surface soil consisted of dark brown to gray silty sand and gravel. Sample log sheets are presented in Appendix D.

18.3.4 Sediment Sampling

B&R Environmental collected five sediment samples, including two field duplicates, in July 1995 to determine if past activities or runoff have impacted sediments and wetlands in the vicinity of the site. Two of the samples, including one field duplicate (16 SD 01 and Dup-12), were collected from the catch basin at the northern side of the site. The sediment material consisted of brown coarse sand with trace amounts of gravel. Three sediment samples, including one field duplicate (16 SD 02, Dup-11, and 16 SD 03), were collected in July 1995 from the drainage ditch located northeast of Building C-50. The work plan stated that three locations along the drainage ditch would be sampled. However, during field observations, B&R Environmental noted that a drainage pipe was in place and covered with clean fill over a portion of the drainage ditch. At the request of NORTHDIV, one sample location was therefore eliminated. The sediment material in the open drainage ditch consisted of brown silty sand with trace amounts of organic material (see Figure 18-1 for sediment locations). The sediment samples were collected using a stainless-steel trowel from 0 to 6 inches bgs. The sediment material was placed directly into the required bottleware via the stainless-steel trowel. The five sediment samples, including two field duplicates, were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, TOC, moisture, and pH analyses. Sample log sheets are presented in Appendix D.

As per the RI Work Plan, four additional sediment samples were to be collected from storm sewers located in the vicinity of the former steam-cleaning area to determine if contamination was present in storm sewers from parts washing storm activities. A field decision was made not to sample storm sewer intakes as drainage from the wash pad was overland to the north.

Table 18-2
Site 16 Soil Boring Characteristics Summary
NWS Earle, Colts Neck, New Jersey

Soil Boring Number	Total Depth[1] (feet)	Ground Surface Elevation[2]	Laboratory Sample Number	Laboratory Sample Depth Interval[1] (feet)	Analytical Parameters[3]
16 SB 01 (MW16-01)	18	101.05	16 SB 01-06	6 to 8	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
16 SB 02 (MW16-02)	15	96.57	16 SB 02-04	4 to 6	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 02-03	(3 to 3.5)	
16 SB 03 (MW16-03)	18	99.85	16 SB 03-02	0 to 2	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 03-06	6 to 8	
16 SB 04 (MW16-04)	18	102.29	16 SB 04-08 (Dup 10)	8 to 10	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 04-10	10 to 12	
16 SB 05 (MW16-05)	20	102.27	16 SB 05-06	6 to 8	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 05-08	8 to 10	
16 SB 06 (MW16-06)	17	96.99	16 SB 06-02	2 to 4	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 06-06	6 to 8	
16 SB 07	8	99.40	16 SB 07-04	4 to 6	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
16 SB 08	10	101.80	16 SB 08-06	6 to 8	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH

Table 18-2
Site 16 Soil Boring Characteristics Summary
NWS Earle Colts Neck, New Jersey
Page 2 of 3

Soil Boring Number	Total Depth[1] (feet)	Ground Surface Elevation[2]	Laboratory Sample Number	Laboratory Sample Depth Interval[1] (feet)	Analytical Parameters[3]
16 SB 09	10	98.60	16 SB 09-00	0 to 2	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 09-06	6 to 8	
16 SB 10	8	100.50	16 SB 10-00	0 to 2	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 10-04	4 to 6	
16 SB 11	11	102.60	16 SB 11-09	9 to 11	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
16 SB 12	10	-	16 SB 12-02	0 to 2	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 12-06	6 to 8	
16 SB 13	10	-	16 SB 13-02	0 to 2	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 13-06	6 to 8	
16 SB 14	10	100.40	16 SB 14-04 (MS/MSD taken here)	4 to 8	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
16 SB 15	10	100.90	16 SB 15-06	6 to 8	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH

Table 18-2
Site 16 Soil Boring Characteristics Summary
NWS Earle Colts Neck, New Jersey
Page 2 of 3

Soil Boring Number	Total Depth[1] (feet)	Ground Surface Elevation[2]	Laboratory Sample Number	Laboratory Sample Depth Interval[1] (feet)	Analytical Parameters[3]
16 SB 16	10	102.30	16 SB 16-06 (Dup 9)	6 to 8	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
16 SB 17	10	100.30	16 SB 17-04 (Dup 8)	4 to 6	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 17-06	6 to 8	
16 SB 18	10	102.30	16 SB 18-02	2 to 4	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 18-06	6 to 8	
16 SB 19	10	102.60	16 SB 19-06	6 to 8	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 19-08	8 to 10	
16 SB 20	10	100.50	16 SB 20-02	2 to 4	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TPH, moisture, and pH
			16 SB 20-06	6 to 8	

18.3.5 Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

B&R Environmental installed six shallow permanent monitoring wells (MW16-01 through MW16-06) at the site in July 1995 to determine the quality of groundwater and to check for free-phase or dissolved-phase product at the site (Figure 18-1). The locations of the wells were based upon the results of the soil gas survey and soil boring activities. MW16-01 was located downgradient of the former UST area associated with Building C-50. The borings were drilled using hollow-stem-auger drilling techniques and 4.25-inch I.D. augers. The borings ranged in depth from 15 to 18 feet, and water was encountered between 6 and 11 feet below grade during drilling. The borings were drilled to approximately 8 feet below the water table and completed as cased wells, screened across the water table. Monitoring well characteristics are summarized in Table 18-3. Subsurface soil samples were collected continuously to the water table by driving a 2-inch O.D. by 24-inch- long split-barrel sampler. The field team screened the samples with an HNu and visually inspected them for evidence of contamination (such as staining and odors) and for lithologic description. The team prepared soil boring log sheets for each boring to evaluate subsurface lithologies (see Appendix C).

The wells were constructed with 2-inch I.D. flush-jointed and threaded, NSF-certified, Schedule 40 PVC well casing and 0.10-foot slotted PVC well screen fitted with a PVC bottom cap. Ten-foot screens were installed in the wells. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 1 to 3 feet above the top of the screen (due to the shallow depth to groundwater, only 1 foot of sand above the top of the screen was used). An approximately 1.5- to 2-foot-thick annular seal, consisting of bentonite pellets, was placed on top of the filter pack (the thin seal was also due to the shallow depth to groundwater). The remainder of the well annulus was backfilled with a cement grout to a height approximately 1 foot below the ground surface. MW16-01 and MW16-03 were completed as flush-mount wells. A concrete, 4- by 4- foot pad was added to the top of each monitoring well at ground level, keyed 1 foot into the well annulus. The remaining wells were completed with 2-foot-high standpipes and with a 4- by 4-foot concrete pad keyed into the well annulus. Monitoring well construction sheets are in Appendix C.

The wells were developed a minimum of 24 hours after installation. Groundwater temperature, pH, conductivity, and turbidity were monitored during development. All wells were developed until removed water was visibly clear of suspended solids. MW16-04 and MW16-05 were developed separately (in August 1995) after consideration of the significant product layer in the wells. Approximately 120 gallons

Table 18-3
Site 16/F Monitoring Well Characteristics Summary
NWS Earle, Colts Neck, New Jersey

Monitoring Well Number	Total Depth[1] (feet)	Ground Surface Elevation[2]			Diameter (inches)	Screened Interval Depth[1] (feet)	Filter Pack Interval Depth[1] (feet)	Date Installed
		Top of Concrete Pad	Top of PVC Riser	Top of Standpipe				
MW16-01	16	101.05	102.34	103.01	2	6 - 16	3 - 16	7/9/95
MW16-02	15	96.57	98.48	99.03	2	5 - 15	4 - 15	7/9/95
MW16-03[3]	16	99.85	99.59	99.86	2	6 - 16	3.5 - 16	7/9/95
MW16-04	18	102.29	104.30	104.84	2	8 - 18	6 - 18	7/9/95
MW16-05	18	102.27	104.14	104.80	2	8 - 18	6 - 18	7/9/95
MW16-06	17	96.99	98.73	99.31	2	7 - 17	5 - 17	7/9/95
MW-1[3]	20	103.37	103.06	103.49	4	-	-	-

Note: All wells were constructed with Schedule 40 polyvinyl chloride (PVC) well casing.

(1) In feet below grade. Reading obtained during monitoring well installation. See Table 18-4 for more accurate measurements.
(2) In feet above mean sea level.
(3) Well is flush mounted.

of water were removed from MW16-01, MW16-03, and MW16-06. Approximately 240 gallons of water were removed from MW16-02. Approximately 150 gallons of water were removed from MW16-04 and MW16-05.

Static-Water-Level Measurements

In order to define groundwater flow directions and horizontal and vertical groundwater gradients, B&R Environmental collected two rounds of static-water-level measurements. The first round of water-level measurements was collected on August 7, 1995, the second on October 17 and October 18, 1995. Static-water levels were measured from the top of the PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation ranged from approximately 90.89 to 92.67 feet above MSL during the first round of measurements and from approximately 90.52 to 92.50 feet above MSL during the second round. Water-level measurements are summarized in Table 18-4.

Groundwater Sampling

Groundwater samples were obtained from the six newly installed monitoring wells (MW16-01, MW16-02, MW16-03, MW16-04, MW16-05, and MW16-06) and the existing well (MW-1) to investigate the current level and extent of contamination and to provide data for use in the risk assessment and the evaluation of remedial action alternatives. The newly installed wells were sampled in August 1995 (MW16-04 and MW16-05 were sampled in September 1995). Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Prior to sampling, B&R Environmental purged the wells (with the exception of MW16-04 and MW16-05), using the micro-purge protocol, to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure little or no drawdown in water levels occurred throughout the purge and sample process. MW16-04 and MW16-05 were not purged prior to sampling. Separate samples of the floating oil layer and aqueous layer were collected. B&R Environmental attempted to collect an uncontaminated groundwater sample from MW16-04 and MW16-05 through the floating oil layer. The team inserted a small-diameter PVC tube with a rubber glove septum on the down well end into the well below the oil/water interphase. A smaller-diameter tube was then inserted, piercing the rubber septum, and the team collected a sample of groundwater via a peristaltic pump.

B&R Environmental submitted seven groundwater samples (16 GW 01 through 16 GW 06 and MW-01) to Lancaster Laboratories for TCL VOC, TCL SVOC, TAL metals, and TPH analyses. At the direction of NORTHDIV, 16 GW 02 and 16 GW 06 were also analyzed for dissolved TAL metals. GC fingerprint and specific gravity analyses were performed on the oily product layer from samples 16 GW 04 and 16 GW 05. Results of analyses performed on samples taken from MW16-04 and MW16-05 were not submitted

TABLE 18-4
SITE 16/F STATIC WATER-LEVEL MEASUREMENT SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY

Monitoring Well Number	August 7, 1995			October 17 and October 18, 1995		
	Depth to Water Table[1] (feet)	Top of PVC Riser[2]	Elevation of Water Table[2]	Depth to Water Table[1] (feet)	Top of PVC Riser[2]	Elevation of Water Table[2]
MW16-01	9.67	102.34	92.67	10.11	102.34	92.23
MW16-02	7.07	98.48	91.41	7.43	98.48	91.05
MW16-03	7.85	99.59	91.74	8.23	99.59	91.36
MW16-04	[3]	104.30	[4]	not measured	104.30	-
MW16-05	[3]	104.14	[4]	not measured	104.14	-
MW16-06	7.84	98.73	90.89	8.21	98.73	90.52
MW-1	[5]	103.06	-	10.56	103.06	92.50

(1) In feet below top of riser
(2) In feet above mean sea level
(3) Non-aqueous free-product layer present
August 17, 1995 measurements:
MW16-04: Top of free-product layer = 11.49 feet
Product - water interface = 14.38 feet
Free-product thickness = 2.89 feet
MW16-05: Top of free product layer = 11.56 feet
Product - water interface = 11.96 feet
Free-product thickness = 0.40 feet
(4) Adjusted water-table elevations not calculated
(5) Water level not measured

for validation using the EPA Region II guidelines and are summarized in Table 18-5. Sample log sheets are presented in Appendix D.

18.3.6 Slug Testing

Slug test were performed according to the procedure presented in Section 2.1.1.4. Hydraulic permeability (k) calculations are presented in Appendix H.

18.4 SITE CHARACTERISTICS

18.4.1 Geology

Regional mapping places Site 16/F within the outcrop area of the Vincentown Formation; upper colluvium may be present at the site. The upper colluvium has a maximum thickness of 10 feet, the Vincentown Formation ranges between 10 and 130 feet in thickness, and the soil borings are no more than 20 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the upper colluvium and the Vincentown Formation. In general, the borings encountered fill material, brown pebbly, silty, fine- to medium-grained sand (possibly representative of the upper colluvium), and brownish-yellow, olive, glauconitic, fine- to medium-grained sand (probably representative of the Vincentown Formation.

Based upon the boring log descriptions, borings 16 SB 13 and 16 SB 15 penetrated fill material and upper colluvium, boring 16 SB 12 penetrated the upper colluvium, borings 16 SB 09 through 16 SB 11, 16 SB 14, and 16 SB 18 penetrated fill material, upper colluvium, and the Vincentown Formation, and wells MW16-01 through MW16-06 and borings 16 SB 07, 16 SB 08, 16 SB 16, 16 SB 17, 16 SB 19, and 16 SB 20 penetrated upper colluvium and the Vincentown Formation.

18.4.2 Hydrogeology

Groundwater in the upper colluvium and Vincentown aquifer beneath the site occurs under unconfined conditions and the geologic units are interpreted to be hydraulically interconnected. A free-product layer consisting of light, non-aqueous phase liquid (LNAPL) was discovered floating on top of shallow groundwater in wells MW16-04 and MW16-05. The available data are not sufficient to define the areal extent, thickness, and movement of the free-product layer. Static-water-level measurements, water-table elevations, and depths to the free-product layer and product-water interface are summarized in Table 18-4. Groundwater elevations for August 1995 and October 1995 are contoured on Figures 18-3 and 18-4, respectively. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October groundwater contour maps, is toward the north. There does not appear to be a significant seasonal variation in groundwater flow direction.

Table 18-5
Site No. 16/F Roundhouse

Preliminary Analytical Results

	16 GW 04 (WATER) Sample Results			16 GW 05 (WATER) Sample Results			16 GW 04 (OIL) Sample Results	16 GW 05 (OIL) Sample Results
VOLATILE ORGANICS	**CRQL**	**UG/L**		**CRQL**	**UG/L**		**UG/L**	**UG/L**
ACETONE	25	49	JDB	50	67	JDB		
1,2-DICHLOROETHENE (TOTAL)	25	11	J	50	ND			
BENZENE	25	350		50	1900	D	NA	NA
TOLUENE	25	40		50	160			
ETHYLBENZENE	25	330		50	170			
XYLENE (TOTAL)	25	1600	D	50	250			
SEMIVOLATILE ORGANICS	**CRQL**	**UG/L**		**CRQL**	**UG/L**		**UG/L**	**UG/L**
PHENOL	100	ND		10	11			
2,4-DIMETHYLPHENOL	100	ND		10	48			
NAPHTHALENE	100	690		10	220	D		
2-METHYLNAPHTHALENE	100	1800	D	10	250	D		
ACENAPHTHENE	100	91	J	10	11	JD		
DIBENZOFURAN	100	73	J	10	7	JD	NA	NA
FLUORENE	100	140		10	11			
PHENANTHRENE	100	240		10	17			
CARBAZOLE	100	ND		10	12			
PYRENE	100	27	J	10	ND			
BIS(2-ETHYLHEXYL)PHTHALATE	100	ND		10	190	D		
QUALITATIVE GC FINGERPRINT	NA			NA			#2 FUEL OIL	#2 FUEL OIL
TPH ANALYSIS	**LOQ**	**MG/L**		**LOQ**	**MG/L**		NA	NA
TOTAL PETROLEUM HYDROCARBONS	30	190		3	20			
TAL METALS	**CRQL**	**UG/L**		**CRQL**	**UG/L**		**UG/L**	**UG/L**
ARSENIC	10	9.4	J	10	ND			
BARIUM	200	4.39	J	200	31.2	J		
CADMIUM	5	0.65	J	5	0.56	J		
CALCIUM	5000	23500		5000	17700			
CHROMIUM	10	24		10	5.28	J		
COBALT	50	0.71	J	50	ND			
COPPER	25	0.8	J	25	0.88	J		
IRON	100	178000		100	49100			
LEAD	3	2.1	J	3	5.4		NA	NA
MAGNESIUM	5000	5800		5000	4660	J		
MANGANESE	15	47		15	84			
MERCURY	0.2	0.035	J	0.2	0.05	J		
POTASSIUM	5000	ND		5000	1870	J		
SELENIUM	5	13.5		5	ND			
SODIUM	5000	104000		5000	157000			
VANADIUM	50	11	J	50	ND			
ZINC	20	20		20	17.2	J		

B -- COMPOUND DETECTED IN ASSOCIATED LABORATORY BLANK

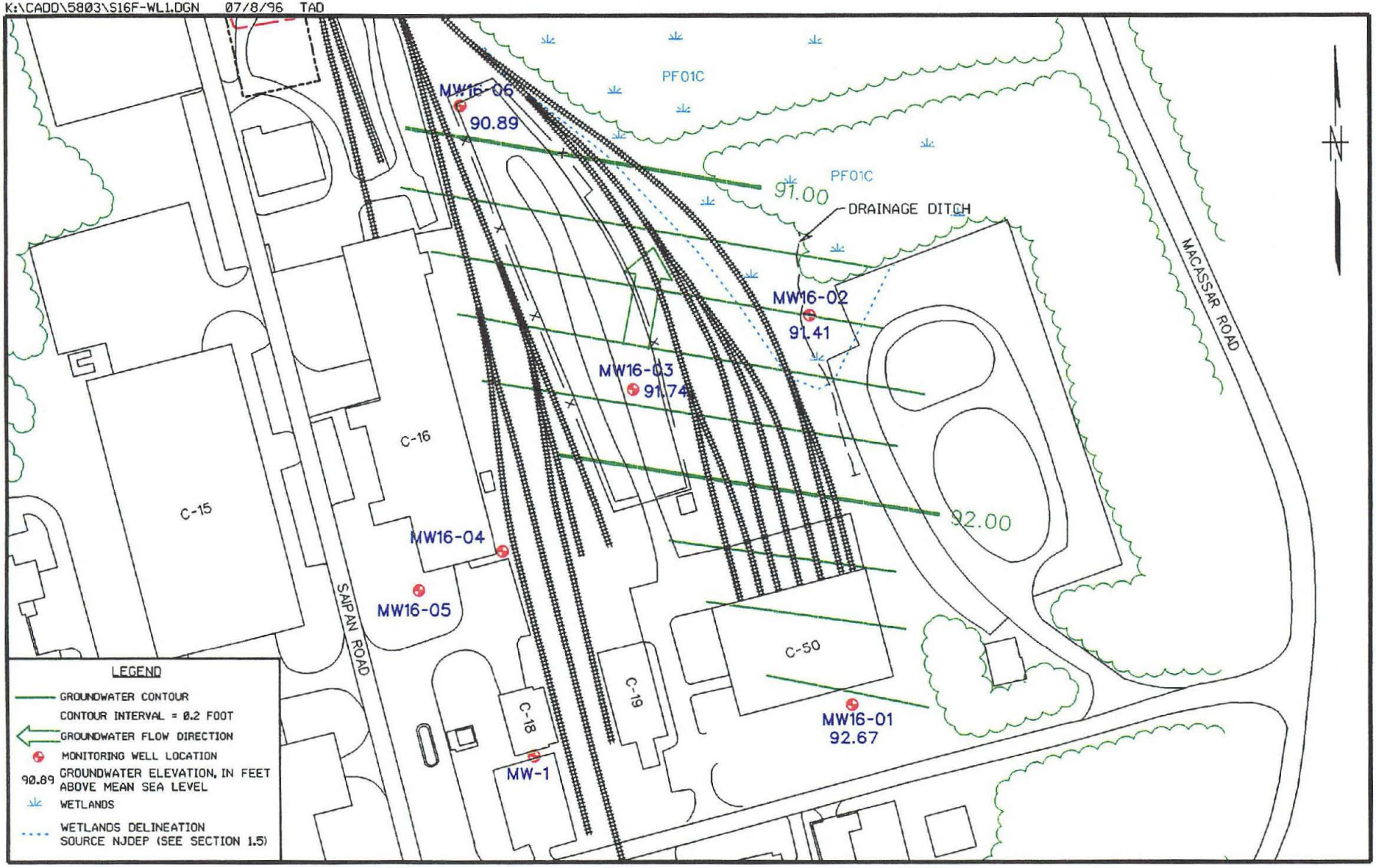
ND -- NOT DETECTED

J -- POSITIVE VALUE IS ESTIMATED AND LESS THAN QUANTITATION LIMIT

D -- DILUTED ANALYSIS

NA -- NOT ANALYZED

K:\CADD\5803\S16F-WL1.DGN 07/8/96 TAD



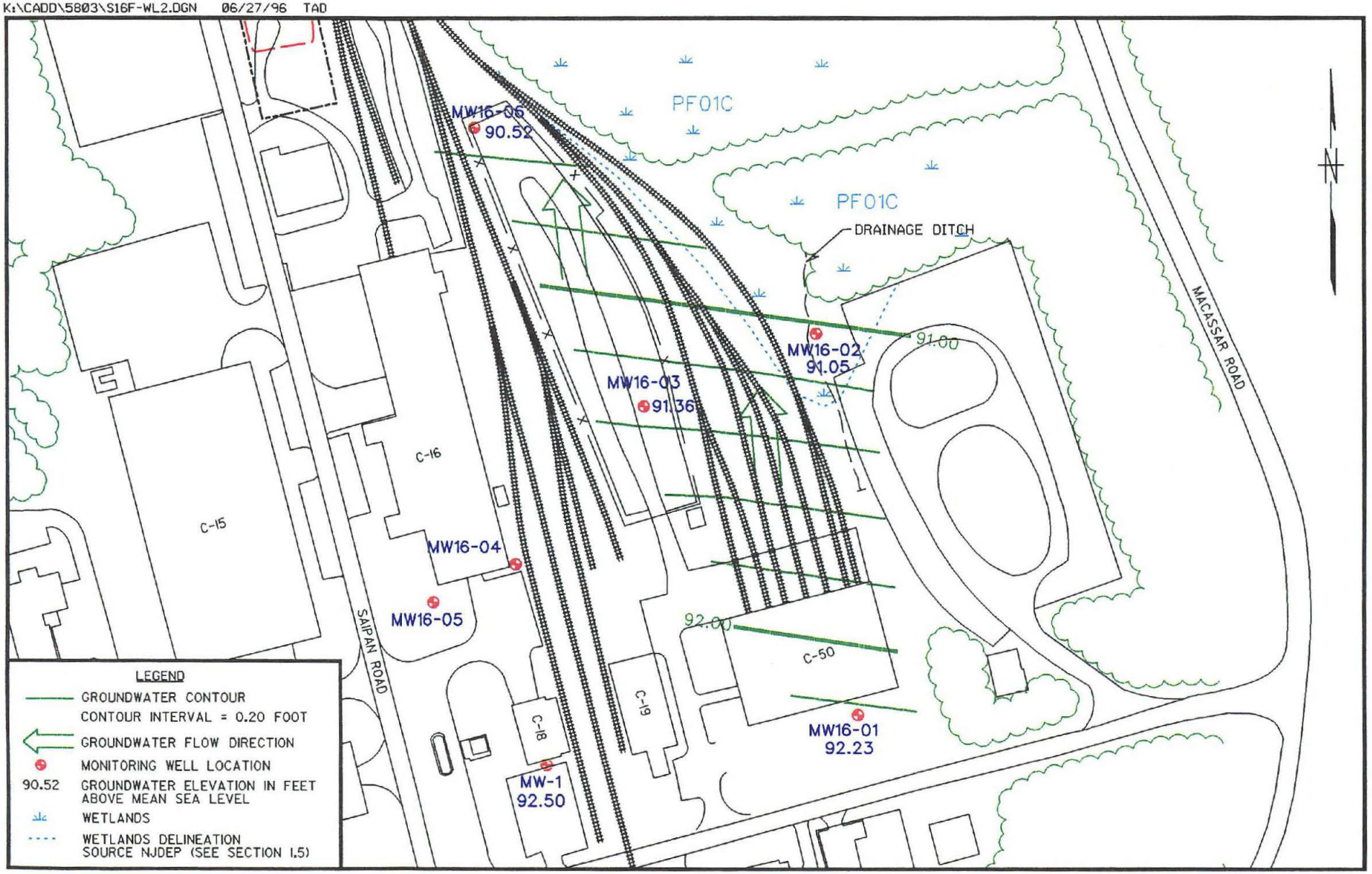
GROUNDWATER CONTOUR MAP AUGUST 7, 1995

SITE 16 AND EPIC SITE F

FIGURE 18-3

Brown & Root Environmental

K:\CADD\5803\S16F-WL2.DGN 06/27/96 TAD



GROUNDWATER CONTOUR MAP OCTOBER 17,1995

SITE 16 AND EPIC SITE F

0 150 300

SCALE IN FEET

FIGURE 18-4

Brown & Root Environmental

Based on boring log descriptions, well MW16-06 is screened in the upper colluvium and the Vincentown Formation, and wells MW16-01 through MW16-05 are screened in the Vincentown Formation. The hydraulic conductivity calculated for MW16-01 (Vincentown Formation) is 3.48×10^{-4} cm/sec (0.99 ft/day). Two hydraulic conductivities were calculated for MW16-06 (upper colluvium and Vincentown Formation): 1.39×10^{-3} cm/sec (3.94 ft/day) from rising-head slug test data and 6.79×10^{-4} cm/sec (1.93 ft/day) from falling-head slug test data. Appendix H contains slug test data and calculations.

18.5 NATURE AND EXTENT OF CONTAMINATION

18.5.1 Surface Soils

Three site-related surface soil samples (16 SS 01 through 16 SS 03) were collected at Site 16 (Figure 18-2). Tables 18-6 and 18-7 present the occurrence and distribution of inorganic and organic chemicals detected in site-related surface soil samples and compare them to background as presented in Section 31. Tables 18-6a and 18-6b present a comparison of detected compounds to ARARs and TBCs. Figure 18-5 presents sample locations with concentrations of compounds found above ARARs and TBCs and for purposes of illustrating the extent of contamination, TPH concentrations above 1,000 mg/kg.

18.5.1.1 Inorganics

Concentrations of antimony, barium, cadmium, chromium, copper, lead, magnesium, nickel, silver, and zinc in all site-related samples were greater than the ranges detected in background samples. Generally, higher levels of metals were found on 16 SS 01 and 16 SS 03.

18.5.1.2 Organics

Fluoranthene (40 ug/kg to 84 ug/kg), pyrene (46 ug/kg), di-n-butyl phthalate (45 ug/kg to 48 ug/kg), and butylbenzyl phthalate (220 ug/kg) were detected in background surface soil samples. PAHs including benz(a)anthracene, benzo(a)pyrene, carbazole, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, fluoranthene, and pyrene were detected in all site-related surface soil samples at levels greater than background, ranging from 42 ug/kg to 4,400 ug/kg. The highest levels of PAHs were detected in sample 16 SS 03.

Phthalates including bis(2-ethylhexyl)- (1,800 ug/kg to 12,000 ug/kg), butylbenzyl- (160 ug/kg), and di-n-butyl- (44 ug/kg to 100 ug/kg) were detected in surface soil samples collected at Site 16. N-nitrosodiphenylamine (63 ug/kg) and 4-methylphenol (110 ug/kg) were each detected in one site-related surface soil sample.

TABLE 18-6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOILS AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	1710 - 5310	6152.50	3 / 3	2570 - 4190	3640.00	NO	4190
ANTIMONY	NOT DETECTED	-	-	3 / 3	0.75 - 28	11.92	YES	28
ARSENIC	4 / 4	1.35 - 14.4	13.43	3 / 3	5.2 - 10.5	7.03	NO	10.5
BARIUM	4 / 4	1.85 - 31	22.53	3 / 3	78.3 - 133	106.77	YES	133
BERYLLIUM	1 / 4	0.28	0.39	3 / 3	0.13 - 0.25	0.19	NO	0.25
CADMIUM	1 / 4	0.57	0.67	3 / 3	6.1 - 10.2	8.13	YES	10.2
CALCIUM	4 / 4	40.1 - 519	551.80	3 / 3	2280 - 4230	3186.67	YES	4230
CHROMIUM	4 / 4	7.8 - 59.5	69.05	3 / 3	40.9 - 171	111.97	YES	171
COBALT	2 / 4	0.75 - 5	3.15	3 / 3	4 - 7.7	5.40	YES	7.7
COPPER	4 / 4	0.97 - 8.4	10.06	3 / 3	49.8 - 231	158.93	YES	231
IRON	4 / 4	3745 - 62500	52402.50	3 / 3	26100 - 57500	37466.67	NO	57500
LEAD	4 / 4	1.8 - 39.4	37.30	3 / 3	359 - 1030	688.00	YES	1030
MAGNESIUM	4 / 4	71.7 - 619	578.85	3 / 3	1300 - 1530	1393.33	YES	1530
MANGANESE	4 / 4	3.45 - 214	128.33	3 / 3	94.8 - 307	179.93	YES	307
MERCURY	4 / 4	0.035 - 0.17	0.18	3 / 3	0.018 - 0.28	0.14	NO	0.28
NICKEL	2 / 4	1.8 - 7.2	5.18	3 / 3	10.3 - 16.5	13.40	YES	16.5
POTASSIUM	4 / 4	95 - 792	912.50	3 / 3	342 - 537	441.33	NO	537
SILVER	2 / 4	0.37 - 0.67	0.69	3 / 3	1.8 - 25.3	12.10	YES	25.3
SODIUM	4 / 4	17.5 - 86.2	78.30	3 / 3	123 - 173	150.33	YES	173
VANADIUM	4 / 4	11.05 - 64	70.13	3 / 3	15.5 - 32.1	23.73	NO	32.1
ZINC	3 / 4	1.1 - 27.6	22.80	3 / 3	111 - 1180	508.67	YES	1180

Note: Selected COPCs are indicated in boldface type.

TABLE 18-7
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	NOT DETECTED	-	-	1 / 2	360	360
4,4'-DDE	2 / 4	16 - 330	277.86	2 / 2	15 - 120	120
4,4'-DDT	2 / 4	43 - 420	355.71	3 / 3	38 - 230	230
4-METHYLPHENOL	NOT DETECTED	-	-	1 / 3	110	110
ACENAPHTHYLENE	NOT DETECTED	-	-	1 / 3	100	100
ALPHA-BHC	NOT DETECTED	-	-	2 / 3	0.047 - 0.13	0.13
ALPHA-CHLORDANE	NOT DETECTED	-	-	1 / 3	33	33
ANTHRACENE	NOT DETECTED	-	-	2 / 3	57 - 170	170
BENZO(A)ANTHRACENE	NOT DETECTED	-	-	3 / 3	160 - 450	450
BENZO(A)PYRENE	NOT DETECTED	-	-	3 / 3	160 - 1200	1200
BENZO(B)FLUORANTHENE	NOT DETECTED	-	-	3 / 3	350 - 1000	1000
BENZO(G,H,I)PERYLENE	NOT DETECTED	-	-	3 / 3	150 - 340	340
BENZO(K)FLUORANTHENE	NOT DETECTED	-	-	1 / 3	86	86
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	3 / 3	1800 - 12000	12000
BUTYLBENZYLPHTHALATE	1 / 4	220	220	1 / 3	160	160
CARBAZOLE	NOT DETECTED	-	-	2 / 3	42 - 54	54
CHRYSENE	NOT DETECTED	-	-	3 / 3	250 - 810	810
DI-N-BUTYLPHTHALATE	2 / 4	45 - 48	48	2 / 3	44 - 100	100
FLUORANTHENE	2 / 4	40 - 84	84	3 / 3	340 - 510	510
GAMMA-CHLORDANE	NOT DETECTED	-	-	3 / 3	1.7 - 35	35
HEPTACHLOR EPOXIDE	NOT DETECTED	-	-	1 / 3	0.39	0.39
INDENO(1,2,3-CD)PYRENE	NOT DETECTED	-	-	2 / 3	120 - 200	200
N-NITROSODIPHENYLAMINE (1	NOT DETECTED	-	-	1 / 3	63	63
PHENANTHRENE	NOT DETECTED	-	-	3 / 3	210 - 370	370
PYRENE	1 / 4	46	46	3 / 3	670 - 4400	4400

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TABLE 18-6a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SS01	16SS02	16SS03	---	---	---	ARARS & TBCs		
LOCATION:	16SS01	16SS02	16SS03	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI						
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**				**mg/kg**	**mg/kg**	**mg/kg**
aluminum	2570	4160	4190				-	-	-
antimony	28.0 E	0.75	7.0				14.0	340	-
arsenic	5.2	10.5 J	5.4				20.0	20.0	-
barium	78.3	133	109				700	47000	-
beryllium	0.13	0.25	0.19				1.00	1.00	-
cadmium	6.1 E J	8.1 E J	10.2 E J				1.00	100	-
calcium	4230 J	2280 J	3050 J				-	-	-
chromium, total	40.9	124	171				-	500	-
cobalt	4.0	7.7	4.5				-	-	-
copper	49.8	196	231				600	600	-
iron	26100	57500	28800				-	-	-
lead	1030 E	359	675 E				400	600	-
magnesium	1350	1300	1530				-	-	-
manganese	138	307	94.8				-	-	-
mercury	0.018	0.12	0.28				14.0	270	-
nickel	10.3	13.4	16.5				250	2400	-
potassium	342	537	445				-	-	-
silver	1.8	9.2	25.3				110	4100	-
sodium	155	123	173				-	-	-
vanadium	15.5	23.6	32.1				370	7100	-
zinc	111	235	1180				1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**	**ug/kg**	**ug/kg**
4-methylphenol	380 U	380 U	110 J				2800000	10000000	-
N-nitrosodiphenylamine (1)	380 U	63.0 J	1000 U				140000	600000	100000
acenaphthylene	380 U	380 U	100 J				-	-	-
anthracene	380 U	57.0 J	170 J				10000000	10000000	100000
benzo(a)anthracene	160 J	240 J	450 J				900	4000	500000
benzo(a)pyrene	160 J	260 J	1200 E J				660	660	100000

TABLE 18-6a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SS01		16SS02		16SS03		---	---	---	ARARS & TBCs		
LOCATION:	16SS01		16SS02		16SS03		---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI							
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	350	J	700	J	1000	E J				900	4000	50000
benzo(g,h,i)perylene	150	J	200	J	340	J				-	-	-
benzo(k)fluoranthene	86.0	J	380	U	1000	UJ				900	4000	500000
bis(2-ethylhexyl)phthalate	1800		7000	J	12000	J				49000	210000	100000
butylbenzylphthalate	160	J	380	UJ	1000	UJ				1100000	10000000	100000
carbazole	54.0	J	42.0	J	1000	U				-	-	-
chrysene	250	J	360	J	810	J				9000	40000	500000
di-n-butylphthalate	100	J	44.0	J	1000	U				5700000	10000000	100000
fluoranthene	510		340	J	480	J				2300000	10000000	100000
indeno(1,2,3-cd)pyrene	120	J	200	J	1000	UJ				900	4000	500000
phenanthrene	210	J	230	J	370	J				-	-	-
pyrene	670		1100	J	4400	J				1700000	10000000	100000
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	3.9	U	7.6	R	360	J				3000	12000	50000
4,4'-DDE	3.9	R	15.0		120					2000	9000	50000
4,4'-DDT	38.0		230		43.0					2000	9000	500000
alpha-BHC	0.047	J	0.13	J	2.6	U				-	-	-
alpha-chlordane	1.9	U	7.0	U	33.0					-	-	-
gamma-BHC (Lindane)	1.9	U	0.13	R	0.13	R				520	2200	50000
gamma-chlordane	1.7	J	7.0	J	35.0					-	-	-
heptachlor	1.9	U	1.5	JN	2.6	U				150	650	50000
heptachlor epoxide	0.39	J	2.0	U	2.6	U				-	-	-

TABLE 18-6a
COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

TABLE 18-6b

COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SS01	16SS02	16SS03	---	---	ARARS & TBCs		
LOCATION:	16SS01	16SS02	16SS03	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI					
MISCELLANEOUS								
moisture %	12.2	12.9	34.3			-	-	-
pH	7.9	5.4	6.6			-	-	-
petroleum hydrocarbons **mg/kg**	1300 J	2900 J	20000 E J			10000 @	10000 @	-

TABLE 18-6b
COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

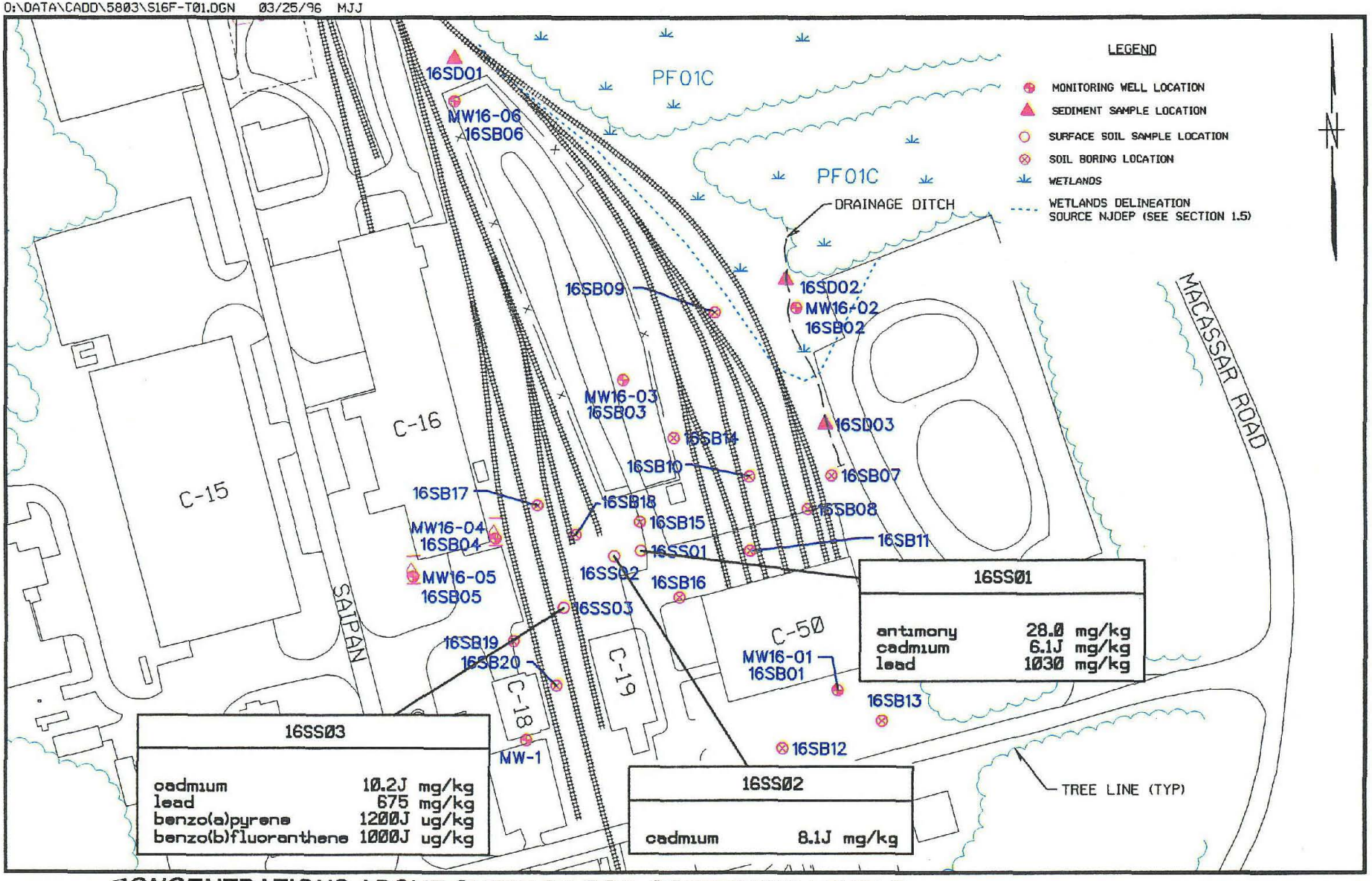
E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

O:\DATA\CADD\5803\S16F-T01.DGN 03/25/96 MJJ



CONCENTRATIONS ABOVE SURFACE SOIL SCREENING LEVELS

SITE 16 AND EPIC SITE F

0 150 300

SCALE IN FEET

FIGURE 18-5

Brown & Root Environmental

4,4'-DDT (43 ug/kg to 420 ug/kg) and 4,4'-DDE (16 ug/kg to 330 ug/kg) were each detected in two background surface soil samples. These pesticides were detected at similar levels in site-related surface soil samples, from 38 ug/kg to 230 ug/kg for 4,4'-DDT and 15 ug/kg to 120 ug/kg for 4,4'-DDE. Other pesticides including 4',4'-DDD (360 ug/kg), alpha-BHC (0.047 ug/kg to 0.13 ug/kg), alpha-chlordane (33 ug/kg), heptachlor epoxide (0.39 ug/kg), and gamma-chlordane (1.7 ug/kg to 35 ug/kg) were also detected in surface soil samples collected at Site 16.

18.5.1.3 Miscellaneous Parameters

Three surface soil samples for Site 16 were analyzed for moisture, pH, and TPH. All samples contained TPH concentrations exceeding maximum background levels. Sample 16 SS 03 contained the highest level of TPH (20,000 mg/kg). TPH in background surface soils ranged from 9 mg/kg to 110 mg/kg. Miscellaneous parameters results are presented in Appendix A.

18.5.2 Subsurface Soils

Thirty-two site-related subsurface soil samples were collected at Site 16 (locations 16 SB 01 through 16 SB 20 in Figure 18-2) at varying depths of up to 9 feet. Tables 18-8 and 18-9 present the occurrence and distribution of inorganic and organic chemicals detected in site-related subsurface soil samples and compare them to background. Tables 18-8a and 18-8b present a comparison of detected compounds to ARARs and TBCs. Figure 18-6 shows sample locations and concentrations of compounds which exceed ARARs and TBCs and for purposes of illustrating the extent of contamination, TPH concentration above 10,000 mg/kg.

18.5.2.1 Inorganics

Concentrations of most metals in site-related samples were within the range of background. Concentrations of chromium were slightly greater than background in samples 16 SB 05-08 and 16 SB 20-06.

18.5.2.2 Organics

Fluoranthene (40 ug/kg to 84 ug/kg) and pyrene (46 ug/kg) were detected in background subsurface soil samples. PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(k)fluoranthene, Table 18-8 dibenzofuran, fluoranthene, fluorene, naphthalene, and pyrene were detected in numerous site-related subsurface soil samples at a range from 41 ug/kg to 220,000 ug/kg. 2-Methylnaphthalene was generally the PAH present at the highest concentration, followed by naphthalene (both PAHs are prevalent in diesel fuel). These PAHs were found at the highest levels (over 30,000 ug/kg) near the area where monitoring wells containing free product are located (within a region bounded by Buildings C-16, C-18, and C-19, close to the location of a former leaking underground diesel line). Samples exhibiting individual PAHs at

TABLE 18-8
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOIL AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5370.00	32 / 32	378 - 4180	2556.31	NO	3158.75
ARSENIC	8 / 8	1.35 - 14.4	13.29	31 / 32	1.2 - 20.3	5.81	NO	7.10
BARIUM	8 / 8	0.92 - 31	17.92	32 / 32	1.2 - 13.8	3.72	NO	4.45
BERYLLIUM	2 / 8	0.12 - 0.28	0.28	31 / 32	0.039 - 0.61	0.25	NO	0.30
CADMIUM	1 / 8	0.57	0.58	19 / 32	0.086 - 1.3	0.35	NO	0.47
CALCIUM	8 / 8	28.6 - 799	577.55	32 / 32	34.5 - 1570	299.60	NO	400.95
CHROMIUM	8 / 8	4.7 - 59.5	54.73	32 / 32	4.1 - 166	71.08	YES	150.53
COBALT	4 / 8	0.75 - 5	2.77	6 / 32	0.13 - 0.75	0.34	NO	0.39
COPPER	8 / 8	0.97 - 8.6	8.66	32 / 32	1.2 - 28	3.26	NO	4.65
IRON	8 / 8	3745 - 62500	40871.25	32 / 32	1160 - 18000	9410.47	NO	13157.99
LEAD	8 / 8	1.4 - 39.4	24.33	32 / 32	2.15 - 70.7	8.39	NO	13.00
MAGNESIUM	8 / 8	18.5 - 619	504.05	32 / 32	39.8 - 1030	348.20	NO	422.81
MANGANESE	8 / 8	2.6 - 214	92.51	25 / 32	0.77 - 31.8	4.24	NO	6.03
MERCURY	8 / 8	0.03 - 0.17	0.13	25 / 32	0.0051 - 0.048	0.02	NO	0.02
NICKEL	4 / 8	1.8 - 7.2	4.75	21 / 32	0.56 - 3.3	1.13	NO	1.34
POTASSIUM	7 / 8	95 - 792	793.35	32 / 32	70.5 - 2530	899.52	YES	1120.44
SELENIUM	2 / 8	0.57 - 0.93	0.79	1 / 32	1	0.52	NO	0.54
SILVER	2 / 8	0.37 - 0.67	0.51	2 / 32	0.31 - 1.1	0.25	NO	0.30
SODIUM	8 / 8	17.5 - 94.8	79.35	31 / 32	18.3 - 292	61.72	NO	85.61
THALLIUM	4 / 8	0.7 - 1.9	1.38	9 / 32	0.86 - 1.6	0.64	NO	0.76
VANADIUM	8 / 8	11.05 - 64	64.71	32 / 32	4.4 - 79.6	40.86	NO	68.01
ZINC	6 / 8	1.1 - 50.7	31.35	32 / 32	1.8 - 29.6	6.49	NO	8.05

Note: Selected COPCs are indicated in boldface type.

TABLE 18-9
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,2-DICHLOROETHENE (TOTAL)	NOT DETECTED	-	-	2 / 32	17 - 96	96
2-BUTANONE	NOT DETECTED	-	-	2 / 32	5 - 8	8
BENZENE	NOT DETECTED	-	-	3 / 32	300 - 1300	225.78
CARBON DISULFIDE	NOT DETECTED	-	-	1 / 32	2	2
ETHYLBENZENE	NOT DETECTED	-	-	13 / 32	13 - 16000	2523.90
METHYLENE CHLORIDE	NOT DETECTED	-	-	17 / 32	2 - 150	150
TETRACHLOROETHENE	NOT DETECTED	-	-	6 / 32	6 - 45	45
TOLUENE	NOT DETECTED	-	-	4 / 32	190 - 770	181.35
TRICHLOROETHENE	NOT DETECTED	-	-	1 / 32	3	3
XYLENE (TOTAL)	NOT DETECTED	-	-	14 / 32	8 - 92000	12066.53
2-METHYLNAPHTHALENE	NOT DETECTED	-	-	15 / 32	2200 - 220000	45515.08
ACENAPHTHENE	NOT DETECTED	-	-	12 / 32	160 - 11000	2774.14
ANTHRACENE	NOT DETECTED	-	-	8 / 32	78 - 3900	2015.77
BENZO(A)ANTHRACENE	NOT DETECTED	-	-	2 / 32	41 - 43	43
BENZO(A)PYRENE	NOT DETECTED	-	-	2 / 32	41 - 43	43
BENZO(K)FLUORANTHENE	NOT DETECTED	-	-	2 / 32	39 - 46	46
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	4 / 32	67 - 1400	1400
CHRYSENE	NOT DETECTED	-	-	3 / 32	55 - 57	57
DIBENZOFURAN	NOT DETECTED	-	-	8 / 32	1300 - 7800	4548.25
DIETHYLPHTHALATE	NOT DETECTED	-	-	3 / 32	38 - 73	73
FLUORANTHENE	2 / 8	40 - 84	84	5 / 32	49 - 140	140
FLUORENE	NOT DETECTED	-	-	13 / 32	320 - 18000	4160.62
NAPHTHALENE	NOT DETECTED	-	-	13 / 32	290 - 60000	11992.62
PHENANTHRENE	NOT DETECTED	-	-	18 / 32	46 - 31000	7208.28
PYRENE	1 / 8	46	46	8 / 32	86 - 2800	2414.98
4,4'-DDD	NOT DETECTED	-	-	2 / 9	2.1 - 26	9.54
4,4'-DDE	2 / 8	16 - 330	121.91	4 / 8	1.8 - 11	6.61
4,4'-DDT	2 / 8	43 - 420	157.34	7 / 9	6 - 20	20
ALPHA-CHLORDANE	NOT DETECTED	-	-	1 / 9	3.7	1.82
AROCLOR-1254	NOT DETECTED	-	-	1 / 32	10	10
ENDOSULFAN I	NOT DETECTED	-	-	1 / 8	9.9	4.18
ENDOSULFAN II	NOT DETECTED	-	-	1 / 9	41	14.28
GAMMA-CHLORDANE	NOT DETECTED	-	-	4 / 7	0.39 - 3.3	1.94
HEPTACHLOR	NOT DETECTED	-	-	1 / 9	0.27	0.27
HEPTACHLOR EPOXIDE	NOT DETECTED	-	-	2 / 8	0.49 - 7.8	3.39

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB01-06	16SB02-04	16SB03-02	16SB03-06	16SB04-08	16SB04-08-DUP	ARARS & TBCs		
LOCATION:	16SB01	16SB02	16SB03	16SB03	16SB04	16SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	2980	3170	378	2690	3180	2330	-	-	-
arsenic	8.3	11.3	0.73 U	6.1	7.8	8.0	20.0	20.0	-
barium	2.4	1.2	4.5	2.1	1.5	1.3	700	47000	-
beryllium	0.47	0.28	0.024 U	0.19	0.37	0.22	1.00	1.00	-
cadmium	0.92	1.3 E	0.10	0.86	1.0	1.0	1.00	100	-
calcium	216	58.4	98.5	111	261	215	-	-	-
chromium, total	111	125	5.5	93.2	90.9	92.2	-	500	-
cobalt	0.70 U	0.72 U	0.13	0.29	0.69 U	0.70 U	-	-	-
copper	2.0	1.9	1.5	2.1	1.4	1.4	600	600	-
iron	12100	18000	1160	11800	12700	12200	-	-	-
lead	3.3	4.3 J	70.7	4.0	3.8 J	4.8 J	400	600	-
magnesium	532	317	40.8	200	464	286	-	-	-
manganese	0.67 U	0.70 U	3.5	2.2	0.67 U	0.68 U	-	-	-
mercury	0.032 J	0.018 J	0.0022 U	0.0023 U	0.0067 UJ	0.010 J	14.0	270	-
nickel	1.0	1.1 U	0.56	1.0	1.0 U	1.0 U	250	2400	-
potassium	1730	1050	91.2	615	1580	973	-	-	-
selenium	1.0 U	1.1 U	1.0 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.49 U	0.50 U	0.21 U	0.22 U	0.49 U	0.49 U	110	4100	-
sodium	282	188	41.7	97.4	21.5	23.0	-	-	-
thallium	0.86 J	1.6 J	0.79 U	0.88	1.5 J	1.4 J	2.00	2.00	-
vanadium	58.7	79.6	6.0	59.2	47.4	47.0	370	7100	-
zinc	7.0 J	6.7 J	3.0 J	3.8 J	6.8 J	7.0 J	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	380 U	400 U	360 U	390 U	130000	170000	-	-	-
acenaphthene	380 U	400 U	360 U	390 U	6900 J	8200 J	3400000	10000000	100000
anthracene	380 U	400 U	360 U	390 U	2300 J	2800 J	10000000	10000000	100000
benzo(a)anthracene	380 U	400 U	360 U	390 U	12000 U	12000 U	900	4000	500000
benzo(a)pyrene	380 U	400 U	360 U	390 U	12000 U	12000 U	660	660	100000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB01-06		16SB02-04		16SB03-02		16SB03-06		16SB04-08		16SB04-08-DUP		ARARS & TBCs		
LOCATION:	16SB01		16SB02		16SB03		16SB03		16SB04		16SB04		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	380	U	400	U	360	U	390	U	12000	U	12000	U	900	4000	50000
benzo(k)fluoranthene	380	U	400	U	360	U	390	U	12000	U	12000	U	900	4000	500000
bis(2-ethylhexyl)phthalate	380	UJ	400	UJ	140	J	150	UJ	12000	UJ	12000	UJ	49000	210000	100000
chrysene	380	U	400	U	360	U	390	U	12000	U	12000	U	9000	40000	500000
dibenzofuran	380	U	400	U	360	U	390	U	5200	J	5900	J	-	-	-
diethylphthalate	380	U	400	U	360	U	390	U	12000	U	12000	U	10000000	10000000	50000
fluoranthene	380	U	400	U	360	U	390	U	12000	U	12000	U	2300000	10000000	100000
fluorene	380	U	400	U	360	U	390	U	13000		13000		2300000	10000000	100000
naphthalene	380	U	400	U	360	U	390	U	39000		42000		230000	4200000	100000
phenanthrene	380	U	400	U	360	U	390	U	21000		24000		-	-	-
phenol	380	U	400	U	360	U	390	U	12000	U	12000	U	10000000	10000000	50000
pyrene	380	U	400	U	360	U	390	U	1600	J	1800	J	1700000	10000000	100000
VOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	12.0	U	12.0	U	11.0	U	12.0	U	17.0	J	5800	U	79000	1000000	1000
2-butanone	12.0	U	12.0	U	11.0	U	12.0	U	58.0	UJ	5800	U	1000000	1000000	50000
benzene	12.0	U	12.0	U	11.0	U	12.0	U	300	J	5800	U	3000	13000	1000
carbon disulfide	12.0	UJ	12.0	U	11.0	UJ	12.0	UJ	58.0	UJ	5800	U	-	-	-
ethylbenzene	12.0	U	12.0	U	11.0	U	12.0	U	6300		9600		1000000	1000000	100000
methylene chloride	12.0	U	12.0	U	11.0	J	12.0	J	58.0	UJ	5800	U	49000	210000	1000
tetrachloroethene	12.0	U	12.0	U	11.0	U	12.0	U	58.0	UJ	5800	U	4000	6000	1000
toluene	12.0	U	12.0	U	11.0	U	12.0	U	620	J	5800	U	1000000	1000000	500000
trichloroethene	12.0	U	12.0	U	11.0	U	12.0	U	58.0	UJ	5800	U	23000	54000	1000
xylene (total)	12.0	U	12.0	U	11.0	U	12.0	U	36000	E	52000	E	410000	1000000	10000
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	n/a		4.0	U	n/a		n/a		n/a		n/a		3000	12000	50000
4,4'-DDE	n/a		4.0	U	n/a		n/a		n/a		n/a		2000	9000	50000
4,4'-DDT	n/a		4.0	U	n/a		n/a		n/a		n/a		2000	9000	500000
Aroclor-1254	38.0	U	40.0	U	36.0	U	39.0	U	38.0	U	38.0	U	490	2000	50000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB01-06	16SB02-04	16SB03-02	16SB03-06	16SB04-08	16SB04-08-DUP	ARARS & TBCs		
LOCATION:	16SB01	16SB02	16SB03	16SB03	16SB04	16SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
aldrin	n/a	2.0 U	n/a	n/a	n/a	n/a	40.0	170	50000
alpha-BHC	n/a	2.0 U	n/a	n/a	n/a	n/a	-	-	-
alpha-chlordane	n/a	2.0 U	n/a	n/a	n/a	n/a	-	-	-
dieldrin	n/a	4.0 U	n/a	n/a	n/a	n/a	42.0	180	50000
endosulfan I	n/a	2.0 U	n/a	n/a	n/a	n/a	340000	6200000	50000
endosulfan II	n/a	4.0 U	n/a	n/a	n/a	n/a	340000	6200000	50000
endrin	n/a	4.0 U	n/a	n/a	n/a	n/a	17000	310000	50000
endrin aldehyde	n/a	4.0 U	n/a	n/a	n/a	n/a	-	-	-
gamma-BHC (Lindane)	n/a	2.0 U	n/a	n/a	n/a	n/a	520	2200	50000
gamma-chlordane	n/a	2.0 U	n/a	n/a	n/a	n/a	-	-	-
heptachlor	n/a	2.0 U	n/a	n/a	n/a	n/a	150	650	50000
heptachlor epoxide	n/a	2.0 U	n/a	n/a	n/a	n/a	-	-	-

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB04-10	16SB05-06	16SB05-08	16SB06-02	16SB06-06	16SB07-04	ARARS & TBCs		
LOCATION:	16SB04	16SB05	16SB05	16SB06	16SB06	16SB07	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	2480	1730	3470	1240	1310	3990	-	-	-
arsenic	9.3	8.5	20.3 E	2.8	1.7	7.2	20.0	20.0	-
barium	1.3	1.9	2.7	5.4	4.1	4.4	700	47000	-
beryllium	0.17	0.081	0.34	0.11	0.10	0.46	1.00	1.00	-
cadmium	1.0	0.81	1.3 E	0.28	0.31	0.086 U	1.00	100	-
calcium	113	410	261	129	102	226	-	-	-
chromium, total	103	86.3	158	18.3	12.5	94.7	-	500	-
cobalt	0.72 U	0.22	0.36	0.70 U	0.69 U	0.68 U	-	-	-
copper	1.4	2.1	2.3	3.0	2.6	3.0	600	600	-
iron	12300	11000	17800	3340	2600	13500	-	-	-
lead	2.7	3.1	4.0	7.8 J	6.6 J	5.5	400	600	-
magnesium	284	182	468	84.7	87.2	638	-	-	-
manganese	0.69 U	3.2	0.82	2.1	4.6	2.8	-	-	-
mercury	0.0071 J	0.0051	0.0023 U	0.045 J	0.033 J	0.041 J	14.0	270	-
nickel	1.1 U	0.60	1.3	1.0 U	1.0 U	2.1	250	2400	-
potassium	986	518	1470	147	180	1720 J	-	-	-
selenium	1.1 U	1.0 J	1.0 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.50 U	0.21 U	0.22 U	0.49 U	0.48 U	0.48 U	110	4100	-
sodium	32.3	13.6 U	26.2	25.6	23.9	26.8	-	-	-
thallium	0.86 U	0.81 U	0.83 U	1.2 J	1.3 J	0.82 U	2.00	2.00	-
vanadium	53.4	53.3	72.7	15.3	9.5	61.2	370	7100	-
zinc	5.3 J	3.2 J	7.0 J	11.4 J	7.6 J	7.9 J	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	220000	36000	140000	390 U	380 U	380 U	-	-	-
acenaphthene	11000 J	2200 J	8900 J	390 U	380 U	380 U	3400000	10000000	100000
anthracene	3900 J	11000 U	2700 J	390 U	380 U	380 U	10000000	10000000	100000
benzo(a)anthracene	12000 U	11000 U	11000 U	390 U	380 U	380 U	900	4000	500000
benzo(a)pyrene	12000 U	11000 U	11000 U	390 U	380 U	380 U	660	660	100000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB04-10	16SB05-06	16SB05-08	16SB06-02	16SB06-06	16SB07-04	ARARS & TBCs		
LOCATION:	16SB04	16SB05	16SB05	16SB06	16SB06	16SB07	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	12000 U	11000 U	11000 U	390 U	380 U	380 U	900	4000	50000
benzo(k)fluoranthene	12000 U	11000 U	11000 U	390 U	380 U	380 U	900	4000	500000
bis(2-ethylhexyl)phthalate	12000 U	11000 UJ	11000 UJ	390 UJ	380 UJ	380 U	49000	210000	100000
chrysene	12000 U	11000 U	11000 U	56.0 J	380 U	380 U	9000	40000	500000
dibenzofuran	7800 J	1300 J	5400 J	390 U	380 U	380 U	-	-	-
diethylphthalate	12000 U	11000 U	11000 U	390 U	380 U	380 U	10000000	10000000	50000
fluoranthene	12000 U	11000 U	11000 U	49.0 J	380 U	380 U	2300000	10000000	100000
fluorene	18000	3300 J	13000	390 U	380 U	380 U	2300000	10000000	100000
naphthalene	60000	8000 J	40000	390 U	380 U	380 U	230000	4200000	100000
phenanthrene	31000	6400 J	26000	50.0 J	380 U	380 U	-	-	-
phenol	12000 U	11000 U	11000 U	390 U	380 U	380 U	10000000	10000000	50000
pyrene	2800 J	11000 U	1400 J	390 U	380 U	380 U	1700000	10000000	100000
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	1500 U	11.0 U	1400 U	12.0 U	11.0 U	11.0 U	79000	1000000	1000
2-butanone	1500 U	5.0 J	1400 U	12.0 U	11.0 U	11.0 UJ	1000000	1000000	50000
benzene	1300 E J	11.0 U	1400 U	12.0 U	11.0 U	11.0 U	3000	13000	1000
carbon disulfide	1500 U	11.0 UJ	1400 U	12.0 U	11.0 U	11.0 U	-	-	-
ethylbenzene	16000	24.0	4100	12.0 U	11.0 U	11.0 U	1000000	1000000	100000
methylene chloride	1500 U	11.0 J	1400 U	12.0 U	11.0 U	7.0 J	49000	210000	1000
tetrachloroethene	1500 U	11.0 U	1400 U	12.0 U	11.0 U	6.0 J	4000	6000	1000
toluene	770 J	11.0 U	190 J	12.0 U	11.0 U	11.0 U	1000000	1000000	500000
trichloroethene	1500 U	11.0 U	1400 U	12.0 U	11.0 U	11.0 U	23000	54000	1000
xylene (total)	92000 E	70.0	9600	12.0 U	11.0 U	11.0 U	410000	1000000	10000
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	n/a	n/a	n/a	n/a	n/a	n/a	3000	12000	50000
4,4'-DDE	n/a	n/a	n/a	n/a	n/a	n/a	2000	9000	50000
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	2000	9000	500000
Aroclor-1254	39.0 U	37.0 U	38.0 U	39.0 U	38.0 U	37.0 U	490	2000	50000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB04-10	16SB05-06	16SB05-08	16SB06-02	16SB06-06	16SB07-04	ARARS & TBCs		
LOCATION:	16SB04	16SB05	16SB05	16SB06	16SB06	16SB07	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
aldrin	n/a	n/a	n/a	n/a	n/a	n/a	40.0	170	50000
alpha-BHC	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
alpha-chlordane	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
dieldrin	n/a	n/a	n/a	n/a	n/a	n/a	42.0	180	50000
endosulfan I	n/a	n/a	n/a	n/a	n/a	n/a	340000	6200000	50000
endosulfan II	n/a	n/a	n/a	n/a	n/a	n/a	340000	6200000	50000
endrin	n/a	n/a	n/a	n/a	n/a	n/a	17000	310000	50000
endrin aldehyde	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
gamma-BHC (Lindane)	n/a	n/a	n/a	n/a	n/a	n/a	520	2200	50000
gamma-chlordane	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
heptachlor	n/a	n/a	n/a	n/a	n/a	n/a	150	650	50000
heptachlor epoxide	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB08-06	16SB09-00	16SB09-06	16SB10-00	16SB10-04	16SB11-09	ARARS & TBCs		
LOCATION:	16SB08	16SB09	16SB09	16SB10	16SB10	16SB11	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	4110	914	2130	1680	1770	4180	-	-	-
arsenic	11.3	1.8	3.7	2.1	3.0	5.3	20.0	20.0	-
barium	3.6	4.2	1.5	13.8	2.4	6.9	700	47000	-
beryllium	0.49	0.12	0.10	0.068	0.10	0.52	1.00	1.00	-
cadmium	0.090 U	0.32	0.66	0.30	0.085 U	0.090 U	1.00	100	-
calcium	297	72.7	34.5	1570 J	105	1240 J	-	-	-
chromium, total	123	5.6	68.4	22.5	34.3	96.5	-	500	-
cobalt	0.71 U	0.67 U	0.74 U	0.68 U	0.67 U	0.71 U	-	-	-
copper	2.9	6.6	1.2	28.0	1.7	2.8	600	600	-
iron	16600	3760	8730	4450	4930	12500	-	-	-
lead	3.7	6.6 J	2.4	62.2	3.3	3.6	400	600	-
magnesium	526	39.8	104	865	153	1030	-	-	-
manganese	0.69 U	4.1	0.71 U	31.8	3.5	3.9	-	-	-
mercury	0.0082 J	0.028 J	0.017 J	0.024 J	0.013 J	0.013 J	14.0	270	-
nickel	1.5	1.0 U	1.1 U	2.5	1.0 U	2.1	250	2400	-
potassium	1670 J	111	297	234	389	1990 J	-	-	-
selenium	1.0 U	1.0 U	1.1 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.50 U	0.47 U	0.51 U	0.48 U	0.47 U	0.49 U	110	4100	-
sodium	18.3	23.1	25.6	21.1	20.0	27.9	-	-	-
thallium	0.85 U	0.81 U	1.4 J	0.82 U	0.80 U	0.85 U	2.00	2.00	-
vanadium	79.1	5.5	31.4	17.1	26.8	59.9	370	7100	-
zinc	4.2 J	2.9 J	1.8 J	12.2 J	2.9 J	8.3 J	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	390 U	2600	400 U	5800 J	370 U	390 U	-	-	-
acenaphthene	390 U	370 U	400 U	11000 U	370 U	390 U	3400000	10000000	100000
anthracene	390 U	370 U	400 U	11000 U	370 U	390 U	10000000	10000000	100000
benzo(a)anthracene	390 U	370 U	400 U	11000 U	370 U	390 U	900	4000	500000
benzo(a)pyrene	390 U	370 U	400 U	11000 U	370 U	390 U	660	660	100000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB08-06		16SB09-00		16SB09-06		16SB10-00		16SB10-04		16SB11-09		ARARS & TBCs		
LOCATION:	16SB08		16SB09		16SB09		16SB10		16SB10		16SB11		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	390	U	370	U	400	U	11000	U	370	U	390	U	900	4000	50000
benzo(k)fluoranthene	390	U	370	U	400	U	11000	U	370	U	390	U	900	4000	500000
bis(2-ethylhexyl)phthalate	390	U	370	UJ	400	UJ	1400	J	370	U	560	U	49000	210000	100000
chrysene	390	U	370	U	400	U	11000	U	370	U	390	U	9000	40000	500000
dibenzofuran	390	U	370	U	400	U	11000	U	370	U	390	U	-	-	-
diethylphthalate	390	U	370	U	400	U	11000	U	38.0	J	390	U	10000000	10000000	50000
fluoranthene	390	U	370	U	400	U	11000	U	370	U	390	U	2300000	10000000	100000
fluorene	390	U	370	U	400	U	11000	U	370	U	390	U	2300000	10000000	100000
naphthalene	390	U	430		400	U	11000	U	370	U	390	U	230000	4200000	100000
phenanthrene	390	U	46.0	J	400	U	2000	J	370	U	390	U	-	-	-
phenol	42.0	J	370	U	400	U	11000	U	52.0	J	49.0	J	10000000	10000000	50000
pyrene	390	U	370	U	400	U	11000	U	370	U	390	U	1700000	10000000	100000
VOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	12.0	U	56.0	U	12.0	U	57.0	U	11.0	U	12.0	U	79000	1000000	1000
2-butanone	12.0	UJ	56.0	U	12.0	U	57.0	U	11.0	U	12.0	UJ	1000000	1000000	50000
benzene	12.0	U	56.0	U	12.0	U	57.0	U	11.0	U	12.0	U	3000	13000	1000
carbon disulfide	12.0	U	56.0	U	12.0	U	57.0	U	11.0	U	12.0	U	-	-	-
ethylbenzene	12.0	U	97.0		12.0	U	57.0	UJ	11.0	U	12.0	U	1000000	1000000	100000
methylene chloride	5.0	J	56.0	U	12.0	U	10.0	J	4.0	J	4.0	J	49000	210000	1000
tetrachloroethene	12.0	U	56.0	U	12.0	U	7.0	J	11.0	U	12.0	U	4000	6000	1000
toluene	12.0	U	56.0	U	12.0	U	57.0	UJ	11.0	U	12.0	U	1000000	1000000	500000
trichloroethene	12.0	U	56.0	U	12.0	U	57.0	U	11.0	U	12.0	U	23000	54000	1000
xylene (total)	12.0	U	96.0		12.0	U	11.0	J	11.0	U	12.0	U	410000	1000000	10000
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	n/a		3.7	U	n/a		3.7	U	n/a		n/a		3000	12000	50000
4,4'-DDE	n/a		3.7	U	n/a		8.5	R	n/a		n/a		2000	9000	50000
4,4'-DDT	n/a		6.0		n/a		3.7	U	n/a		n/a		2000	9000	500000
Aroclor-1254	39.0	U	37.0	U	10.0	J	37.0	U	37.0	U	39.0	U	490	2000	50000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB08-06	16SB09-00		16SB09-06	16SB10-00		16SB10-04	16SB11-09	ARARS & TBCs		
LOCATION:	16SB08	16SB09		16SB09	16SB10		16SB10	16SB11	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI		1995 RI	1995 RI		1995 RI	1995 RI			
PESTICIDES	**ug/kg**	**ug/kg**		**ug/kg**	**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
aldrin	n/a	1.9	U	n/a	1.4	R	n/a	n/a	40.0	170	50000
alpha-BHC	n/a	1.9	U	n/a	0.26	R	n/a	n/a	-	-	-
alpha-chlordane	n/a	1.9	U	n/a	1.9	U	n/a	n/a	-	-	-
dieldrin	n/a	3.7	U	n/a	0.77	R	n/a	n/a	42.0	180	50000
endosulfan I	n/a	1.9	U	n/a	9.9		n/a	n/a	340000	6200000	50000
endosulfan II	n/a	3.7	U	n/a	41.0		n/a	n/a	340000	6200000	50000
endrin	n/a	3.7	U	n/a	3.7	U	n/a	n/a	17000	310000	50000
endrin aldehyde	n/a	3.7	U	n/a	25.0	R	n/a	n/a	-	-	-
gamma-BHC (Lindane)	n/a	0.088	R	n/a	0.40	R	n/a	n/a	520	2200	50000
gamma-chlordane	n/a	1.9	U	n/a	0.91	R	n/a	n/a	-	-	-
heptachlor	n/a	1.9	U	n/a	1.9	U	n/a	n/a	150	650	50000
heptachlor epoxide	n/a	1.9	U	n/a	7.8		n/a	n/a	-	-	-

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB12-02	16SB12-06	16SB13-02	16SB13-06	16SB14-04	16SB15-06	ARARS & TBCs		
LOCATION:	16SB12	16SB12	16SB13	16SB13	16SB14	16SB15	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	1780	1730	1810	1430	3600	3170	-	-	-
arsenic	1.2	1.9	1.5	2.1	5.5	9.9	20.0	20.0	-
barium	6.6	3.3	5.5	4.9	4.9	2.6	700	47000	-
beryllium	0.039	0.15	0.14	0.14	0.22	0.31	1.00	1.00	-
cadmium	0.19	0.42	0.31	0.43	0.087 U	0.086 U	1.00	100	-
calcium	439	784	216	550	128	154	-	-	-
chromium, total	4.1	55.3	4.9	32.6	58.9	105	-	500	-
cobalt	0.40	0.14 U	0.63 U	0.67 U	0.69 U	0.68 U	-	-	-
copper	3.0	1.5	4.2	3.4	2.5	2.8	600	600	-
iron	1890	5620	3210	4430	10200	13900	-	-	-
lead	9.1	3.6	8.2 J	6.9 J	5.3	3.7	400	600	-
magnesium	175	364	162	254	253	397	-	-	-
manganese	12.1	7.1	10.7	9.9	3.2	3.8	-	-	-
mercury	0.013	0.0023 U	0.025 J	0.048 J	0.014 J	0.0073 UJ	14.0	270	-
nickel	1.4	0.72	1.1	1.0 U	1.2	1.0	250	2400	-
potassium	74.5	353	70.5	249	721	1240 J	-	-	-
selenium	1.0 U	1.0 U	0.93 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.31	0.21 U	0.44 U	1.1	0.48 U	0.47 U	110	4100	-
sodium	55.9	23.7	48.4	32.7	26.4	188	-	-	-
thallium	0.78 U	1.1	1.4 J	0.81 U	0.83 U	0.81 U	2.00	2.00	-
vanadium	4.4	27.0	5.0	18.2	41.2	61.1	370	7100	-
zinc	12.5 J	3.5 J	29.6 J	12.4 J	5.8 J	5.1 J	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	350 U	4900	350 U	2200	380 U	370 U	-	-	-
acenaphthene	350 U	240 J	350 U	160 J	380 U	370 U	3400000	10000000	100000
anthracene	350 U	380 U	350 U	78.0 J	380 U	370 U	10000000	10000000	100000
benzo(a)anthracene	43.0 J	380 U	350 U	41.0 J	380 U	370 U	900	4000	500000
benzo(a)pyrene	43.0 J	380 U	350 U	41.0 J	380 U	370 U	660	660	100000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB12-02		16SB12-06		16SB13-02		16SB13-06		16SB14-04		16SB15-06		ARARS & TBCs		
LOCATION:	16SB12		16SB12		16SB13		16SB13		16SB14		16SB15		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	38.0	J	380	U	350	U	40.0	J	380	U	370	U	900	4000	50000
benzo(k)fluoranthene	46.0	J	380	U	350	U	39.0	J	380	U	370	U	900	4000	500000
bis(2-ethylhexyl)phthalate	67.0	J	110	J	350	UJ	370	U	380	U	370	U	49000	210000	100000
chrysene	55.0	J	380	U	350	U	57.0	J	380	U	370	U	9000	40000	500000
dibenzofuran	350	U	380	U	350	U	370	U	380	U	370	U	-	-	-
diethylphthalate	350	U	380	U	350	U	370	U	73.0	J	370	U	10000000	10000000	50000
fluoranthene	110	J	380	U	350	U	140	J	380	U	370	U	2300000	10000000	100000
fluorene	350	U	610		350	U	320	J	380	U	370	U	2300000	10000000	100000
naphthalene	350	U	810		350	U	290	J	380	U	370	U	230000	4200000	100000
phenanthrene	65.0	J	1000		350	U	600		380	U	370	U	-	-	-
phenol	350	U	380	U	350	U	370	U	380	U	370	U	10000000	10000000	50000
pyrene	86.0	J	120	J	350	U	110	J	380	U	370	U	1700000	10000000	100000
VOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	11.0	U	11.0	U	10.0	U	11.0	U	96.0		11.0	U	79000	1000000	1000
2-butanone	11.0	U	11.0	U	10.0	U	11.0	U	11.0	UJ	8.0	J	1000000	1000000	50000
benzene	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	3000	13000	1000
carbon disulfide	11.0	UJ	11.0	UJ	10.0	UJ	11.0	UJ	11.0	U	11.0	U	-	-	-
ethylbenzene	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	1000000	1000000	100000
methylene chloride	11.0	J	11.0	J	10.0	U	11.0	U	11.0	U	2.0	J	49000	210000	1000
tetrachloroethene	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	4000	6000	1000
toluene	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	1000000	1000000	500000
trichloroethene	11.0	U	11.0	U	10.0	U	11.0	U	3.0	J	11.0	U	23000	54000	1000
xylene (total)	11.0	U	11.0	U	10.0	U	11.0	U	11.0	U	11.0	U	410000	1000000	10000
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	2.1	NJ	n/a		3.5	U	3.7	U	26.0		n/a		3000	12000	50000
4,4'-DDE	11.0		n/a		5.6		7.9		1.8	J	n/a		2000	9000	50000
4,4'-DDT	16.0		n/a		6.3		20.0		8.2		n/a		2000	9000	500000
Aroclor-1254	35.0	U	37.0	U	35.0	U	37.0	U	38.0	U	37.0	U	490	2000	50000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB12-02		16SB12-06	16SB13-02		16SB13-06		16SB14-04		16SB15-06	ARARS & TBCs		
LOCATION:	16SB12		16SB12	16SB13		16SB13		16SB14		16SB15	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI	1995 RI		1995 RI		1995 RI		1995 RI			
PESTICIDES	**ug/kg**		**ug/kg**	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
aldrin	1.8	U	n/a	1.8	U	1.9	U	2.0	U	n/a	40.0	170	50000
alpha-BHC	0.032	R	n/a	1.8	U	1.9	U	2.0	U	n/a	-	-	-
alpha-chlordane	3.7		n/a	1.8	U	1.9	U	2.0	U	n/a	-	-	-
dieldrin	3.6		n/a	2.9	J	3.7	U	3.8	U	n/a	42.0	180	50000
endosulfan I	1.8	U	n/a	1.8	U	1.9	U	2.0	U	n/a	340000	6200000	50000
endosulfan II	3.5	U	n/a	3.5	U	3.7	U	3.8	U	n/a	340000	6200000	50000
endrin	3.5	U	n/a	3.5	U	3.7	U	3.8	U	n/a	17000	310000	50000
endrin aldehyde	3.5	U	n/a	3.5	U	3.7	U	3.8	U	n/a	-	-	-
gamma-BHC (Lindane)	1.8	U	n/a	1.8	U	0.23	R	2.0	U	n/a	520	2200	50000
gamma-chlordane	3.3		n/a	1.1	J	1.1	J	0.39	J	n/a	-	-	-
heptachlor	0.27	J	n/a	1.8	U	1.9	U	2.0	U	n/a	150	650	50000
heptachlor epoxide	1.8	U	n/a	1.8	U	1.9	U	2.0	U	n/a	-	-	-

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB16-06	16SB16-06-DUP	16SB17-04	16SB17-04-DUP	16SB17-06	16SB18-02	ARARS & TBCs		
LOCATION:	16SB16	16SB16	16SB17	16SB17	16SB17	16SB18	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	2630	2540	3360	3700	3670	1460	-	-	-
arsenic	4.5	5.2	4.4	4.2	10.2	1.2	20.0	20.0	-
barium	2.0	2.0	4.2	4.5	1.4	6.0	700	47000	-
beryllium	0.32	0.26	0.30	0.35	0.61	0.11	1.00	1.00	-
cadmium	0.085 U	0.086 U	0.10	0.085 U	0.090 U	0.083 U	1.00	100	-
calcium	283	353	218	179	122	62.6	-	-	-
chromium, total	78.4	79.4	71.1	65.5	115	6.8	-	500	-
cobalt	0.67 U	0.68 U	0.68 U	0.67 U	0.71 U	0.75	-	-	-
copper	1.5	1.7	2.2	2.1	1.4	2.6	600	600	-
iron	9040	8530	9830	9790	15700	2860	-	-	-
lead	2.1	2.2	3.4	3.4	2.6	7.1	400	600	-
magnesium	437	365	371	486	727	52.4	-	-	-
manganese	1.0	1.2	8.4	8.2	2.2	5.5	-	-	-
mercury	0.0073 UJ	0.0074 J	0.032 J	0.028 J	0.0088 J	0.011 J	14.0	270	-
nickel	1.0 U	1.0 U	1.5	1.5	1.9	3.3	250	2400	-
potassium	1310 J	970	1140 J	1510 J	2530 J	141	-	-	-
selenium	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	63.0	3100	-
silver	0.47 U	0.48 U	0.47 U	0.47 U	0.49 U	0.46 U	110	4100	-
sodium	25.9	26.1	27.7	27.5	22.1	22.4	-	-	-
thallium	0.81 U	0.82 U	0.81 U	0.81 U	0.85 U	0.78 U	2.00	2.00	-
vanadium	48.1	48.9	43.4	39.9	63.6	5.7	370	7100	-
zinc	5.9 J	2.7 J	6.6 J	9.3 J	3.8 J	5.2 J	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	370 U	380 U	6600 J	8800	74000	11000 U	-	-	-
acenaphthene	370 U	380 U	11000 U	370 U	3000 J	1300 J	3400000	10000000	100000
anthracene	370 U	380 U	11000 U	400	1600 J	11000 U	10000000	10000000	100000
benzo(a)anthracene	370 U	380 U	11000 U	370 U	12000 U	11000 U	900	4000	500000
benzo(a)pyrene	370 U	380 U	11000 U	370 U	12000 U	11000 U	660	660	100000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB16-06		16SB16-06-DUP		16SB17-04		16SB17-04-DUP		16SB17-06		16SB18-02		ARARS & TBCs		
LOCATION:	16SB16		16SB16		16SB17		16SB17		16SB17		16SB18		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	370	U	380	U	11000	U	370	U	12000	U	11000	U	900	4000	50000
benzo(k)fluoranthene	370	U	380	U	11000	U	370	U	12000	U	11000	U	900	4000	500000
bis(2-ethylhexyl)phthalate	370	U	380	U	11000	UJ	370	U	12000	UJ	11000	UJ	49000	210000	100000
chrysene	370	U	380	U	11000	U	370	U	12000	U	11000	U	9000	40000	500000
dibenzofuran	370	U	380	U	11000	U	370	U	2200	J	11000	U	-	-	-
diethylphthalate	370	U	54.0	J	11000	U	370	U	12000	U	11000	U	10000000	10000000	50000
fluoranthene	370	U	380	U	11000	U	110	J	12000	U	11000	U	2300000	10000000	100000
fluorene	370	U	380	U	1100	J	370	U	5900	J	1600	J	2300000	10000000	100000
naphthalene	370	U	380	U	11000	U	370	U	13000		11000	U	230000	4200000	100000
phenanthrene	370	U	380	U	2800	J	4100		12000		2800	J	-	-	-
phenol	370	U	380	U	11000	U	370	U	12000	U	11000	U	10000000	10000000	50000
pyrene	370	U	380	U	11000	U	220	J	12000	U	11000	U	1700000	10000000	100000
VOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	11.0	U	11.0	U	11.0	U	56.0	U	1500	U	54.0	U	79000	1000000	1000
2-butanone	11.0	U	11.0	U	11.0	UJ	56.0	U	1500	U	54.0	U	1000000	1000000	50000
benzene	11.0	U	11.0	U	11.0	U	56.0	U	1500	U	54.0	U	3000	13000	1000
carbon disulfide	11.0	U	11.0	U	2.0	J	56.0	U	1500	U	54.0	U	-	-	-
ethylbenzene	11.0	U	11.0	U	42.0		47.0	J	2100		13.0	J	1000000	1000000	100000
methylene chloride	2.0	J	2.0	J	3.0	J	56.0	U	150	J	54.0	U	49000	210000	1000
tetrachloroethene	11.0	U	11.0	U	4.0	J	10.0	J	1500	U	45.0	J	4000	6000	1000
toluene	11.0	U	11.0	U	11.0	U	56.0	U	1500	U	54.0	U	1000000	1000000	500000
trichloroethene	11.0	U	11.0	U	11.0	U	56.0	U	1500	U	54.0	U	23000	54000	1000
xylene (total)	11.0	U	11.0	U	93.0		110		2000		8.0	J	410000	1000000	10000
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	n/a		n/a		n/a		n/a		n/a		3.6	U	3000	12000	50000
4,4'-DDE	n/a		n/a		n/a		n/a		n/a		3.6	U	2000	9000	50000
4,4'-DDT	n/a		n/a		n/a		n/a		n/a		7.4		2000	9000	500000
Aroclor-1254	37.0	U	37.0	U	37.0	U	37.0	U	39.0	U	36.0	U	490	2000	50000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB16-06	16SB16-06-DUP	16SB17-04	16SB17-04-DUP	16SB17-06	16SB18-02		ARARS & TBCs		
LOCATION:	16SB16	16SB16	16SB17	16SB17	16SB17	16SB18		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI				
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
aldrin	n/a	n/a	n/a	n/a	n/a	1.8	U	40.0	170	50000
alpha-BHC	n/a	n/a	n/a	n/a	n/a	0.20	R	-	-	-
alpha-chlordane	n/a	n/a	n/a	n/a	n/a	1.8	U	-	-	-
dieldrin	n/a	n/a	n/a	n/a	n/a	3.6	U	42.0	180	50000
endosulfan I	n/a	n/a	n/a	n/a	n/a	1.8	U	340000	6200000	50000
endosulfan II	n/a	n/a	n/a	n/a	n/a	3.6	U	340000	6200000	50000
endrin	n/a	n/a	n/a	n/a	n/a	0.29	R	17000	310000	50000
endrin aldehyde	n/a	n/a	n/a	n/a	n/a	3.6	U	-	-	-
gamma-BHC (Lindane)	n/a	n/a	n/a	n/a	n/a	1.8	U	520	2200	50000
gamma-chlordane	n/a	n/a	n/a	n/a	n/a	0.31	R	-	-	-
heptachlor	n/a	n/a	n/a	n/a	n/a	1.8	U	150	650	50000
heptachlor epoxide	n/a	n/a	n/a	n/a	n/a	0.37	R	-	-	-

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB18-06	16SB19-06	16SB19-08	16SB20-02	16SB20-06	---	ARARS & TBCs		
LOCATION:	16SB18	16SB19	16SB19	16SB20	16SB20	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI				
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**		**mg/kg**	**mg/kg**	**mg/kg**
aluminum	3000	3280	2700	3280	3800		-	-	-
arsenic	3.0	7.8	10.4	2.9	8.2		20.0	20.0	-
barium	2.8	3.3	1.7	2.9	3.0		700	47000	-
beryllium	0.19	0.52	0.35	0.16	0.53		1.00	1.00	-
cadmium	0.082 U	0.086	0.091 U	0.084 U	0.090 U		1.00	100	-
calcium	113	318	573	157	172		-	-	-
chromium, total	39.4	138	103	48.9	166		-	500	-
cobalt	0.64 U	0.68 U	0.72 U	0.66 U	0.71 U		-	-	-
copper	3.4	2.4	2.3	1.5	3.0		600	600	-
iron	8230	12900	14800	6580	15200		-	-	-
lead	6.4	2.4	3.9	3.0	2.6		400	600	-
magnesium	226	659	348	155	614		-	-	-
manganese	2.8	0.77	1.0	2.4	0.68 U		-	-	-
mercury	0.020 J	0.014 J	0.0077 UJ	0.0072 UJ	0.0076 J		14.0	270	-
nickel	1.2	1.4	1.1 U	1.1	1.9		250	2400	-
potassium	595	2310 J	1310 J	361	2060 J		-	-	-
selenium	0.94 U	1.0 U	1.1 U	1.0 U	1.0 U		63.0	3100	-
silver	0.45 U	0.48 U	0.50 U	0.46 U	0.50 U		110	4100	-
sodium	20.1	230	292	20.7	30.0		-	-	-
thallium	0.77 U	0.82 U	0.86 U	0.79 U	0.85 U		2.00	2.00	-
vanadium	29.0	67.4	59.6	29.6	69.6		370	7100	-
zinc	3.5 J	2.2 J	3.8 J	3.3 J	2.6 J		1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	29000	78000	130000	28000	7700		-	-	-
acenaphthene	2000 J	3500 J	4800 J	1900 J	390 U		3400000	10000000	100000
anthracene	11000 U	1400 J	1600 J	11000 U	390 U		10000000	10000000	100000
benzo(a)anthracene	11000 U	11000 U	12000 U	11000 U	390 U		900	4000	500000
benzo(a)pyrene	11000 U	11000 U	12000 U	11000 U	390 U		660	660	100000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB18-06		16SB19-06		16SB19-08		16SB20-02		16SB20-06		---	ARARS & TBCs		
LOCATION:	16SB18		16SB19		16SB19		16SB20		16SB20		---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI					
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**			**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	11000	U	11000	U	12000	U	11000	U	390	U		900	4000	50000
benzo(k)fluoranthene	11000	U	11000	U	12000	U	11000	U	390	U		900	4000	500000
bis(2-ethylhexyl)phthalate	11000	UJ	11000	UJ	12000	UJ	11000	UJ	390	U		49000	210000	100000
chrysene	11000	U	11000	U	12000	U	11000	U	390	U		9000	40000	500000
dibenzofuran	2000	J	3500	J	3900	J	11000	U	390	U		-	-	-
diethylphthalate	11000	U	11000	U	12000	U	11000	U	390	U		10000000	10000000	50000
fluoranthene	11000	U	11000	U	12000	U	11000	U	82.0	J		2300000	10000000	100000
fluorene	4000	J	7600	J	9100	J	2500	J	390	U		2300000	10000000	100000
naphthalene	3000	J	21000		30000		5000	J	1200			230000	4200000	100000
phenanthrene	5500	J	13000		16000		4900	J	1400			-	-	-
phenol	11000	U	11000	U	12000	U	11000	U	390	U		10000000	10000000	50000
pyrene	11000	U	11000	U	12000	U	11000	U	98.0	J		1700000	10000000	100000
VOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**			**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	54.0	U	1400	U	1500	U	11.0	U	12.0	U		79000	1000000	1000
2-butanone	54.0	U	1400	U	1500	U	11.0	UJ	12.0	UJ		1000000	1000000	50000
benzene	54.0	U	1400	U	330	J	11.0	U	12.0	U		3000	13000	1000
carbon disulfide	54.0	U	1400	U	1500	U	11.0	U	12.0	U		-	-	-
ethylbenzene	120		5400		10000		150		57.0			1000000	1000000	100000
methylene chloride	6.0	J	1400	U	1500	U	3.0	J	5.0	J		49000	210000	1000
tetrachloroethene	17.0	J	1400	U	1500	U	11.0	U	9.0	J		4000	6000	1000
toluene	54.0	U	1400	U	260	J	11.0	U	12.0	U		1000000	1000000	500000
trichloroethene	54.0	U	1400	U	1500	U	11.0	U	12.0	U		23000	54000	1000
xylene (total)	120		5700		47000	E	540		310			410000	1000000	10000
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**			**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	3.6	U	n/a		n/a		n/a		n/a			3000	12000	50000
4,4'-DDE	3.6	U	n/a		n/a		n/a		n/a			2000	9000	50000
4,4'-DDT	9.9		n/a		n/a		n/a		n/a			2000	9000	500000
Aroclor-1254	36.0	U	37.0	U	39.0	U	37.0	U	39.0	U		490	2000	50000

TABLE 18-8a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB18-06		16SB19-06	16SB19-08	16SB20-02	16SB20-06	---	ARARS & TBCs		
LOCATION:	16SB18		16SB19	16SB19	16SB20	16SB20	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI	1995 RI	1995 RI	1995 RI				
PESTICIDES	**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
aldrin	0.16	R	n/a	n/a	n/a	n/a		40.0	170	50000
alpha-BHC	0.29	R	n/a	n/a	n/a	n/a		-	-	-
alpha-chlordane	1.9	U	n/a	n/a	n/a	n/a		-	-	-
dieldrin	3.6	U	n/a	n/a	n/a	n/a		42.0	180	50000
endosulfan I	0.092	R	n/a	n/a	n/a	n/a		340000	6200000	50000
endosulfan II	3.6	U	n/a	n/a	n/a	n/a		340000	6200000	50000
endrin	3.6	U	n/a	n/a	n/a	n/a		17000	310000	50000
endrin aldehyde	3.6	U	n/a	n/a	n/a	n/a		-	-	-
gamma-BHC (Lindane)	0.57	R	n/a	n/a	n/a	n/a		520	2200	50000
gamma-chlordane	1.9	U	n/a	n/a	n/a	n/a		-	-	-
heptachlor	1.9	U	n/a	n/a	n/a	n/a		150	650	50000
heptachlor epoxide	0.49	J	n/a	n/a	n/a	n/a		-	-	-

TABLE 18-8a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- No standard is available for this chemical in this classification.

TABLE 18-8b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB01-06	16SB02-04	16SB03-02	16SB03-06	16SB04-08	ARARS & TBCs		
LOCATION:	16SB01	16SB02	16SB03	16SB03	16SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS								
moisture %	13.7	16.8	9.1	14.6	13.6	-	-	-
pH	8.2	6.1	5.6	5.9	5.0	-	-	-
petroleum hydrocarbons mg/kg	110	20.0 U	50.0	15.0 J	18000 E	10000 @	10000 @	-

SAMPLE NUMBER:	16SB04-08-DUP	16SB04-10	16SB05-06	16SB05-08	16SB06-02	ARARS & TBCs		
LOCATION:	16SB04	16SB04	16SB05	16SB05	16SB06	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS								
moisture %	14.2	16.2	11.5	13.2	14.7	-	-	-
pH	4.9	4.9	6.3	5.8	5.4	-	-	-
petroleum hydrocarbons mg/kg	17000 E	33000 E	1800	7600	700	10000 @	10000 @	-

SAMPLE NUMBER:	16SB06-06	16SB07-04	16SB08-06	16SB09-00	16SB09-06	ARARS & TBCs		
LOCATION:	16SB06	16SB07	16SB08	16SB09	16SB09	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS								
moisture %	13.3	11.7	15.6	10.8	18.4	-	-	-
pH	5.5	5.9	5.6	5.2	5.7	-	-	-
petroleum hydrocarbons mg/kg	70.0	20.0 U	17.0 J	1600	40.0	10000 @	10000 @	-

TABLE 18-8b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB10-00	16SB10-04	16SB11-09	16SB12-02	16SB12-06	ARARS & TBCs		
LOCATION:	16SB10	16SB10	16SB11	16SB12	16SB12	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS								
moisture %	11.8	10.3	15.1	7.2	11.7	-	-	-
pH	5.4	6.1	7.4	7.0	7.5	-	-	-
petroleum hydrocarbons mg/kg	4900	320	90.0	40.0	800	10000 @	10000 @	-

SAMPLE NUMBER:	16SB13-02	16SB13-06	16SB14-04	16SB15-06	16SB16-06	ARARS & TBCs		
LOCATION:	16SB13	16SB13	16SB14	16SB15	16SB16	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS								
moisture %	5.4	10.6	13.1	11.4	11.1	-	-	-
pH	6.2	7.6	5.4	6.1	7.4	-	-	-
petroleum hydrocarbons mg/kg	11.0 J	700	160	30.0	20.0	10000 @	10000 @	-

SAMPLE NUMBER:	16SB16-06-DUP	16SB17-04	16SB17-04-DUP	16SB17-06	16SB18-02	ARARS & TBCs		
LOCATION:	16SB16	16SB17	16SB17	16SB17	16SB18	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS								
moisture %	12.0	11.3	11.1	15.1	7.9	-	-	-
pH	7.5	5.5	5.5	5.4	5.3	-	-	-
petroleum hydrocarbons mg/kg	22.0 J	20.0 UJ	1900 J	3400	1700	10000 @	10000 @	-

TABLE 18-8b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SB18-06	16SB19-06	16SB19-08	16SB20-02	16SB20-06	ARARS & TBCs		
LOCATION:	16SB18	16SB19	16SB19	16SB20	16SB20	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS								
moisture %	6.8	11.9	16.4	10.1	15.2	-	-	-
pH	5.8	7.1	6.7	6.2	5.2	-	-	-
petroleum hydrocarbons mg/kg	2400	5400	5900	2200	600	10000 @	10000 @	-

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

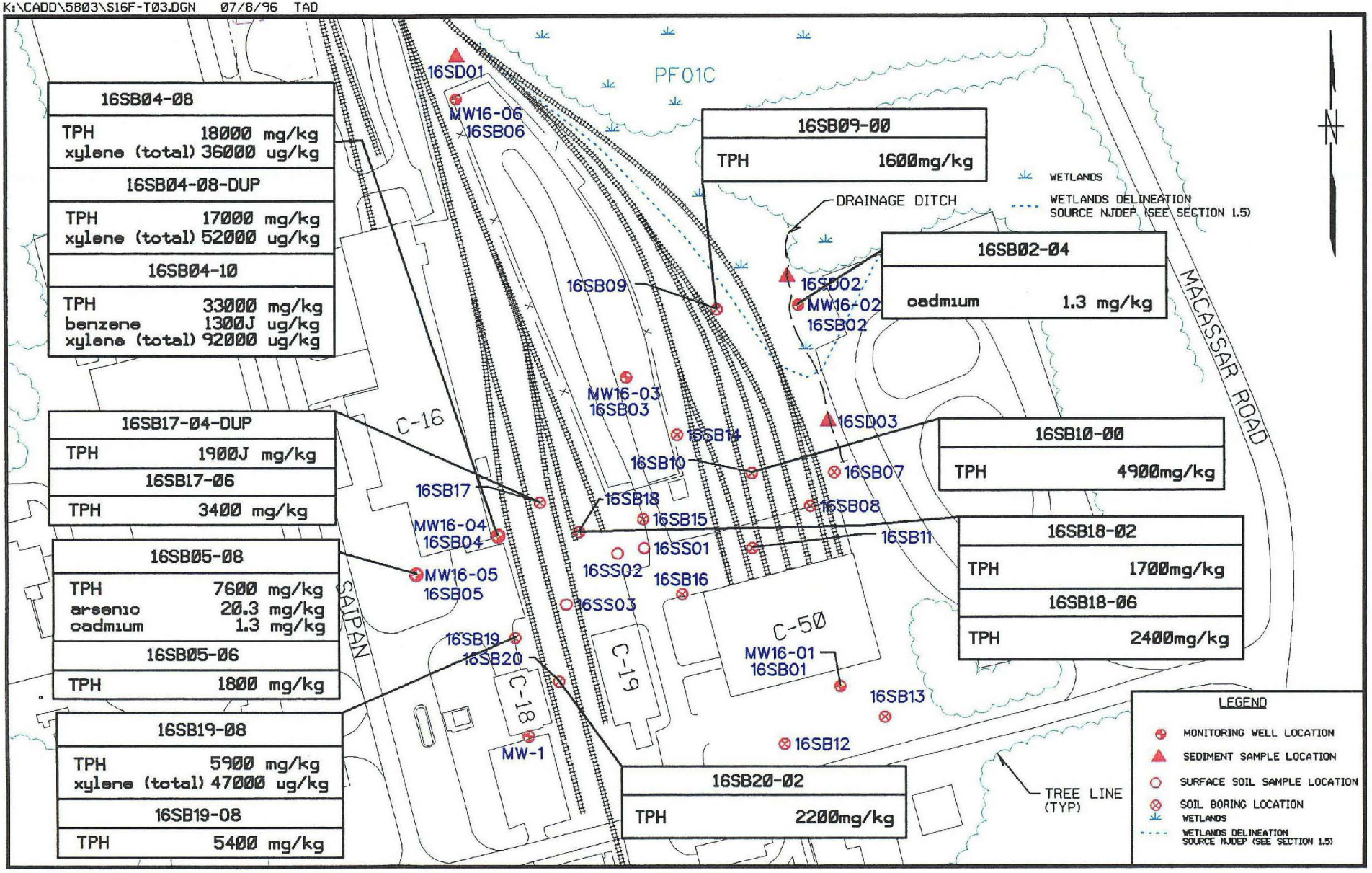
E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

. - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

K:\CADD\5803\S16F-T03.DGN 07/8/96 TAD



CONCENTRATIONS ABOVE SUBSURFACE SOIL SCREENING LEVELS

SITE 16 AND EPIC SITE F

0 150 300

SCALE IN FEET

FIGURE 18-6

Brown & Root Environmental

levels above 30,000 ug/kg include 16 SB 04-08, 16 SB 04-10, 16 SB 05-06, 16 SB 05-08, 16 SB 17-06, 616 SB 19-06, and 16 SB 19-08. 2-Methylnaphthalene and/or naphthalene were detected at levels greater than 3,000 ug/kg in samples 16 SB 10-00, 16 SB 12-06, 16 SB 17-04, 16 SB 18-06, 16 SB 20-02, and 16 SB 20-06.

Aroclor 1254 was detected in one site-related subsurface soil sample (16 SB 09-06) at a concentration of 10 ug/kg. VOCs were detected in subsurface soils, including 1,2-DCE (17 ug/kg to 96 ug/kg), 2-butanone (5 ug/kg to 8 ug/kg), benzene (300 ug/kg to 1,300 ug/kg), carbon disulfide (2 ug/kg), ethylbenzene (13 ug/kg to 16,000 ug/kg), methylene chloride (2 ug/kg to 150 ug/kg), PCE (6 ug/kg to 45 ug/kg), TCE (3 ug/kg), and xylene (8 ug/kg to 92,000 ug/kg). The halogenated VOCs detected in multiple samples include PCE (detected in six samples) and 1,2-DCE (two samples). The highest concentration of 1,2-DCE (96 ug/kg) was detected in sample 16 SB 14-04; the highest concentration of PCE (45 ug/kg) was observed in sample 16 SB 18-02. Most of the samples containing chlorinated ethenes were located approximately along a line beginning at the southeast corner of Building C-16 and extending east/northeast past the shed north of Building C-50. Toluene was detected in 16 SB 04-08, 16 SB 04-10, 16 SB 05-08, and 16 SB 19-08 (benzene was detected in three out of four of these samples).

Phthalates including bis(2-ethylhexyl)- (67 ug/kg to 4,100 ug/kg) and diethyl- (38 ug/kg to 73 ug/kg) were detected in subsurface soil samples collected at Site 16.

Pesticides were detected in site-related subsurface soil samples collected at Site 16 from 6 ug/kg to 20 ug/kg (4,4'-DDT) and 1.8 ug/kg to 11 ug/kg (4,4'-DDE). Other pesticides including 4',4'-DDD (2.1 ug/kg to 26 ug/kg), endosulfan I (9.9 ug/kg), endosulfan II (41 ug/kg), alpha-chlordane (3.7 ug/kg), heptachlor epoxide (0.49 ug/kg to 7.8 ug/kg), heptachlor (0.27 u/kg), and gamma-chlordane (1.7 ug/kg to 35 ug/kg) were also detected in subsurface soil samples.

Due to the relatively high concentrations of aromatic hydrocarbons present in many samples, the pesticide results at Site 16 should be qualified. Concentrations of aromatic hydrocarbons can interfere to produce a GC trace that can overlap the ranges for pesticides during analysis. Such interferences are normally removed by mandatory clean-up procedures in the laboratory; however, pesticide sensitivity ranges are four to five orders of magnitude less than the levels of hydrocarbons in many of the Site 16 samples, which, in some samples, might produce biased or artifactual results for one or more pesticides. Hence, data for pesticides at Site 16 might be viewed more as screening information or for a worst-case evaluation.

18.5.2.3 Miscellaneous Parameters

Thirty-two subsurface soil samples collected at Site 16 were analyzed for moisture (5.4% to 16.8%), pH (4.9 to 8.3), and TPH (11.0 mg/kg to 33,000 mg/kg). Nineteen samples contained TPH concentrations greater than maximum background. Samples containing the highest concentrations of TPH (over 3,000

mg/kg) were obtained in the area bounded by Buildings C-16, C-18, and C-19. Eight samples pH levels exceeding 6.9 or maximum background. Miscellaneous parameters results are presented in Appendix A.

18.5.3 Sediment

Three site-related sediment samples (16 SD 01 through 16 SD 03) were collected at Site 16 (Figure 18-2). Tables 18-10 and 18-11 present the occurrence and distribution of inorganic and organic chemicals detected in site-related sediment samples and compare them to background. Tables 18-10a and 18-10b present a comparison of detected compounds to ARARs and TBCs. Figure 18-7 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

18.5.3.1 Inorganics

Concentrations of most metals in site-related samples were similar to background levels. In all samples, lead and zinc were detected at low levels but at levels slightly greater than the levels found in background samples. Antimony, cadmium, silver, and thallium were detected in site-related sediment samples at concentrations near the instrument detection limit but were not detected in background samples.

18.5.3.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, fluoranthene, fluorene, phenanthrene, and pyrene were detected in all background sediment samples at a range from 140 ug/kg to 1,900 ug/kg. The pesticide 4,4'-DDD (4.9 ug/kg to 21.0 ug/kg) was detected in two samples and pesticide compounds gamma-chlordane (0.095 ug/kg), 4,4'-DDE (1.7 ug/kg) and 4,4'-DDT (19 ug/kg) were each detected in only one background sediment sample.

Background PAHs, plus naphthalene (72.5 ug/kg), acenaphthene (145 ug/kg), and anthracene (215.0 ug/kg), were detected in the site-related sediment samples at comparable or slightly lower concentrations (concentration range of 63.0 ug/kg to 1,250 ug/kg). The pesticides 4,4'-DDE (4.9 ug/kg to 16.5 ug/kg), 4,4'-DDT (8.1 ug/kg to 41.0 ug/kg), and gamma-chlordane (2.85 ug/kg to 3.1 ug/kg) were detected in all site-related sediment samples. The pesticide compounds 4,4'-DDE (66.5 ug/kg) and methoxychlor (9.6 ug/kg) were detected in only one site-related sediment sample. The following compounds were found in site-related samples but not detected in the associated background sediments: 2-methylnaphthalene (119.5 ug/kg), alpha-BHC (0.045 ug/kg), carbazole (165 ug/kg), dibenzofuran (79.5 ug/kg), and phthalates (concentration range of 65 ug/kg to 460 ug/kg).

18.5.3.3 Miscellaneous Parameters

The three sediment samples collected for Site 16 were analyzed for moisture, pH, TOC, and TPH. All samples contained TPH concentrations from 50.0 mg/kg to 660 mg/kg. Moisture content and TOC levels

TABLE 18-10
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	5492.67	3 / 3	1400 - 4295	2838.33	NO	4295
ANTIMONY	NOT DETECTED	-	-	1 / 3	1.5	0.76	YES	1.5
ARSENIC	2 / 3	2.4 - 6.2	5.95	3 / 3	2.5 - 7.45	5.22	NO	7.45
BARIUM	3 / 3	3.9 - 10.6	14.07	3 / 3	16.5 - 22.35	19.87	YES	22.35
BERYLLIUM	1 / 3	0.57	0.67	3 / 3	0.125 - 0.36	0.24	NO	0.36
CADMIUM	NOT DETECTED	-	-	3 / 3	1.9 - 2.4	2.17	YES	2.4
CALCIUM	3 / 3	179 - 518	685.33	3 / 3	450.5 - 1850	1153.50	YES	1850
CHROMIUM	3 / 3	4.3 - 56	43.13	3 / 3	18.45 - 58.7	44.48	YES	58.7
COBALT	1 / 3	2.1	3.30	3 / 3	0.86 - 2.25	1.64	NO	2.25
COPPER	3 / 3	1.5 - 13	12.47	3 / 3	19.45 - 26.7	23.92	YES	26.7
IRON	3 / 3	228 - 7650	6578.67	3 / 3	11000 - 13900	12016.67	YES	13900
LEAD	3 / 3	4.6 - 34.3	30.60	3 / 3	44.9 - 57.9	51.65	YES	57.9
MAGNESIUM	3 / 3	60.7 - 256	306.47	3 / 3	181.5 - 1540	947.17	YES	1540
MANGANESE	3 / 3	4.6 - 9.2	13.80	3 / 3	38.7 - 93.05	63.05	YES	93.05
MERCURY	1 / 3	0.068	0.05	3 / 3	0.021 - 0.0615	0.05	NO	0.0615
NICKEL	2 / 3	2.1 - 6	7.93	3 / 3	3.55 - 5.5	4.55	NO	5.5
POTASSIUM	2 / 3	86.1 - 681	589.40	3 / 3	128.5 - 942	529.83	NO	942
SILVER	NOT DETECTED	-	-	3 / 3	0.37 - 0.63	0.50	YES	0.63
SODIUM	3 / 3	26.6 - 116	115.27	3 / 3	39.85 - 135.5	95.12	NO	135.5
THALLIUM	NOT DETECTED	-	-	2 / 3	1.3 - 1.6	1.13	YES	1.6
VANADIUM	3 / 3	5.9 - 42.7	36.93	3 / 3	8.85 - 40.75	28.93	NO	40.75
ZINC	3 / 3	14.2 - 26.9	37.33	3 / 3	106.55 - 132	122.35	YES	132

Note: Selected COPCs are indicated in boldface type.

TABLE 18-11
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
2-METHYLNAPHTHALENE	NOT DETECTED	-	-	1 / 3	119.5	119.5
4,4'-DDD	2 / 3	4.9 - 21	21	1 / 3	66.5	66.5
4,4'-DDE	1 / 3	1.7	1.7	3 / 3	4.9 - 16.5	16.5
4,4'-DDT	1 / 3	19	19	3 / 3	8.1 - 41	41
ACENAPHTHENE	NOT DETECTED	-	-	1 / 3	145	145
ALPHA-BHC	NOT DETECTED	-	-	1 / 3	0.045	0.045
ANTHRACENE	NOT DETECTED	-	-	1 / 3	215	215
BENZO(A)ANTHRACENE	2 / 3	140 - 560	560	3 / 3	63 - 660	660
BENZO(A)PYRENE	2 / 3	160 - 590	590	3 / 3	75 - 590	590
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	3 / 3	150 - 750	750
BENZO(G,H,I)PERYLENE	2 / 3	130 - 380	380	3 / 3	71 - 350	350
BENZO(K)FLUORANTHENE	2 / 3	150 - 470	470	2 / 3	96 - 250	250
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	3 / 3	235 - 460	460
BUTYLBENZYLPHTHALATE	NOT DETECTED	-	-	1 / 3	65	65
CARBAZOLE	NOT DETECTED	-	-	1 / 3	165	165
CHRYSENE	2 / 3	250 - 940	940	3 / 3	120 - 690	690
DIBENZ(A,H)ANTHRACENE	NOT DETECTED	-	-	1 / 3	90	90
DIBENZOFURAN	NOT DETECTED	-	-	1 / 3	79.5	79.5
FLUORANTHENE	2 / 3	300 - 1800	1800	3 / 3	110 - 1250	1250
FLUORENE	1 / 3	190	190	1 / 3	130	130
GAMMA-CHLORDANE	1 / 3	0.095	0.095	3 / 3	2.85 - 3.1	3.1
INDENO(1,2,3-CD)PYRENE	2 / 3	110 - 310	310	3 / 3	71 - 290	290
METHOXYCHLOR	NOT DETECTED	-	-	1 / 3	9.6	9.6
NAPHTHALENE	NOT DETECTED	-	-	1 / 3	72.5	72.5
PHENANTHRENE	2 / 3	200 - 1900	1900	3 / 3	59 - 965	965
PYRENE	2 / 3	350 - 1900	1900	3 / 3	220 - 1800	1800

TABLE 18-10a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SD01	16SD01-DUP	16SD02	16SD02-DUP	16SD03	---	---	ARARS & TBCs
LOCATION:	16SD01	16SD01	16SD02	16SD02	16SD03	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**
aluminum	1220	1580	4250	4340	2820			-
antimony	1.5	0.74 U	0.81 U	0.81 U	0.73 U			2.00 M
arsenic	2.2	2.8	8.9 E	6.0	5.7			8.20 L
barium	20.7	24.0	19.4	22.1	16.5			40.0 B
beryllium	0.12	0.13	0.39	0.33	0.23			-
cadmium	2.8 E J	2.0 E J	1.9 E J	2.5 E J	1.9 E J			1.20 L
calcium	443	458	1690 J	2010 J	1160			-
chromium, total	18.3	18.6	59.7	57.7	56.3			81.0 L
cobalt	0.89	0.83	1.9	2.6	1.8			50.0 T
copper	21.2	17.7	21.9	29.3	26.7			34.0 L
iron	11400	10900	12900	14900	11000			-
lead	51.0 E	53.3 E	39.5	50.3 E	57.9 E			47.0 L
magnesium	176	187	1340	1740	1120			-
manganese	41.3	36.1	79.1	107	57.4			460 O
mercury	0.072	0.051	0.063	0.055	0.021			0.150 L
nickel	3.4	3.7	4.9	6.1	4.6			21.0 L
potassium	110	147	1080	804	519			-
silver	0.41	0.33	0.52	0.45	0.63			1.00 M
sodium	29.8	49.9	112	159	110			-
thallium	1.0 UJ	1.0 UJ	1.1 UJ	1.6 J	1.3 J			-
vanadium	9.3	8.4	38.2	43.3	37.2			-
zinc	132	81.1	111	146	132			150 L
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**			**ug/kg**
2-methylnaphthalene	160 J	79.0 J	490 U	500 U	440 U			330 F
acenaphthene	160 J	130 J	490 U	500 U	440 U			620 Q
anthracene	210 J	220 J	490 U	500 U	440 U			330 F
benzo(a)anthracene	410 E J	660 E	81.0 J	160 J	63.0 J			330 F
benzo(a)pyrene	360 J	590 E	92.0 J	130 J	75.0 J			430 L

TABLE 18-10a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16SD01		16SD01-DUP		16SD02		16SD02-DUP		16SD03		---		---		ARARS & TBCs	
LOCATION:	16SD01		16SD01		16SD02		16SD02		16SD03		---		---		Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI							
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**						**ug/kg**	
benzo(b)fluoranthene	590	E J	750	E	180	J	320	J	150	J					330	F
benzo(g,h,i)perylene	260	J	440	E J	59.0	J	140	J	71.0	J					330	F
benzo(k)fluoranthene	200	J	300	J	490	U	96.0	J	440	UJ					330	F
bis(2-ethylhexyl)phthalate	330	J	360	J	250	J	220	J	460						890000000	S
butylbenzylphthalate	440	U	460	U	65.0	J	500	U	440	U					11000	Q
carbazole	170	J	160	J	490	U	500	U	440	U					330	F
chrysene	430	E J	690	E	140	J	250	J	120	J					330	F
dibenz(a,h)anthracene	60.0	J	120	J	490	U	500	UJ	440	UJ					330	F
dibenzofuran	100	J	59.0	J	490	U	500	U	440	U					2000	P
fluoranthene	1100		1400		190	J	360	J	110	J					2900	Q
fluorene	150	J	110	J	490	U	500	U	440	U					540	P
indeno(1,2,3-cd)pyrene	210	J	370	E J	81.0	J	110	J	71.0	J					330	F
naphthalene	98.0	J	47.0	J	490	U	500	U	440	U					480	P
phenanthrene	940	E	990	E	81.0	J	90.0	J	59.0	J					850	Q
pyrene	1500	E	2100	E	280	J	410	J	220	J					660	L
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**						**ug/kg**	
4,4'-DDD	72.0	E	61.0	E	8.3	U	8.3	U	4.5	U					1.60	L
4,4'-DDE	16.0	E	17.0	E	5.0	E	5.1	E	4.9	E					2.20	L
4,4'-DDT	36.0	E J	41.0	E	19.0	E	20.0	E	8.1	E					1.60	L
alpha-BHC	2.3	U	2.4	U	2.5	U	0.045	J	2.3	U					3.70	S
gamma-BHC (Lindane)	2.3	U	2.4	U	2.5	U	2.6	U	0.036	R					-	
gamma-chlordane	2.8	J	3.4	J	2.9		2.8		3.0						7.00	O
methoxychlor	23.0	U	24.0	U	25.0	U	25.0	U	9.6	J					19.0	P

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - *Positive result is considered rejected based on exceedance of data validation quality control criteria.*

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 18-10b

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		16SD01	16SD01-DUP	16SD02	16SD02-DUP	16SD03	---	---	ARARS & TBCs
LOCATION:		16SD01	16SD01	16SD02	16SD02	16SD03	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS									
moisture	%	25.5	28.2	33.3	33.5	26.1			-
pH		6.6	6.7	6.8	6.8	6.9			-
petroleum hydrocarbons	**mg/kg**	1300 J	1300 J	1300 J	900 J	1400 J			-
total organic carbon	**mg/kg**	2500 J	n/a	7600 J	n/a	3200 J			-

TABLE 18-10b
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

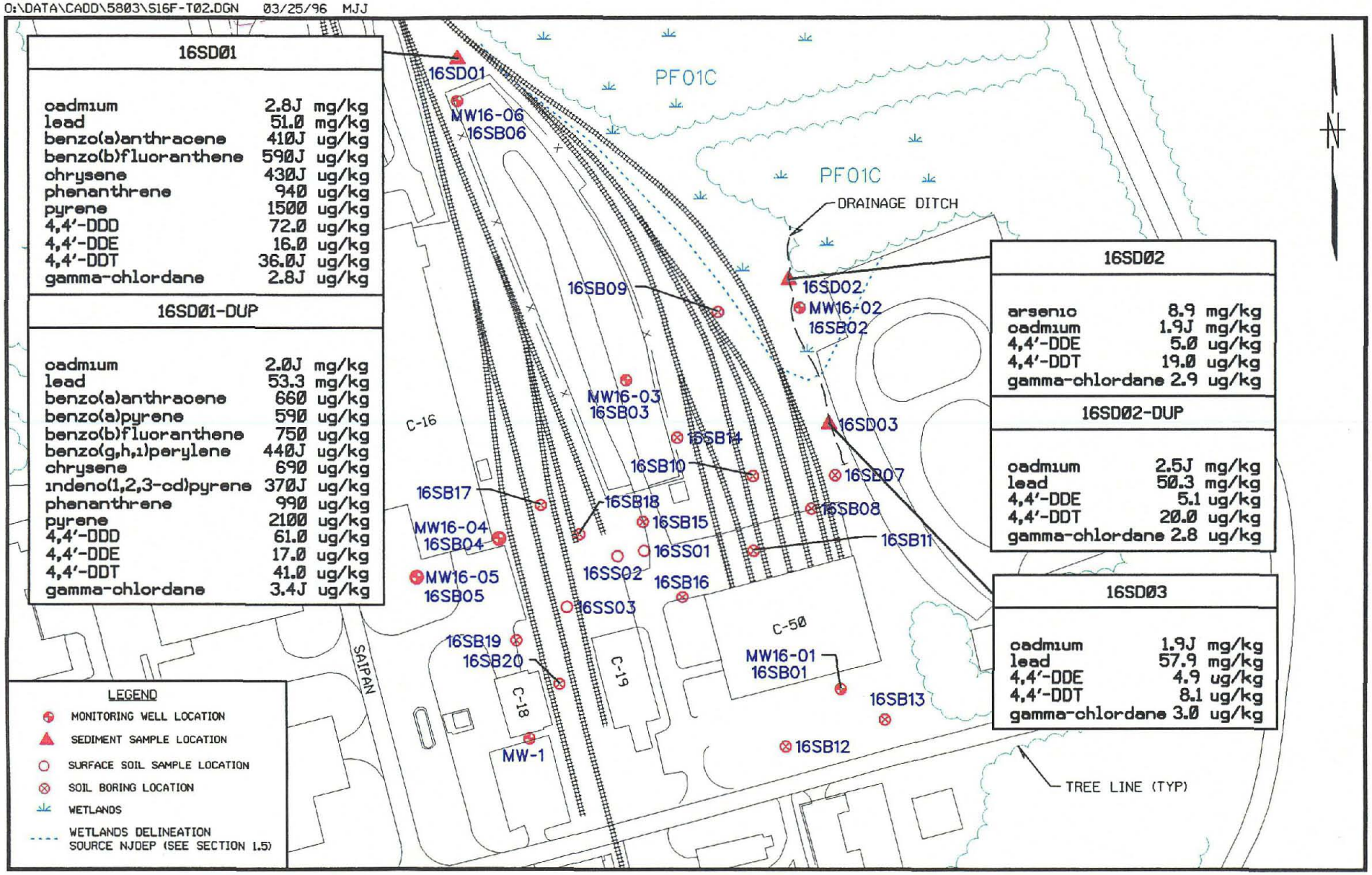
Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

O:\DATA\CADD\5803\S16F-T02.DGN 03/25/96 MJJ



CONCENTRATIONS ABOVE SEDIMENT SCREENING LEVELS

SITE 16 AND EPIC SITE F

0 150 300

SCALE IN FEET

FIGURE 18-7

Brown & Root Environmental

were within the range found in background samples. Miscellaneous parameters results are presented in Appendix A.

18.5.4 Groundwater

Five site-related groundwater samples (16 GW 01 through 16 GW 03, 16 GW 06, and 16 MW 01) were collected at Site 16 (Figure 18-2). Tables 18-12 and 18-13 present the occurrence and distribution of inorganic and organic chemicals detected in site-related groundwater samples and compare them to background. Tables 18-12a and 18-12b present a comparison of detected compounds to ARARs and TBCs. Figure 18-8 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

18.5.4.1 Inorganics

Four samples [16 GW 04 (water), 16 GW 05 (water), 16 GW 04 (oil), and 16 GW 05 (oil) were obtained from the two monitoring wells with floating product. Table 18-5 presents the sample results from the laboratory. The GC fingerprint analysis indicated No. 2 fuel oil was the floating product oil samples. The analysis results from the water samples are not considered reliable because despite precautions taken to obtain a discreet sample of the water layer, it is apparent that some oil was present in the water sample (organic compounds were found in the groundwater sample at concentrations above their solubility).

Concentrations of metals in most site-related samples were similar to background. Downgradient sample 16 GW 06 contained high levels of aluminum (85,200 ug/L) and elevated or high levels of several other metals (arsenic, beryllium, cadmium, chromium, iron, thallium, vanadium, and zinc). Filtered sample results from the same location (16 GW 06-F) did not exhibit elevated levels of any metals except arsenic (3.6 ug/L) and iron (53,500 ug/L). Upgradient sample 16 GW 03 displayed concentrations of iron (15,300 ug/L) and arsenic (5.3 ug/L) similar to 16 GW 06-F.

18.5.4.2 Organics

Chloroform was detected in three groundwater samples collected at Site 16 at a range of 4 ug/L to 14 ug/L. Bis(2-ethylhexyl) phthalate (1 ug/L to 3 ug/L) and naphthalene (1 ug/L to 3 ug/L) were each detected in two groundwater samples collected at Site 16. 1,2-DCE (38 ug/L), benzene (200 ug/L), bromodichloromethane (1 ug/L), ethylbenzene (2 ug/L), phenol (12 ug/L), PCE (1 ug/L), toluene (7 ug/L), and xylene (26 ug/L) were each detected in one groundwater sample at Site 16. None of these compounds were detected in background groundwater samples.

TABLE 18-12
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	11 / 11	287 - 7870	5097.82	5 / 5	2110 - 85200	20360.00	YES	54941.61
ARSENIC	1 / 11	5.8 - 5.8	4.05	4 / 5	5.3 - 156	34.87	YES	99.45
BARIUM	11 / 11	2.6 - 518	229.60	5 / 5	133 - 432	330	YES	432
BERYLLIUM	4 / 11	0.21 - 1.6	0.49	4 / 5	0.18 - 9.8	2.147	YES	6.23
CADMIUM	5 / 11	0.6 - 1.9	1.21	2 / 5	0.41 - 4.9	1.176	NO	3.16
CALCIUM	11 / 11	506 - 17200	8306.55	5 / 5	2530 - 14200	6658	NO	14200
CHROMIUM	NOT DETECTED	-	-	5 / 5	34 - 2070	483.3	YES	1329.56
COBALT	6 / 11	0.7 - 10.1	4.06	5 / 5	1.3 - 8.8	3.14	NO	6.20
COPPER	9 / 11	0.79 - 13.5	6.53	5 / 5	5.1 - 41.9	17.62	YES	41.90
IRON	11 / 11	153 - 7690	4197.09	5 / 5	1240 - 379000	84188	YES	241399.99
LEAD	3 / 11	2.1 - 3	2.44	5 / 5	2 - 46.5	11.36	YES	30.10
MAGNESIUM	11 / 11	273 - 27400	8449.64	5 / 5	1410 - 17700	5340	NO	11949.01
MANGANESE	11 / 11	3.3 - 65	46.18	5 / 5	10.8 - 79.6	52.82	YES	79.6
MERCURY	11 / 11	0.005 - 0.12	0.12	5 / 5	0.084 - 0.18	0.1044	NO	0.14
NICKEL	10 / 11	0.81 - 25.5	11.98	2 / 5	20 - 184	41.025	YES	117.65
POTASSIUM	11 / 11	350 - 3245	2810.55	5 / 5	2510 - 54900	13650	YES	35647.10
SELENIUM	1 / 11	5.3 - 5.3	4.96	1 / 5	17	5.16	YES	17
SODIUM	11 / 11	1850 - 11650	8449.09	5 / 5	16100 - 69300	48100	YES	69300
THALLIUM	3 / 11	4 - 5.1	5.15	2 / 5	13 - 15.6	6.8	YES	15.6
VANADIUM	10 / 11	0.69 - 42.25	16.48	5 / 5	1 - 874	203.08	YES	561.23
ZINC	6 / 9	3.7 - 348	178.61	5 / 5	2 - 360	204.2	YES	360

Note: Selected COPCs are indicated in boldface type.

TABLE 18-13
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,2-DICHLOROETHENE (TOTAL)	NOT DETECTED	-	-	1 / 5	38	38
BENZENE	NOT DETECTED	-	-	1 / 5	200	200
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	2 / 5	1 - 3	3
BROMODICHLOROMETHANE	NOT DETECTED	-	-	1 / 5	1	1
CHLOROFORM	NOT DETECTED	-	-	3 / 5	4 - 14	10.70
ETHYLBENZENE	NOT DETECTED	-	-	1 / 5	2	2
NAPHTHALENE	NOT DETECTED	-	-	2 / 5	1 - 3	3
PHENOL	NOT DETECTED	-	-	1 / 5	12	10.76
TETRACHLOROETHENE	NOT DETECTED	-	-	1 / 5	1	1
TOLUENE	NOT DETECTED	-	-	1 / 5	7	6.34
XYLENE (TOTAL)	NOT DETECTED	-	-	1 / 5	26	26

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TABLE 18-12a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW01	16GW02	16GW02-F	16GW03	16GW04	16GW04-DL	ARARS & TBCs		
LOCATION:	16GW01	16GW02	16GW02	16GW03	16GW04	16GW04	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI Unvalidated Data	1995 RI Unvalidated Data			
GENERAL CHEMISTRY	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**
specific gravity	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	5290 E J	3720 E J	161	5480 E J	1340 E	n/a	-	-	200
arsenic	5.6	5.8	3.3 U	5.3	9.4 E	n/a	50.0	-	8.00
barium	321	356	3.1	408	4.4	n/a	2000	2000 a	2000
beryllium	0.18	0.11 U	0.11 U	0.26	5.0 U	n/a	4.00	4000 e	20.0
cadmium	0.38 U	0.38 U	0.38 U	0.38 U	0.65	n/a	5.00	5.00 e	4.00
calcium	7190	2530	1990	6160	23500	n/a	-	-	-
chromium, total	116 E	80.5	13.6	116 E	24.0	n/a	100 •	100 a	100
cobalt	1.4	1.3	0.88	1.6	0.71	n/a	-	-	-
copper	12.2	15.2	3.2	13.7	0.80	n/a	1300	-	1000
iron	14100 E	11300 E	179	15300 E	178000 E	n/a	-	-	300
lead	3.2	2.0	1.5 UJ	3.1	2.1	n/a	15.0	-	10.0
magnesium	2100	1410	602	2610	5800	n/a	-	-	-
manganese	70.2 E	10.8	10.9	25.6	47.0	n/a	-	-	50.0
mercury	0.086	0.084	0.025	0.088	0.035	n/a	2.00	2.00 b	2.00
nickel	0.75 U	0.75 U	1.9	0.75 U	40.0 U	n/a	100	100 a	100
potassium	3870	2510	323	4320	5000 U	n/a	-	-	-
selenium	4.4 U	4.4 U	4.4 U	4.4 U	13.5	n/a	50.0	-	50.0
sodium	57700 E	49400	50100 E	48000	104000 E	n/a	-	-	50000
thallium	3.6 U	3.6 U	3.6 U	3.6 U	10.0 U	n/a	2.00	0.400 a	10.0
vanadium	52.9	34.1	1.0	53.4	11.0	n/a	-	-	-
zinc	191	260	4.2	208	20.0	n/a	-	2000 a	5000
SEMIVOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
2,4-dimethylphenol	10.0 U	10.0 U	n/a	10.0 U	100 U	400 U	-	-	100
2-methylnaphthalene	10.0 U	10.0 U	n/a	10.0 U	1900 J	1800	-	-	-
acenaphthene	10.0 U	10.0 U	n/a	10.0 U	91.0 J	91.0 J	-	-	400
bis(2-ethylhexyl)phthalate	10.0 U	10.0 U	n/a	1.0 J	100 U	400 U	-	-	30.0

TABLE 18-12a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW01		16GW02		16GW02-F	16GW03		16GW04			16GW04-DL			ARARS & TBCs			
LOCATION:	16GW01		16GW02		16GW02	16GW03		16GW04			16GW04			Maximum Contaminant Level (MCL)		Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI		1995 RI		1995 RI	1995 RI		1995 RI Unvalidated Data			1995 RI Unvalidated Data							
SEMIVOLATILES	**ug/L**		**ug/L**		**ug/L**	**ug/L**		**ug/L**			**ug/L**			**ug/L**		**ug/L**		**ug/L**
carbazole	10.0	U	10.0	U	n/a	10.0	U	100		U	400		U	-		-		-
dibenzofuran	10.0	U	10.0	U	n/a	10.0	U	73.0		J	63.0		J	-		-		-
fluorene	10.0	U	10.0	U	n/a	10.0	U	140			140		J	-		-		300
naphthalene	10.0	U	10.0	U	n/a	1.0	J	690	E		690	E		-		20.0	a	-
phenanthrene	10.0	U	10.0	U	n/a	10.0	U	240			230		J	-		-		-
phenol	10.0	U	10.0	U	n/a	10.0	U	100		U	400		U	-		4000	a	4000
pyrene	10.0	U	10.0	U	n/a	10.0	U	27.0		J	400		U	-		-		200
VOLATILES	**ug/L**		**ug/L**		**ug/L**	**ug/L**		**ug/L**			**ug/L**			**ug/L**		**ug/L**		**ug/L**
1,2-dichloroethene (total)	10.0	U	10.0	U	n/a	10.0	U	11.0	E	J	10.0		J	70.0	a	70.0	a	10.0
benzene	10.0	U	10.0	U	n/a	10.0	U	350	E		340	E		5.00		200	d	1.00
bromodichloromethane	10.0	U	10.0	U	n/a	1.0	J	25.0		U	100		U	100		2000	e	1.00
chloroform	4.0	J	10.0	U	n/a	6.0	J	25.0		U	100		U	100		100	e	6.00
ethylbenzene	10.0	U	10.0	U	n/a	10.0	U	330			300			700		700	a	700
tetrachloroethene	10.0	U	10.0	U	n/a	1.0	J	25.0		U	100		U	5.00		1000	e	1.00
toluene	10.0	U	10.0	U	n/a	10.0	U	40.0			39.0			1000		1000	a	1000
xylene (total)	10.0	U	10.0	U	n/a	10.0	U	1700	E	J	1600	E		10000		10000	a	40.0

TABLE 18-12a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW04-OIL	16GW05	16GW05-DL	16GW05-OIL	16GW06	16GW06-F	ARARS & TBCs		
LOCATION:	16GW04	16GW05	16GW05	16GW05	16GW06	16GW06	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI Unvalidated Data	1995 RI Unvalidated Data	1995 RI Unvalidated Data	1995 RI Unvalidated Data	1995 RI	1995 RI			
GENERAL CHEMISTRY	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**	**none**
specific gravity	0.85	n/a	n/a	0.86	n/a	n/a	-	-	-
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	n/a	900 E	n/a	n/a	85200 E J	132	-	-	200
arsenic	n/a	10.0 U	n/a	n/a	156 E	3.6	50.0	-	8.00
barium	n/a	31.2	n/a	n/a	432	8.1	2000	2000 a	2000
beryllium	n/a	5.0 U	n/a	n/a	9.8 E	0.11 U	4.00	4000 e	20.0
cadmium	n/a	0.56	n/a	n/a	4.9 E	2.0	5.00	5.00 e	4.00
calcium	n/a	17700	n/a	n/a	3210	2490	-	-	-
chromium, total	n/a	5.3	n/a	n/a	2070 E	12.6	100 *	100 a	100
cobalt	n/a	50.0 U	n/a	n/a	8.8	0.75	-	-	-
copper	n/a	0.88	n/a	n/a	41.9	0.87	1300	-	1000
iron	n/a	49100 E	n/a	n/a	379000 E	53500 E	-	-	300
lead	n/a	5.4	n/a	n/a	46.5 E	1.5 UJ	15.0	-	10.0
magnesium	n/a	4660	n/a	n/a	17700	763	-	-	-
manganese	n/a	84.0 E	n/a	n/a	79.6 E	39.0	-	-	50.0
mercury	n/a	0.050	n/a	n/a	0.18	0.016	2.00	2.00 b	2.00
nickel	n/a	40.0 U	n/a	n/a	20.0	1.3	100	100 a	100
potassium	n/a	1870	n/a	n/a	54900	624	-	-	-
selenium	n/a	5.0 U	n/a	n/a	17.0	4.4 U	50.0	-	50.0
sodium	n/a	159000 E	n/a	n/a	16100	16100	-	-	50000
thallium	n/a	10.0 U	n/a	n/a	15.6 E	3.6 U	2.00	0.400 a	10.0
vanadium	n/a	50.0 U	n/a	n/a	874	0.87	-	-	-
zinc	n/a	17.2	n/a	n/a	360	10.0	-	2000 a	5000
SEMIVOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
2,4-dimethylphenol	n/a	48.0	52.0	n/a	10.0 U	n/a	-	-	100
2-methylnaphthalene	n/a	170 J	250	n/a	10.0 U	n/a	-	-	-
acenaphthene	n/a	8.0 J	11.0 J	n/a	10.0 U	n/a	-	-	400
bis(2-ethylhexyl)phthalate	n/a	92.0 E J	190 E	n/a	3.0 J	n/a	-	-	30.0

TABLE 18-12a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW04-OIL	16GW05	16GW05-DL	16GW05-OIL	16GW06	16GW06-F	ARARS & TBCs		
LOCATION:	16GW04	16GW05	16GW05	16GW05	16GW06	16GW06	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI Unvalidated Data	1995 RI Unvalidated Data	1995 RI Unvalidated Data	1995 RI Unvalidated Data	1995 RI	1995 RI			
SEMIVOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
carbazole	n/a	12.0	16.0 J	n/a	10.0 U	n/a	-	-	-
dibenzofuran	n/a	6.0 J	7.0 J	n/a	10.0 U	n/a	-	-	-
fluorene	n/a	11.0	14.0 J	n/a	10.0 U	n/a	-	-	300
naphthalene	n/a	100 E J	220 E	n/a	3.0 J	n/a	-	20.0 a	-
phenanthrene	n/a	17.0	22.0 J	n/a	10.0 U	n/a	-	-	-
phenol	n/a	11.0	15.0 J	n/a	12.0	n/a	-	4000 a	4000
pyrene	n/a	10.0 U	50.0 U	n/a	10.0 U	n/a	-	-	200
VOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
1,2-dichloroethene (total)	n/a	50.0 U	100 U	n/a	38.0 E	n/a	70.0 a	70.0 a	10.0
benzene	n/a	1700 E J	1900 E	n/a	200 E	n/a	5.00	200 d	1.00
bromodichloromethane	n/a	50.0 U	100 U	n/a	10.0 U	n/a	100	2000 e	1.00
chloroform	n/a	50.0 U	100 U	n/a	10.0 U	n/a	100	100 e	6.00
ethylbenzene	n/a	170	160	n/a	2.0 J	n/a	700	700 a	700
tetrachloroethene	n/a	50.0 U	100 U	n/a	10.0 U	n/a	5.00	1000 e	1.00
toluene	n/a	160	160	n/a	7.0 J	n/a	1000	1000 a	1000
xylene (total)	n/a	250 E	250 E	n/a	26.0	n/a	10000	10000 a	40.0

TABLE 18-12a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16MW01	---	---	---	---	---	ARARS & TBCs		
LOCATION:	16MW01	---	---	---	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI								
GENERAL CHEMISTRY	**none**						**none**	**none**	**none**
specific gravity	n/a						-	-	-
INORGANICS	**ug/L**						**ug/L**	**ug/L**	**ug/L**
aluminum	2110 E						-	-	200
arsenic	3.3 U						50.0	-	8.00
barium	133						2000	2000 a	2000
beryllium	0.44						4.00	4000 e	20.0
cadmium	0.41						5.00	5.00 e	4.00
calcium	14200						-	-	-
chromium, total	34.0						100 •	100 a	100
cobalt	2.6						-	-	-
copper	5.1						1300	-	1000
iron	1240 E						-	-	300
lead	2.0						15.0	-	10.0
magnesium	2880						-	-	-
manganese	77.9 E						-	-	50.0
mercury	0.084 J						2.00	2.00 b	2.00
nickel	184 E						100	100 a	100
potassium	2650						-	-	-
selenium	4.4 U						50.0	-	50.0
sodium	69300 E						-	-	50000
thallium	13.0 E						2.00	0.400 a	10.0
vanadium	1.0						-	-	-
zinc	2.0						-	2000 a	5000
SEMIVOLATILES	**ug/L**						**ug/L**	**ug/L**	**ug/L**
2,4-dimethylphenol	10.0 U						-	-	100
2-methylnaphthalene	10.0 U						-	-	-
acenaphthene	10.0 U						-	-	400
bis(2-ethylhexyl)phthalate	10.0 U						-	-	30.0

TABLE 18-12a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16MW01		---	---	---	---	---	ARARS & TBCs		
LOCATION:	16MW01		---	---	---	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI									
SEMIVOLATILES	**ug/L**							**ug/L**	**ug/L**	**ug/L**
carbazole	10.0	U						-	-	-
dibenzofuran	10.0	U						-	-	-
fluorene	10.0	U						-	-	300
naphthalene	10.0	U						-	20.0 a	-
phenanthrene	10.0	U						-	-	-
phenol	10.0	U						-	4000 a	4000
pyrene	10.0	U						-	-	200
VOLATILES	**ug/L**							**ug/L**	**ug/L**	**ug/L**
1,2-dichloroethene (total)	10.0	U						70.0 a	70.0 a	10.0
benzene	10.0	U						5.00	200 d	1.00
bromodichloromethane	10.0	U						100	2000 e	1.00
chloroform	14.0	E						100	100 e	6.00
ethylbenzene	10.0	U						700	700 a	700
tetrachloroethene	10.0	U						5.00	1000 e	1.00
toluene	10.0	U						1000	1000 a	1000
xylene (total)	10.0	U						10000	10000 a	40.0

TABLE 18-12a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

• - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 18-12b

COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 16

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	16GW01		16GW02		16GW03		16GW04	16GW05	16GW06		ARARS & TBCs		
LOCATION:	16GW01		16GW02		16GW03		16GW04	16GW05	16GW06		Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI Unvalidated Data	1995 RI Unvalidated Data	1995 RI				
MISCELLANEOUS	**mg/L**		**mg/L**		**mg/L**		**mg/L**	**mg/L**	**mg/L**		**mg/L**	**mg/L**	**mg/L**
petroleum hydrocarbons	0.30	U	0.30	U	0.30	U	190	20.0	0.20	J	-	-	-

SAMPLE NUMBER:	16MW01		---	---	---	---	---	ARARS & TBCs		
LOCATION:	16MW01		---	---	---	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI									
MISCELLANEOUS	**mg/L**							**mg/L**	**mg/L**	**mg/L**
petroleum hydrocarbons	0.10	J						-	-	-

TABLE 18-12b
COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

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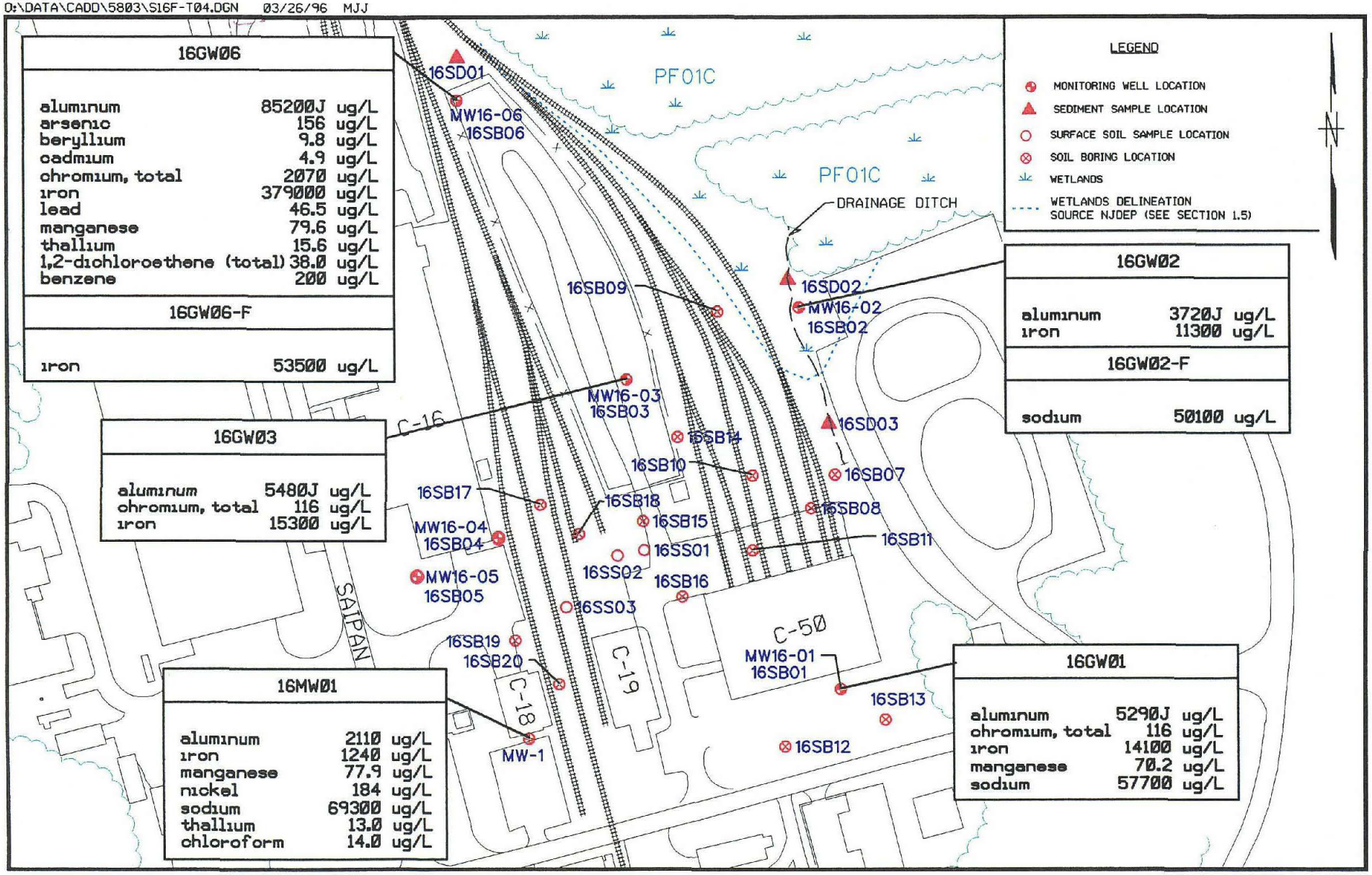

CONCENTRATIONS ABOVE GROUNDWATER SCREENING LEVELS

SITE 16 AND EPIC SITE F

FIGURE 18-8

0 150 300

SCALE IN FEET

Brown & Root Environmental

18.5.4.3 Miscellaneous Parameters

Two groundwater samples, 16 GW 06 and 16 MW 01, were found with TPH (0.200 mg/L and 0.100 mg/L, respectively). This is less than the required detection limit for TPH in aqueous samples of 0.300 mg/L.

18.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 16 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 18.6.1. Persistence of detected chemicals in the environment is discussed in Section 18.6.2. Section 18.6.3 presents a brief discussion of contaminant trends.

18.6.1 Detected Chemicals and Transport Potential

Groundwater investigation results at Site 16 indicate the presence of a floating layer of free product (LNAPL) in contact with groundwater. At two monitoring wells, MW16-04 and MW16-05, GC fingerprint analysis of the free product indicated primarily diesel No. 2 fuel is present. Aromatic volatiles (BTEX) and semivolatiles (naphthalene and other PAHs) associated with petroleum fuels were also detected in other groundwater samples that did not contain free product. This LNAPL layer is a source of hydrocarbons into groundwater.

Subsurface soil samples revealed notable concentrations of BTEX compounds (in seven samples), TPH (greater than 3,000 mg/kg in seven samples), and the lighter PAHs (greater than 30,000 ug/kg in seven samples and greater than 3,000 ug/kg in six samples). Because of the significant concentration ranges present, there is also a probability for leaching of aromatic volatiles and the lighter PAHs (naphthalene and 2-methylnaphthalene) from subsurface soils into groundwater.

In surface soil samples, individual PAHs were less than 4,400 ug/kg, with TPH levels of up to 20,000 mg/kg. The highest level of TPH was detected in sample 16 SS 03, which is located near the northwestern corner of the former (and current) wash area next to Building C-19. All three sediment samples revealed several PAHs at levels similar to background. In site-related sediment sample 16 SD 01 (located at the catch basin in the northern end of the site), low levels of 2-methylnaphthalene were detected, although this compound was not found in background sediments. 2-Methylnaphthalene is associated with diesel range fuels, which suggests that at least a portion of the observed sediment PAH distribution is related to surface water runoff for erosional transport migration from the site. Slightly elevated TPH levels were also noted in all three sediment samples.

Groundwater concentrations of several metals were generally greater than levels in the corresponding filtered sample collected at the same location. With the exception of arsenic and iron, elevated levels of

metals were not present in the filtered samples, which indicates the presence of suspended solids. Metals in suspension are expected to have a greatly diminished potential for in-situ transport compared to metals in solution. Given a geologic formation that does not include conditions conducive to solution channeling or fracture-based flow, samples from wells with high turbidity would show higher metal concentrations than actually mobile in the subsurface. Despite efforts such as installation of dedicated low-flow bladder pumps and adherence to the EPA low-flow sampling procedure, at several wells, low-turbidity samples could not be collected. Samples obtained from wells where turbidity could not be reduced displayed metals concentrations higher than representative for the formation and, in the case of 16 GW 02 and 16 GW 05, filtered results were lower.

Elevated levels of metals were found in the three surface soil samples taken in the C-19, former wash runoff area. Slightly elevated levels of antimony, lead, and chromium in subsurface soil and lead and zinc in sediment were observed. Most metals are adsorbed onto soil and sediment easily but may also exist in dissolved or suspended forms. The transport and fate of metals in the environment are primarily controlled by sorption to soil/sediment material. The metal-organic relationships, both in soil and water, increase in importance as the organic carbon content increases. Soils in contact with high levels of petroleum hydrocarbons could increase the sorptive capacity of soil and, in the case of surface soil, could decrease the tendency for fugitive dust emissions.

Phenol, 1,2-DCE, chloroform, and bromodichloromethane were also detected in groundwater at the site. 1,2-DCE is associated with degradation of TCE and PCE (Cline and Viste, 1983). The downgradient monitoring well sample 16 GW 06 exhibited 1,2-DCE, which could be related to detections of this compound, TCE, and PCE in several subsurface soil samples located in an upgradient direction. All detected volatile organic groundwater contaminants are volatile and characteristically mobile in the environment (either through soil gas migration or groundwater transport). PCBs, which were detected at a low level in one subsurface soil, are typically strongly bound to organic matter and are not expected to migrate significantly. Pesticides, which were detected at low levels in sediment, are also considered to exhibit low mobility except in conjunction with surface water erosional patterns.

Several phthalates were detected at low levels in groundwater, surface soil, subsurface soil, and sediment. These compounds exhibit a tendency to bind to soil containing organic carbon and are considered common in the environment due to their presence in plastics.

The physical transport data for detected compounds are presented in Table 2-10. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

18.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation. In the case of high levels of hydrocarbons present in groundwater, the heavier molecular weight PAHs may be transported along with the lighter PAHs to a point where contaminant concentrations are somewhat lower. Volatile organics and the lightest PAHs (naphthalene and 2-methyl naphthalene) are highly mobile in groundwater.

Biodegradation of fuel-related substances (BTEX, PAHs, and TPH) is an important fate process for the volatile and semivolatile fuel-related impacts. However, the near impact of reduction through this mechanism may be ineffective when a source exists from free product. (The free-product layer can introduce compounds into groundwater, resulting in a biotoxic zone for microorganisms in the immediate proximity of the LNAPL boundary.)

The chlorinated ethenes detected in groundwater have been associated with degradation of TCE and PCE (Cline and Viste, 1983). PCBs are considered highly persistent, typically exhibiting biodegradation patterns that proceed slowly and to varying degrees, depending upon the individual isomer chlorination pattern of the PCB congeners that make up the Aroclor mixtures.

18.6.3 Observed Chemical Contaminant Trends

A variety of fuel-related substances, including the BTEX compounds and the lighter PAHs, originate in a free-product layer in groundwater and were detected in multiple subsurface soil and groundwater samples. The source area appears to be located near the former diesel line between Buildings C-16, C-18, and C-19. No significant subsurface soil or groundwater impacts were detected near MW16-01, which is located south of Building C-50, or near MW16-02, which is located northeast of Building C-50. BTEX compounds were not detected in the surface soils collected near the current wash area north of Building C-19.

Monitoring well MW16-06, which is located more than 600 feet downgradient of the area of highest contamination, was the only well (other than the wells containing free product) that revealed BTEX compounds. Another monitoring well, MW16-03, is located downgradient and slightly cross-gradient (to the northeast) of the area of highest concentration. However, MW16-03 did exhibit the presence of naphthalene, a component of diesel range fuels. Since the subsurface soil locations revealing the highest levels of naphthalene and 2-methylnaphthalene were the same as those exhibiting the highest levels of TPH and BTEX, there do not appear to be clear differences in the spatial distributions of BTEX compounds versus PAH compounds near the potential source areas.

PCE, TCE, and related degradation by-products were observed at low or trace levels in subsurface soil and groundwater. 1,2-DCE was detected in the sample from Monitoring Well 16 GW 06, a finding that could be related to detections of 1,2-DCE, TCE, and PCE in several subsurface soil samples located in an upgradient direction. Most of the soil samples displaying chlorinated ethenes were located approximately along a line beginning at the southeastern corner of Building C-16 and extending east/northeast past the shed north of Building C-50. Since soil gas results and soil samples did not identify any locations of high concentrations, this suggests the possibility that source areas for halogenated VOCs have been largely depleted. Low levels of pesticides were reported in surface and subsurface soils and sediment but were not detected in groundwater. The reported data for pesticides in subsurface soils that also contain high levels of hydrocarbons should be treated more as screening information because of possible analytical bias associated with potential interferences.

Chloroform was detected in three wells, MW16-03 (6.0 ug/L) and two upgradient wells, MW16-01 (4 ug/L) and MW-1 (14.0 ug/L).

The presence of suspended solids in groundwater samples 16 GW 02, 16 GW 03, and 16 GW 06 is indicated by high turbidity readings and elevated levels of metals, such as aluminum, that are normally relatively insoluble in most common forms. Unfiltered sample results were used in calculations for the groundwater risk assessment in accordance with the recommended conservative approach to this evaluation. However, filtered sample results of two wells at Site 16 appear to be more representative of dissolved-phase concentrations.

18.6.4 Conclusions

Hydrocarbons detected in the subsurface soils at Site 16 have impacted the groundwater. The groundwater contamination (primarily volatile organics and fuel constituents) is associated with a free-product LNAPL layer. The floating product is a source of organics to groundwater. In addition, there is a potential for residual leaching of aromatic volatiles and the lighter PAHs from subsurface soils into groundwater because of the significant concentrations present. TPH and PAH detections in sediment indicate that a limited degree of transport via surface water runoff and erosional dispersion has occurred.

Low levels of PCE, TCE, and degradation products were detected in subsurface soil and groundwater at Site 16. The low levels detected may be attributable to residual material present from past spills and may indicate that sources have been depleted over time.

Other substances detected at low levels in surface soils, subsurface soils, and sediment, such as metals, heavier PAHs, pesticides, and PCBs, are not expected to transport quickly from the source areas.

Except in the two wells containing free product, only one PAH compound and one phthalate compound were detected in groundwater.

With the exception of iron, groundwater data do not suggest migration of dissolved inorganic contaminants from the site.

18.7 BASELINE RISK ASSESSMENT

This section of the RI report presents the results of the baseline risk assessment for Site 16. The risk assessment was performed using the approach outlined in Section 2.4. Tables 18-14 through 18-17 provide the selected COPCs and representative concentrations of inorganic and organics in site-related surface soil, subsurface soil, sediment, and groundwater, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are also included.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation alternatives are identified for a site.

18.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of current land use (industrial employee) and hypothetical future land use (residential receptors, recreational receptors, and industrial receptors).

18.7.1.1 Current Industrial Employee

The estimated total cancer risks for the current industrial employee for exposure to COPCs in surface soil at Site 16 are 5.9E-05 (ingestion), 3.0E-05 (dermal contact), and 1.0E-07 (inhalation of COPCs in fugitive dust). The total surface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate ARARs. The

TABLE 18-14
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SURFACE SOIL - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ANTIMONY	28	NONPARAMETRIC
ARSENIC	10.5	NONPARAMETRIC
BARIUM	133	NONPARAMETRIC
BERYLLIUM	0.25	NONPARAMETRIC
CADMIUM	10.2	NONPARAMETRIC
CHROMIUM	171	NONPARAMETRIC
COBALT	7.7	NONPARAMETRIC
COPPER	231	NONPARAMETRIC
LEAD	1030	NONPARAMETRIC
MANGANESE	307	NONPARAMETRIC
MERCURY	0.28	NONPARAMETRIC
NICKEL	16.5	NONPARAMETRIC
SILVER	25.3	NONPARAMETRIC
ZINC	1180	NONPARAMETRIC
4,4'-DDD*	360	NONPARAMETRIC
4,4'-DDE*	120	NONPARAMETRIC
4,4'-DDT*	230	NONPARAMETRIC
4-METHYLPHENOL*	110	LOGNORMAL
ACENAPHTHYLENE*	100	LOGNORMAL
ALPHA-BHC*	0.13	NONPARAMETRIC
ALPHA-CHLORDANE*	33	NONPARAMETRIC
ANTHRACENE*	170	NONPARAMETRIC
BENZO(A)ANTHRACENE*	450	NONPARAMETRIC
BENZO(A)PYRENE*	1200	NONPARAMETRIC
BENZO(B)FLUORANTHENE*	1000	NONPARAMETRIC
BENZO(G,H,I)PERYLENE*	340	NONPARAMETRIC
BENZO(K)FLUORANTHENE*	86	NONPARAMETRIC
BIS(2-ETHYLHEXYL)PHTHALATE*	12000	NONPARAMETRIC
BUTYLBENZYLPHTHALATE*	160	NONPARAMETRIC
CARBAZOLE*	54	NONPARAMETRIC
CHRYSENE*	810	NONPARAMETRIC
DI-N-BUTYLPHTHALATE*	100	NONPARAMETRIC
FLUORANTHENE*	510	NONPARAMETRIC
GAMMA-CHLORDANE*	35	NONPARAMETRIC
HEPTACHLOR EPOXIDE*	0.39	NONPARAMETRIC
INDENO(1,2,3-CD)PYRENE*	200	NONPARAMETRIC
N-NITROSODIPHENYLAMINE*	63	NONPARAMETRIC
PHENANTHRENE*	370	NONPARAMETRIC
PYRENE*	4400	NONPARAMETRIC

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

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TABLE 18-15
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ARSENIC	7.10	NORMAL
BERYLLIUM	0.30	NORMAL
CADMIUM	0.47	NORMAL
CHROMIUM	150.53	LOGNORMAL
COPPER	4.65	NORMAL
IRON	13157.99	LOGNORMAL
LEAD	13.00	NORMAL
SELENIUM	0.54	NORMAL
SILVER	0.30	NORMAL
VANADIUM	68.01	LOGNORMAL
1,2-DICHLOROETHENE (TOTAL)*	96	NORMAL
2-BUTANONE*	8	NORMAL
BENZENE*	225.78	NORMAL
CARBON DISULFIDE*	2	NORMAL
ETHYLBENZENE*	2523.90	NORMAL
METHYLENE CHLORIDE*	150	NORMAL
TETRACHLOROETHENE*	45	NORMAL
TOLUENE*	181.35	NORMAL
TRICHLOROETHENE*	3	NORMAL
XYLENE (TOTAL)*	12066.53	NORMAL
2-METHYLNAPHTHALENE*	45515.08	NORMAL
ACENAPHTHENE*	2774.14	NORMAL
ANTHRACENE*	2015.77	NORMAL
BENZO(A)ANTHRACENE*	43	NORMAL
BENZO(A)PYRENE*	43	NORMAL
BENZO(K)FLUORANTHENE*	46	NORMAL
BIS(2-ETHYLHEXYL)PHTHALATE*	1400	NORMAL
CHRYSENE*	57	NORMAL
DIBENZOFURAN*	4548.25	LOGNORMAL
DIETHYLPHTHALATE*	73	NORMAL
FLUORANTHENE*	140	NORMAL
FLUORENE*	4160.62	NORMAL
NAPHTHALENE*	11992.62	NORMAL
PHENANTHRENE*	7208.28	NORMAL
PYRENE*	2414.98	NORMAL
4,4'-DDD*	9.54	NORMAL
4,4'-DDE*	6.61	NORMAL
4,4'-DDT*	20	NONPARAMETRIC
ALPHA-CHLORDANE*	1.82	NORMAL
AROCLOR-1254*	10	LOGNORMAL
ENDOSULFAN I*	4.18	NORMAL
ENDOSULFAN II*	14.28	NORMAL
GAMMA-CHLORDANE*	1.94	NORMAL
HEPTACHLOR*	0.27	LOGNORMAL
HEPTACHLOR EPOXIDE*	3.39	NORMAL

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

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TABLE 18-16
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SEDIMENT - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ALUMINUM	4295	NONPARAMETRIC
ANTIMONY	1.5	NONPARAMETRIC
ARSENIC	7.45	NONPARAMETRIC
BARIUM	22.35	NONPARAMETRIC
BERYLLIUM	0.36	NONPARAMETRIC
CADMIUM	2.4	NONPARAMETRIC
CHROMIUM	58.7	NONPARAMETRIC
COBALT	2.25	NONPARAMETRIC
COPPER	26.7	NONPARAMETRIC
IRON	13900	NONPARAMETRIC
LEAD	57.9	NONPARAMETRIC
MANGANESE	93.05	NONPARAMETRIC
SILVER	0.63	NONPARAMETRIC
THALLIUM	1.6	NONPARAMETRIC
ZINC	132	NONPARAMETRIC
2-METHYLNAPHTHALENE*	119.5	NONPARAMETRIC
4,4'-DDD*	66.5	NONPARAMETRIC
4,4'-DDE*	16.5	NORMAL
4,4'-DDT*	41	NONPARAMETRIC
ACENAPHTHENE*	145	NONPARAMETRIC
ALPHA-BHC*	0.045	LOGNORMAL
ANTHRACENE*	215	NONPARAMETRIC
BENZO(A)ANTHRACENE*	660	NONPARAMETRIC
BENZO(A)PYRENE*	590	NONPARAMETRIC
BENZO(B)FLUORANTHENE*	750	NONPARAMETRIC
BENZO(G,H,I)PERYLENE*	350	NONPARAMETRIC
BENZO(K)FLUORANTHENE*	250	NONPARAMETRIC
BIS(2-ETHYLHEXYL)PHTHALAT*	460	NONPARAMETRIC
BUTYLBENZYLPHTHALATE*	65	LOGNORMAL
CARBAZOLE*	165	NONPARAMETRIC
CHRYSENE*	690	NONPARAMETRIC
DIBENZ(A,H)ANTHRACENE*	90	NONPARAMETRIC
DIBENZOFURAN*	79.5	NONPARAMETRIC
FLUORANTHENE*	1250	NONPARAMETRIC
FLUORENE*	130	NONPARAMETRIC
GAMMA-CHLORDANE*	3.1	NONPARAMETRIC
INDENO(1,2,3-CD)PYRENE*	290	NONPARAMETRIC
METHOXYCHLOR*	9.6	NONPARAMETRIC
NAPHTHALENE*	72.5	NONPARAMETRIC
PHENANTHRENE*	965	NONPARAMETRIC
PYRENE*	1800	NONPARAMETRIC

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 18-17
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
GROUNDWATER - SITE 16 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	54941.61	NORMAL
ARSENIC	99.45	NORMAL
BARIUM	432	NONPARAMETRIC
BERYLLIUM	6.23	NORMAL
CADMIUM	3.16	NORMAL
CHROMIUM	1329.56	NORMAL
COBALT	6.20	NORMAL
COPPER	41.9	NONPARAMETRIC
IRON	241399.99	NORMAL
LEAD	30.10	NORMAL
MERCURY	0.14	NORMAL
NICKEL	117.65	NORMAL
SELENIUM	17	LOGNORMAL
THALLIUM	15.6	LOGNORMAL
VANADIUM	561.23	NORMAL
ZINC	360	LOGNORMAL
1,2-DICHLOROETHENE (TOTAL)	38	LOGNORMAL
BENZENE	200	LOGNORMAL
BIS(2-ETHYLHEXYL)PHTHALATE	3	LOGNORMAL
BROMODICHLOROMETHANE	1	LOGNORMAL
CHLOROFORM	10.70	NORMAL
ETHYLBENZENE	2	LOGNORMAL
NAPHTHALENE	3	LOGNORMAL
PHENOL	10.76	LOGNORMAL
TETRACHLOROETHENE	1	LOGNORMAL
TOLUENE	6.34	LOGNORMAL
XYLENE (TOTAL)	26	LOGNORMAL

principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion, 93 percent of the cancer risk for this pathway; and dermal contact, 60 percent of the cancer risk for this pathway) and beryllium (dermal contact, 39 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the current industrial employee assuming exposure to surface soil at Site 16 are less than 1.0 for ingestion, dermal contact and inhalation exposure pathways. Adverse noncarcinogenic health effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for current industrial receptors exposed to surface soils at Site 16 in Tables 18-18 and 18-19, respectively.

18.7.1.2 Future Industrial Employee

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 16 are 3.8E-05 (ingestion), 2.6E-05 (dermal contact), and 9.0E-08 (inhalation of COPCs in fugitive dust). The estimated total cancer risks for exposure to COPCs in groundwater at Site 16 are 6.4E-04 (ingestion) and 4.5E-06 (dermal contact). The total subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The total groundwater cancer risk exceeds the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 98 percent of the cancer risk for this pathway; and dermal contact, 46 percent of the cancer risk for this pathway) and beryllium (dermal contact, 53 percent of the cancer risk for this pathway). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 82 percent of the cancer risk for this pathway) and beryllium (ingestion, 15 percent of the cancer risk for this pathway; and dermal contact, 85 percent of the cancer risk for this pathway). As noted in the groundwater discussion for Nature and Extent, the calculated cancer risk may not be representative of dissolved-phase metals contamination receptor impacts because of the use of unfiltered sample results.

The estimated individual noncarcinogenic HQs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becoming future surface soils) at Site 16 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. The estimated noncarcinogenic HQs for exposure to arsenic, chromium (total), iron, and vanadium via ingestion of groundwater at Site 16 are 3.2, 2.6, 7.9, and 1.9, respectively. The individual estimated noncarcinogenic HQs for the future industrial employee assuming exposure to COPCs via the dermal route is less than 1.0. Adverse noncarcinogenic health effects cannot be ruled out when the HQs exceed 1.0. The target organs are as follows: arsenic (skin), chromium (total) (kidney, skin, and respiratory tract), and iron (pancreas and liver).

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soils at Site 16 in Tables 18-20 and 18-21, respectively. Estimated carcinogenic

TABLE 18-18
CARCINOGENIC RISK TO CURRENT INDUSTRIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	3.0E-08	5.9E-08	5.6E-12
4,4'-DDE	1.4E-08	2.8E-08	2.6E-12
4,4'-DDT	2.7E-08	5.3E-08	6.1E-12
4-METHYLPHENOL	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	2.9E-10	4.5E-10	6.4E-14
ALPHA-CHLORDANE	1.5E-08	2.9E-08	3.3E-12
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	1.1E-07	*	2.5E-11
BENZO(A)PYRENE	3.1E-06	*	6.6E-10
BENZO(B)FLUORANTHENE	2.6E-07	*	5.5E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	2.2E-09	*	4.7E-13
BIS(2-ETHYLHEXYL)PHTHALATE	5.9E-08	1.8E-07	1.1E-11
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	3.8E-10	*	7.0E-14
CHRYSENE	2.1E-09	*	4.5E-13
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
GAMMA-CHLORDANE	1.6E-08	3.1E-08	3.5E-12
HEPTACHLOR EPOXIDE	1.2E-09	4.8E-09	2.8E-13
INDENO(1,2,3-CD)PYRENE	5.1E-08	*	1.1E-11
N-NITROSODIPHENYLAMINE (1)	1.1E-10	3.4E-10	2.0E-14
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	5.5E-05	1.8E-05	1.2E-08
BARIUM	N/A	N/A	N/A
BERYLLIUM	3.8E-07	1.2E-05	9.7E-11
CADMIUM	N/A	N/A	8.3E-10
CHROMIUM	N/A	N/A	9.3E-08
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
MANGANESE	N/A	N/A	N/A
MERCURY	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	5.9E-05	3.0E-05	1.1E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

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TABLE 18-19
NONCARCINOGENIC HQS, CURRENT INDUSTRIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	4.5E-04	8.8E-04	8.3E-08
4-METHYLPHENOL	2.2E-05	5.6E-05	4.0E-09
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	N/A	N/A	N/A
ALPHA-CHLORDANE	5.4E-04	1.0E-03	1.0E-07
ANTHRACENE	5.5E-07	1.7E-06	1.0E-10
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	5.9E-04	1.8E-03	1.1E-07
BUTYLBENZYLPHTHALATE	7.8E-07	1.2E-06	1.4E-10
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	9.8E-07	1.7E-06	1.8E-10
FLUORANTHENE	1.2E-05	3.9E-05	2.3E-09
GAMMA-CHLORDANE	5.7E-04	1.1E-03	1.1E-07
HEPTACHLOR EPOXIDE	2.9E-05	1.1E-04	5.4E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
N-NITROSODIPHENYLAMINE (1)	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	1.4E-04	4.5E-04	2.7E-08
ANTIMONY	6.8E-02	4.3E-01	1.3E-05
ARSENIC	3.4E-02	1.1E-02	6.3E-06
BARIUM	1.9E-03	1.5E-02	3.4E-05
BERYLLIUM	4.9E-05	1.5E-03	9.1E-09
CADMIUM	2.0E-02	1.2E-01	1.0E-05
CHROMIUM	3.3E-02	5.2E-01	6.2E-06
COBALT	1.3E-04	7.8E-04	2.3E-08
COPPER	5.7E-03	2.9E-03	1.0E-06
LEAD	N/A	N/A	N/A
MANGANESE	6.0E-02	6.2E-01	7.9E-04
MERCURY	9.1E-04	4.1E-03	2.9E-07
NICKEL	8.1E-04	1.7E-03	1.5E-07
SILVER	5.0E-03	7.7E-03	9.2E-07
ZINC	3.8E-03	4.8E-03	7.1E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

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TABLE 18-20
CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
2-BUTANONE	N/A	N/A	N/A
BENZENE	2.3E-09	7.1E-09	5.1E-13
CARBON DISULFIDE	N/A	N/A	N/A
ETHYLBENZENE	N/A	N/A	N/A
METHYLENE CHLORIDE	3.9E-10	1.2E-09	7.6E-14
TETRACHLOROETHENE	8.2E-10	2.6E-09	1.5E-13
TOLUENE	N/A	N/A	N/A
TRICHLOROETHENE	1.2E-11	3.6E-11	2.4E-15
XYLENE (TOTAL)	N/A	N/A	N/A
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	1.1E-08	*	2.4E-12
BENZO(A)PYRENE	1.1E-07	*	2.4E-11
BENZO(K)FLUORANTHENE	1.2E-09	*	2.5E-13
BIS(2-ETHYLHEXYL)PHTHALATE	6.8E-09	2.1E-08	1.3E-12
CHRYSENE	1.5E-10	*	3.1E-14
DIBENZOFURAN	N/A	N/A	N/A
DIETHYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
4,4'-DDD	8.0E-10	1.6E-09	1.5E-13
4,4'-DDE	7.9E-10	1.5E-09	1.5E-13
4,4'-DDT	2.4E-09	4.6E-09	5.3E-13
ALPHA-CHLORDANE	8.3E-10	1.6E-09	1.8E-13
AROCLOR-1254	2.7E-08	5.9E-08	5.0E-12
ENDOSULFAN I	N/A	N/A	N/A
ENDOSULFAN II	N/A	N/A	N/A
GAMMA-CHLORDANE	8.8E-10	1.7E-09	2.0E-13
HEPTACHLOR	4.2E-10	1.7E-09	9.5E-14
HEPTACHLOR EPOXIDE	1.1E-08	4.2E-08	2.4E-12
ARSENIC	3.7E-05	1.2E-05	8.3E-09
BERYLLIUM	4.5E-07	1.4E-05	1.2E-10
CADMIUM	N/A	N/A	3.8E-11
CHROMIUM	N/A	N/A	8.2E-08
COPPER	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SELENIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
TOTAL RISK	3.8E-05	2.6E-05	9.0E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

*CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 18-21
NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTAL)	1.0E-05	3.3E-05	1.9E-09
2-BUTANONE	1.3E-08	4.1E-08	3.4E-12
BENZENE	N/A	N/A	4.8E-09
CARBON DISULFIDE	2.0E-08	1.2E-07	4.0E-12
ETHYLBENZENE	2.5E-05	9.6E-05	4.9E-09
METHYLENE CHLORIDE	2.4E-06	7.6E-06	4.6E-10
TETRACHLOROETHENE	4.4E-06	1.4E-05	8.2E-10
TOLUENE	8.9E-07	2.8E-06	2.2E-10
TRICHLOROETHENE	4.9E-07	1.5E-06	9.1E-11
XYLENE (TOTAL)	5.9E-06	2.0E-05	6.2E-09
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	4.5E-05	1.4E-04	8.4E-09
ANTHRACENE	6.6E-06	1.6E-05	1.2E-09
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	6.8E-05	2.1E-04	1.3E-08
CHRYSENE	N/A	N/A	N/A
DIBENZOFURAN	1.1E-03	1.7E-03	2.1E-07
DIETHYLPHTHALATE	8.9E-08	2.8E-07	1.7E-11
FLUORANTHENE	3.4E-06	1.1E-05	6.3E-10
FLUORENE	1.0E-04	3.2E-04	1.9E-08
NAPHTHALENE	2.9E-04	9.2E-04	5.4E-08
PHENANTHRENE	N/A	N/A	N/A
PYRENE	7.9E-05	1.9E-04	1.5E-08
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	3.9E-05	7.6E-05	7.2E-09
ALPHA-CHLORDANE	3.0E-05	5.8E-05	5.5E-09
AROCLOR-1254	N/A	N/A	N/A
ENDOSULFAN I	6.8E-07	1.8E-06	1.3E-10
ENDOSULFAN II	2.3E-06	6.1E-06	4.3E-10
GAMMA-CHLORDANE	3.2E-05	6.2E-05	5.9E-09
HEPTACHLOR	5.3E-07	2.1E-06	9.8E-11
HEPTACHLOR EPOXIDE	2.6E-04	1.0E-03	4.7E-08
ARSENIC	2.3E-02	7.6E-03	4.3E-06
BERYLLIUM	5.9E-05	1.8E-03	1.1E-08
CADMIUM	9.2E-04	5.7E-03	4.7E-07
CHROMIUM	2.9E-02	4.6E-01	5.5E-06
COPPER	1.1E-04	5.9E-05	2.1E-08
IRON	4.3E-02	2.7E-01	7.9E-06
LEAD	N/A	N/A	N/A
SELENIUM	1.1E-04	4.1E-05	2.0E-08
SILVER	5.8E-05	9.1E-05	1.1E-08
VANADIUM	9.5E-03	3.0E-01	1.8E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

XSBRSK16.XLS 3/27/96 7:43 AM

risks and noncarcinogenic HQs are presented for future industrial receptors exposed to groundwater at Site 16 in Tables 18-22 and 18-23, respectively.

18.7.1.3 Future Residential Receptor

Surface Soil and Groundwater

The estimated total cancer risks for the future lifetime resident assuming exposure to COPCs in surface soil at Site 16 are 2.7E-04 (ingestion), 1.0E-04 (dermal contact), and 6.6E-08 (inhalation of COPCs in fugitive dust). The estimated total cancer risks for exposure to COPCs in groundwater at Site 16 are 2.7E-03 (ingestion), 1.1E-04 (dermal contact), and 1.4E-04 (inhalation of volatiles). The surface soil cancer risk exceeds the 1E-04 to 1E-06 target acceptable risk range. The groundwater cancer risk exceeds the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion, 93 percent of the cancer risk for this pathway; and dermal contact, 60 percent of the cancer risk for this pathway) and beryllium (dermal contact, 39 percent of the cancer risk for this pathway). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 82 percent of the cancer risk for this pathway), beryllium (dermal contact, 82 percent of the cancer risk for this pathway), benzene (dermal contact, 11 percent of the cancer risk for this pathway; and inhalation of volatiles; 89 percent of the cancer risk for this pathway), and chloroform (inhalation of volatiles, 11 percent of the cancer risk for this pathway). As noted in the groundwater discussion for Nature and Extent, the calculated cancer risk may not be representative of dissolved phase metals contamination receptor impacts because of the use of unfiltered sample results.

The estimated noncarcinogenic HQs for the future child resident assuming exposure to antimony, chromium (total), and manganese via dermal contact with surface soil at Site 16 are 3.5, 4.3, and 5.1, respectively. The estimated individual HQs for the future residential child receptor via the ingestion and inhalation routes are less than 1.0. The estimated noncarcinogenic HQs for exposure to aluminum, arsenic, chromium (total), iron, thallium, and vanadium via ingestion of groundwater at Site 16 are 3.5, 21, 17, 51, 12, and 5.1, respectively. The estimated noncarcinogenic HQs for exposure to chromium and iron via dermal contact with groundwater by a future child resident at Site 16 are 1.7 and 2.0, respectively. The estimated noncarcinogenic HQ for the future adult resident (inhalation of vapors during showering) assuming exposure to benzene in groundwater at Site 16 is 6.0. Adverse noncarcinogenic health effects cannot be ruled out when the HQs exceed 1.0. The target organs are as follows: antimony (heart), arsenic (skin), chromium (total) (kidney, skin, and respiratory tract), iron (pancreas and liver), manganese (CNS), thallium (GI tract, CNS, skin, and liver), and benzene (hematopoietic system and CNS) As noted in the groundwater discussion of Nature and Extent the estimated HQ may not be representative of dissolved phase metals contamination receptor impacts because of the use of unfiltered sample results.

TABLE 18-22
CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
BENZENE	2.0E-05	3.5E-07
BIS(2-ETHYLHEXYL)PHTHALATE	1.5E-07	7.1E-08
BROMODICHLOROMETHANE	2.2E-07	1.9E-09
CHLOROFORM	2.3E-07	2.2E-09
ETHYLBENZENE	N/A	N/A
NAPHTHALENE	N/A	N/A
PHENOL	N/A	N/A
TETRACHLOROETHENE	1.8E-07	1.3E-08
TOLUENE	N/A	N/A
XYLENE (TOTAL)	N/A	N/A
ALUMINUM	N/A	N/A
ARSENIC	5.2E-04	2.2E-07
BARIUM	N/A	N/A
BERYLLIUM	9.4E-05	3.8E-06
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MERCURY	N/A	N/A
NICKEL	N/A	N/A
SELENIUM	N/A	N/A
THALLIUM	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	6.4E-04	4.5E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 18-23
NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,2-DICHLOROETHENE (TOTAL)	4.1E-02	3.9E-04
BENZENE	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	1.5E-03	7.1E-04
BROMODICHLOROMETHANE	4.9E-04	4.2E-06
CHLOROFORM	1.0E-02	1.0E-04
ETHYLBENZENE	2.0E-04	1.8E-05
NAPHTHALENE	7.3E-04	N/A
PHENOL	1.8E-04	8.9E-07
TETRACHLOROETHENE	9.8E-04	7.1E-05
TOLUENE	3.1E-04	1.3E-05
XYLENE (TOTAL)	1.3E-04	1.1E-05
ALUMINUM	5.4E-01	4.4E-03
ARSENIC	3.2E+00	1.4E-03
BARIUM	6.0E-02	6.2E-04
BERYLLIUM	1.2E-02	5.0E-04
CADMIUM	6.2E-02	5.1E-04
CHROMIUM	2.6E+00	5.3E-02
COBALT	1.0E-03	8.3E-06
COPPER	1.0E-02	7.0E-06
IRON	7.9E+00	6.5E-02
LEAD	N/A	N/A
MERCURY	4.7E-03	2.8E-05
NICKEL	5.8E-02	1.6E-04
SELENIUM	3.3E-02	1.7E-05
THALLIUM	1.9E+00	1.6E-02
VANADIUM	7.8E-01	3.2E-02
ZINC	1.2E-02	1.9E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

XGWRSK16.XLS 3/27/96 7:44 AM

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to surface soil at Site 16 in Tables 18-24 and 18-25, respectively. Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 16 in Tables 18-26 and 18-27, respectively.

Subsurface Soil and Groundwater

The estimated total cancer risks for the future lifetime resident assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 16 are 1.7E-04 (ingestion), 8.8E-05 (dermal contact), and 5.6E-08 (inhalation of COPCs in fugitive dust). The estimated total cancer risks for exposure to COPCs in groundwater at Site 16 are 2.7E-03 (ingestion), 1.1E-04 (dermal contact), and 1.4E-04 (inhalation of volatiles). The subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The groundwater cancer risk exceeds the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 98 percent of the cancer risk for this pathway; and dermal contact, 46 percent of the cancer risk for this pathway) and beryllium (dermal contact, 54 percent of the cancer risk for this pathway). The principal COPCs contributing to the groundwater cancer risk are arsenic (ingestion, 82 percent of the cancer risk for this pathway), beryllium (dermal contact, 82 percent of the cancer risk for this pathway), benzene (dermal contact, 11 percent of the cancer risk for this pathway; and inhalation of volatiles; 89 percent of the cancer risk for this pathway), and chloroform (inhalation of volatiles, 11 percent of the cancer risk for this pathway). As noted in the groundwater discussion for Nature and Extent, the calculated cancer risk may not be representative of dissolved-phase metals contamination receptor impacts because of the use of unfiltered sample results for risk assessment.

The estimated noncarcinogenic HQs for the future child resident assuming exposure to chromium (total), iron, and vanadium via dermal contact with subsurface soil (assuming subsurface soils become future surface soils) at Site 16 are 3.8, 2.2, and 2.4, respectively. The estimated individual HQs for the future residential child receptor via the ingestion and inhalation routes are less than 1.0. The estimated noncarcinogenic HQs for exposure to aluminum, arsenic, chromium (total), iron, thallium, and vanadium via ingestion of groundwater at Site 16 are 3.5, 21, 17, 51, 12, and 5.1, respectively. The estimated noncarcinogenic HQs for exposure to chromium and iron via dermal contact with groundwater by a future child resident at Site 16 are 1.7 and 2.0, respectively. The estimated noncarcinogenic HQ for the future adult resident (inhalation of vapors during showering) assuming exposure to benzene in groundwater at Site 16 is 6.0. Adverse noncarcinogenic health effects cannot be ruled out when the HQs exceed 1.0. The target organs are as follows: arsenic (skin), chromium (total) (kidney, skin, and respiratory tract), iron (pancreas and liver), manganese (CNS), thallium (GI tract, CNS, skin, and liver), and benzene (hematopoietic system and CNS) As noted in the groundwater discussion of Nature and Extent the estimated HQ may not be representative of dissolved phase metals contamination receptor impacts because of the use of unfiltered sample results.

TABLE 18-24
CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDD	1.4E-07	1.9E-07	3.4E-12
4,4'-DDE	6.4E-08	9.2E-08	1.6E-12
4,4'-DDT	1.2E-07	1.8E-07	3.7E-12
4-METHYLPHENOL	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	1.3E-09	1.5E-09	3.9E-14
ALPHA-CHLORDANE	6.7E-08	9.7E-08	2.0E-12
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	5.1E-07	*	1.5E-11
BENZO(A)PYRENE	1.4E-05	*	4.1E-10
BENZO(B)FLUORANTHENE	1.1E-06	*	3.4E-11
BENZO(G,H,I)PERYLENE	N/A	*	N/A
BENZO(K)FLUORANTHENE	9.8E-09	*	2.9E-13
BIS(2-ETHYLHEXYL)PHTHALATE	2.6E-07	6.1E-07	6.7E-12
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	1.7E-09	*	4.3E-14
CHRYSENE	9.3E-09	*	2.7E-13
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
GAMMA-CHLORDANE	7.1E-08	1.0E-07	2.2E-12
HEPTACHLOR EPOXIDE	5.6E-09	1.6E-08	1.7E-13
INDENO(1,2,3-CD)PYRENE	2.3E-07	*	6.8E-12
N-NITROSODIPHENYLAMINE (1)	4.8E-10	1.1E-09	1.2E-14
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ANTIMONY	N/A	N/A	N/A
ARSENIC	2.5E-04	6.0E-05	7.5E-09
BARIUM	N/A	N/A	N/A
BERYLLIUM	1.7E-06	3.9E-05	5.9E-11
CADMIUM	N/A	N/A	5.1E-10
CHROMIUM	N/A	N/A	5.7E-08
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
MANGANESE	N/A	N/A	N/A
MERCURY	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	2.6E-04	1.0E-04	6.6E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

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TABLE 18-25
NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 16
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - CHILD	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	5.9E-03	7.2E-03	8.8E-08
4-METHYLPHENOL	2.8E-04	4.6E-04	4.2E-09
ACENAPHTHYLENE	N/A	N/A	N/A
ALPHA-BHC	N/A	N/A	N/A
ALPHA-CHLORDANE	7.0E-03	8.6E-03	1.1E-07
ANTHRACENE	7.2E-06	1.4E-05	1.1E-10
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	7.7E-03	1.5E-02	1.1E-07
BUTYLBENZYLPHTHALATE	1.0E-05	1.0E-05	1.5E-10
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	1.3E-05	1.4E-05	1.9E-10
FLUORANTHENE	1.6E-04	3.2E-04	2.4E-09
GAMMA-CHLORDANE	7.5E-03	9.1E-03	1.1E-07
HEPTACHLOR EPOXIDE	3.8E-04	9.4E-04	5.7E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
N-NITROSODIPHENYLAMINE (1)	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	1.9E-03	3.7E-03	2.8E-08
ANTIMONY	8.9E-01	3.5E+00	1.3E-05
ARSENIC	4.5E-01	9.2E-02	6.7E-06
BARIUM	2.4E-02	1.2E-01	3.6E-05
BERYLLIUM	6.4E-04	1.2E-02	9.6E-09
CADMIUM	2.6E-01	1.0E+00	1.1E-05
CHROMIUM	4.4E-01	4.3E+00	6.5E-06
COBALT	1.6E-03	6.4E-03	2.5E-08
COPPER	7.4E-02	2.4E-02	1.1E-06
LEAD	N/A	N/A	N/A
MANGANESE	7.9E-01	5.1E+00	8.3E-04
MERCURY	1.2E-02	3.3E-02	3.0E-07
NICKEL	1.1E-02	1.4E-02	1.6E-07
SILVER	6.5E-02	6.3E-02	9.7E-07
ZINC	5.0E-02	3.9E-02	7.5E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

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TABLE 18-26
CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
BENZENE	8.6E-05	1.1E-05	1.0E-04
BIS(2-ETHYLHEXYL)PHTHALATE	6.2E-07	2.3E-06	N/A
BROMODICHLOROMETHANE	9.2E-07	5.9E-08	N/A
CHLOROFORM	9.7E-07	7.1E-08	1.2E-05
ETHYLBENZENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENOL	N/A	N/A	N/A
TETRACHLOROETHENE	7.7E-07	4.2E-07	2.7E-08
TOLUENE	N/A	N/A	N/A
XYLENE (TOTAL)	N/A	N/A	N/A
ALUMINUM	N/A	N/A	N/A
ARSENIC	2.2E-03	5.3E-06	N/A
BARIUM	N/A	N/A	N/A
BERYLLIUM	4.0E-04	9.0E-05	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	N/A
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
MERCURY	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
SELENIUM	N/A	N/A	N/A
THALLIUM	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	2.7E-03	1.1E-04	1.1E-04

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 18-27
NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 16
GROUNDWATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - CHILD	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
1,2-DICHLOROETHENE (TOTAL)	2.7E-01	1.5E-02	N/A
BENZENE	N/A	N/A	6.0E+00
BIS(2-ETHYLHEXYL)PHTHALATE	9.6E-03	2.7E-02	N/A
BROMODICHLOROMETHANE	3.2E-03	1.6E-04	N/A
CHLOROFORM	6.8E-02	3.9E-03	N/A
ETHYLBENZENE	1.3E-03	6.9E-04	3.2E-04
NAPHTHALENE	4.8E-03	N/A	N/A
PHENOL	1.1E-03	3.4E-05	N/A
TETRACHLOROETHENE	6.4E-03	2.7E-03	N/A
TOLUENE	2.0E-03	4.8E-04	2.7E-03
XYLENE (TOTAL)	8.3E-04	4.3E-04	1.4E-02
ALUMINUM	3.5E+00	1.4E-01	N/A
ARSENIC	2.1E+01	4.4E-02	N/A
BARIUM	3.9E-01	1.9E-02	N/A
BERYLLIUM	8.0E-02	1.6E-02	N/A
CADMIUM	4.0E-01	1.6E-02	N/A
CHROMIUM	1.7E+01	1.7E+00	N/A
COBALT	6.6E-03	2.6E-04	N/A
COPPER	6.7E-02	2.2E-04	N/A
IRON	5.1E+01	2.0E+00	N/A
LEAD	N/A	N/A	N/A
MERCURY	3.1E-02	8.6E-04	N/A
NICKEL	3.8E-01	4.9E-03	N/A
SELENIUM	2.2E-01	5.3E-04	N/A
THALLIUM	1.2E+01	4.9E-01	N/A
VANADIUM	5.1E+00	1.0E+00	N/A
ZINC	7.7E-02	6.0E-04	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

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Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soils at Site 16 in Tables 18-28 and 18-29, respectively. Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater at Site 16 in Tables 18-26 and 18-27, respectively.

18.7.1.4 Future Recreational Receptor

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 16 are 2.1E-07 (ingestion) and 7.2E-08 (dermal contact). This sediment cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The estimated individual HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 16 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 16 in Tables 18-30 and 18-31, respectively.

18.7.1.5 Lead Results

Lead was found above the EPA level of concern (400 mg/kg) in one surface soil sample taken during RI and lead was found at concentrations exceeding the EPA action level (15 ug/L) in one groundwater sample taken.

The IEUBK Lead Model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 16 exposures are presented in Appendix I.

18.7.2 Conclusions

Surface soil, subsurface soil, sediment, and groundwater were sampled at Site 16. The potential receptors for this site were current industrial and future industrial, residential, and recreational receptors.

The cancer risks associated with future industrial (subsurface soil and groundwater) and future residential (surface soil and groundwater and subsurface soil and groundwater) exposure scenarios were at or above 1E-04, the upper end of the target risk range. Arsenic (via ingestion of groundwater) and beryllium (via dermal contact with groundwater) were the major COPCs that contributed to the cancer risk for the future industrial receptor exposure scenario. Arsenic (via ingestion of surface soil, subsurface soil, and groundwater; and via dermal contact with surface and subsurface soil) and beryllium (via dermal contact

TABLE 18-28
CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
2-BUTANONE	N/A	N/A	N/A
BENZENE	1.0E-08	2.4E-08	3.1E-13
CARBON DISULFIDE	N/A	N/A	N/A
ETHYLBENZENE	N/A	N/A	N/A
METHYLENE CHLORIDE	1.8E-09	4.1E-09	4.7E-14
TETRACHLOROETHENE	3.7E-09	8.4E-09	9.4E-14
TOLUENE	N/A	N/A	N/A
TRICHLOROETHENE	5.2E-11	1.2E-10	1.5E-15
XYLENE (TOTAL)	N/A	N/A	N/A
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	4.9E-08	*	1.5E-12
BENZO(A)PYRENE	4.9E-07	*	1.5E-11
BENZO(K)FLUORANTHENE	5.3E-09	*	1.6E-13
BIS(2-ETHYLHEXYL)PHTHALATE	3.1E-08	7.1E-08	7.8E-13
CHRYSENE	6.5E-10	*	1.9E-14
DIBENZOFURAN	N/A	N/A	N/A
DIETHYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
4,4'-DDD	3.6E-09	5.2E-09	9.1E-14
4,4'-DDE	3.5E-09	5.1E-09	8.9E-14
4,4'-DDT	1.1E-08	1.5E-08	3.2E-13
ALPHA-CHLORDANE	3.7E-09	5.3E-09	1.1E-13
AROCLOR-1254	1.2E-07	2.0E-07	3.1E-12
ENDOSULFAN I	N/A	N/A	N/A
ENDOSULFAN II	N/A	N/A	N/A
GAMMA-CHLORDANE	4.0E-09	5.7E-09	1.2E-13
HEPTACHLOR	1.9E-09	5.5E-09	5.8E-14
HEPTACHLOR EPOXIDE	4.8E-08	1.4E-07	1.5E-12
ARSENIC	1.7E-04	4.0E-05	5.1E-09
BERYLLIUM	2.0E-06	4.7E-05	7.1E-11
CADMIUM	N/A	N/A	2.3E-11
CHROMIUM	N/A	N/A	5.0E-08
COPPER	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SELENIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
TOTAL RISK	1.7E-04	8.7E-05	5.5E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

*CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 18-29
NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 16
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
1,2-DICHLOROETHENE (TOTAL)	1.4E-04	2.7E-04	2.0E-09
2-BUTANONE	1.7E-07	3.3E-07	3.6E-12
BENZENE	N/A	N/A	5.1E-09
CARBON DISULFIDE	2.6E-07	1.0E-06	4.2E-12
ETHYLBENZENE	3.2E-04	7.9E-04	5.2E-09
METHYLENE CHLORIDE	3.2E-05	6.2E-05	4.9E-10
TETRACHLOROETHENE	5.8E-05	1.1E-04	8.6E-10
TOLUENE	1.2E-05	2.3E-05	2.3E-10
TRICHLOROETHENE	6.4E-06	1.2E-05	9.6E-11
XYLENE (TOTAL)	7.7E-05	1.7E-04	6.5E-09
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	5.9E-04	1.2E-03	8.8E-09
ANTHRACENE	8.6E-05	1.3E-04	1.3E-09
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	8.9E-04	1.7E-03	1.3E-08
CHRYSENE	N/A	N/A	N/A
DIBENZOFURAN	1.5E-02	1.4E-02	2.2E-07
DIETHYLPHTHALATE	1.2E-06	2.3E-06	1.7E-11
FLUORANTHENE	4.5E-05	8.7E-05	6.7E-10
FLUORENE	1.3E-03	2.6E-03	2.0E-08
NAPHTHALENE	3.8E-03	7.5E-03	5.7E-08
PHENANTHRENE	N/A	N/A	N/A
PYRENE	1.0E-03	1.5E-03	1.5E-08
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	5.1E-04	6.2E-04	7.7E-09
ALPHA-CHLORDANE	3.9E-04	4.7E-04	5.8E-09
AROCLOR-1254	N/A	N/A	N/A
ENDOSULFAN I	8.9E-06	1.5E-05	1.3E-10
ENDOSULFAN II	3.0E-05	5.0E-05	4.6E-10
GAMMA-CHLORDANE	4.1E-04	5.1E-04	6.2E-09
HEPTACHLOR	6.9E-06	1.7E-05	1.0E-10
HEPTACHLOR EPOXIDE	3.3E-03	8.1E-03	5.0E-08
ARSENIC	3.0E-01	6.2E-02	4.5E-06
BERYLLIUM	7.7E-04	1.5E-02	1.1E-08
CADMIUM	1.2E-02	4.7E-02	4.9E-07
CHROMIUM	3.8E-01	3.8E+00	5.8E-06
COPPER	1.5E-03	4.8E-04	2.2E-08
IRON	5.6E-01	2.2E+00	8.4E-06
LEAD	N/A	N/A	N/A
SELENIUM	1.4E-03	3.4E-04	2.1E-08
SILVER	7.6E-04	7.4E-04	1.1E-08
VANADIUM	1.2E-01	2.4E+00	1.9E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

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TABLE 18-30
CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 16
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
2-METHYLNAPHTHALENE	N/A	N/A
4,4'-DDD	1.7E-10	4.3E-11
4,4'-DDE	6.1E-11	1.5E-11
4,4'-DDT	1.5E-10	3.8E-11
ACENAPHTHENE	N/A	N/A
ALPHA-BHC	3.1E-12	6.2E-13
ANTHRACENE	N/A	N/A
BENZO(A)ANTHRACENE	5.3E-09	*
BENZO(A)PYRENE	4.7E-08	*
BENZO(B)FLUORANTHENE	6.0E-09	*
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	2.0E-10	*
BIS(2-ETHYLHEXYL)PHTHALATE	7.1E-11	2.8E-11
BUTYLBENZYLPHTHALATE	N/A	N/A
CARBAZOLE	3.6E-11	*
CHRYSENE	5.5E-11	*
DIBENZ(A,H)ANTHRACENE	7.2E-09	*
DIBENZOFURAN	N/A	N/A
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
GAMMA-CHLORDANE	4.4E-11	1.1E-11
INDENO(1,2,3-CD)PYRENE	2.3E-09	*
METHOXYCHLOR	N/A	N/A
NAPHTHALENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
ALUMINUM	N/A	N/A
ANTIMONY	N/A	N/A
ARSENIC	1.2E-07	5.1E-09
BARIUM	N/A	N/A
BERYLLIUM	1.7E-08	6.7E-08
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
SILVER	N/A	N/A
THALLIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	2.1E-07	7.2E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

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TABLE 18-31
NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 16
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
2-METHYLNAPHTHALENE	NA	NA
4,4'-DDD	NA	NA
4,4'-DDE	NA	NA
4,4'-DDT	1.0E-05	2.6E-06
ACENAPHTHENE	3.1E-07	1.2E-07
ALPHA-BHC	NA	NA
ANTHRACENE	9.2E-08	3.6E-08
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	2.9E-06	1.2E-06
BUTYLBENZYLPHTHALATE	4.2E-08	8.2E-09
CARBAZOLE	NA	NA
CHRYSENE	NA	NA
DIBENZ(A,H)ANTHRACENE	NA	NA
DIBENZOFURAN	2.5E-06	5.0E-07
FLUORANTHENE	4.0E-06	1.6E-06
FLUORENE	4.2E-07	1.6E-07
GAMMA-CHLORDANE	6.6E-06	1.6E-06
INDENO(1,2,3-CD)PYRENE	NA	NA
METHOXYCHLOR	2.5E-07	5.4E-08
NAPHTHALENE	2.3E-07	9.2E-08
PHENANTHRENE	NA	NA
PYRENE	7.7E-06	3.0E-06
ALUMINUM	5.5E-04	4.3E-04
ANTIMONY	4.8E-04	3.8E-04
ARSENIC	3.2E-03	1.3E-04
BARIUM	4.1E-05	4.0E-05
BERYLLIUM	9.2E-06	3.6E-05
CADMIUM	6.1E-04	4.9E-04
CHROMIUM	1.5E-03	3.0E-03
COBALT	4.8E-06	3.8E-06
COPPER	8.5E-05	5.6E-06
IRON	5.9E-03	4.7E-03
LEAD	NA	NA
MANGANESE	2.4E-03	3.1E-03
SILVER	NA	NA
THALLIUM	2.6E-03	2.0E-03
ZINC	5.6E-05	8.9E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

with surface soil, subsurface soil, and groundwater) were the major COPCs that contributed to the cancer risks for the future residential exposure scenarios.

Noncarcinogenic HQs associated with future industrial (groundwater) and future (residential (surface soil and groundwater; and subsurface soil and groundwater) exposure scenarios exceeded 1.0; the cutoff point below which adverse noncarcinogenic effects are expected to occur. Arsenic (via ingestion of groundwater), chromium (total)(via ingestion of groundwater), iron (via ingestion of groundwater), and vanadium (via ingestion of groundwater) were the COPCs that exceeded 1.0 for the future industrial receptor exposure scenario. Antimony (via dermal contact with surface soil), arsenic (via ingestion of surface soil; subsurface soil and groundwater; and via dermal contact with surface soil and subsurface soil), chromium (total) (via dermal contact with surface soil), manganese (via dermal contact with surface soil), aluminum (via ingestion of groundwater), iron (via ingestion and dermal contact with groundwater), thallium (via ingestion of groundwater), vanadium (via ingestion of and dermal contact with groundwater), and benzene (via inhalation of vapors in groundwater) were the COPCs that exceeded 1.0 for the future residential exposure scenarios.

Lead concentrations at the site were detected at levels that may be expected to be associated with significant increases in blood-lead levels based on the results (blood-lead levels greater than 10 ug/dl are expected in 64.0 percent of the population of children, age 0 through 6 years) of the IEUBK Lead Model (v. 0.99). The cutoff level is 5 percent of the population with blood-lead greater than 10 ug/dl, the protection level most often used by EPA (1994).

Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 16 in Table 18-32 for surface soil, subsurface soil, sediment, and groundwater.

18.8 ECOLOGICAL RISK ASSESSMENT

18.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Site 16 and EPIC Site F are located in a highly developed area. The sites are characterized by heavy equipment storage areas, railroad beds, buildings, paved areas, and graveled areas. A small catch basin between the railroad beds that lead to Buildings C-19 and C-50 collects surface runoff from most of the area. Although a small culvert is present between the catch basin and the eastern edge of the railroad tracks, water tends to perch and infiltrate rather than flow through the culvert. In addition, a small drainage ditch lies adjacent to the railroad tracks northeast of Building C-50 that collects runoff from the eastern portion of the site. Water drains to the north, but flows in the ditch only after periods of heavy rainfall. Another small drainage depression exists within the railroad tracks that lead up to Building C-19, and flows

TABLE 18-32
SUMMARY OF ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk					Estimated Hazard Index**					
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident Child	Future Resident Child	Future Resident Adult	Future Recreational Child
Surface Soil	Incidental Ingestion	5.9E-05	N/A	N/S	2.6E-04	N/A	2.4E-01	N/A	N/S	3.1E+00	N/A	N/A
	Dermal Contact	3.0E-05	N/A	N/S	1.0E-04	N/A	1.8E+00	N/A	N/S	1.4E+01	N/A	N/A
	Inhalation of Fugitive Dust	1.1E-07	N/A	N/S	6.6E-08	N/A	8.6E-04	N/A	N/S	9.1E-04	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	3.8E-05	1.7E-04	N/S	N/A	N/A	1.1E-01	1.4E+00	N/S	N/A	N/A
	Dermal Contact	N/A	2.6E-05	8.7E-05	N/S	N/A	N/A	1.0E+00	8.6E+00	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	9.0E-08	5.5E-08	N/S	N/A	N/A	2.0E-05	2.1E-05	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/A	2.1E-07	N/A	N/A	N/A	N/A	N/A	1.7E-02
	Dermal Contact	N/A	N/A	N/A	N/A	7.2E-08	N/A	N/A	N/A	N/A	N/A	1.4E-02
Groundwater	Ingestion	N/A	6.4E-04	2.7E-03	2.7E-03	N/A	N/A	1.7E+01	1.1E+02	1.1E+02	N/A	N/A
	Dermal Contact	N/A	4.5E-06	1.1E-04	1.1E-04	N/A	N/A	1.8E-01	5.4E+00	5.4E+00	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	1.1E-04	1.1E-04	N/A	N/A	N/A	N/A	N/A	6.0E+00	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/A	N/S
TOTAL		8.9E-05	7.0E-04	3.2E-03	3.3E-03	2.8E-07	2.0E+00	1.8E+01	1.3E+02	1.3E+02	6.0E+00	3.2E-02

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

to a catch basin to the north. However, no outlet for flowing water exists in the catch basin and water tends to perch and infiltrate; water is present in this drainage area also only after periods of heavy rainfall.

The sites are completely devoid of vegetation due to their heavily developed nature, with the exception of some areas that are covered by mowed turfgrass. However, an extensive forested wetland is located approximately 300 feet to the north of Site 16 and Epic Site F. The wetland is dominated by red maple, with some pitch pine and gray birch, and provides excellent habitat, primarily for terrestrial receptors. Most species of mammals and birds that are attracted to forested areas are expected to utilize these areas.

Some standing water is present on the edge of the wetlands, but water is scarce in the wetland interior, precluding the existence of an extensive aquatic community. The small drainage ditch northeast of the site terminates in the forested area. The catch basins in and between the railroad bed and the drainage ditch northeast of the site are relatively small and contain no aquatic habitat. The closest significant surface water is a branch of Hockhockson Brook, located approximately 400 yards northwest of the site. Hence, the site is located within the Hockhockson Brook watershed. Yet no outlet exists for water to exit the wetlands. RI Site 29 is located approximately 400 yards north of Site 16 and Epic Site F. No sensitive habitats, other than the wetlands, and no threatened or endangered species are known to occur on and around the site.

Contaminant Sources, Release Mechanisms, and Migration Pathways

A leak in the underground fuel line north of Building C-19 was discovered in 1977, and the contaminated soil was excavated. Also, water that was released from an oil/water separator was sent to the drainage ditch within the railroad beds. In 1989, the oil/water separator failed and the ditch was excavated. Some soil in the railroad tracks is also stained with oil, most likely from locomotive maintenance. The major release pathways from these areas include overland runoff and infiltration of contaminants. Precipitation runoff at Site 16 and Epic Site F may carry constituents to nearby surface waters and sediments. This is of major importance at Site 16 and Epic Site F since runoff from part of the developed areas drains to the ditch northeast of the site that eventually drains to wetlands. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a contaminant may be carried with the flow of groundwater to downgradient locations. Groundwater from the site may eventually discharge to surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of semi-aquatic organisms in the wetland area to the north. However, although some areas of standing water are present at the edge of the wetland, significant surface water does not exist, limiting the significance of this pathway.

Exposure Routes

Direct exposure to contaminants in soil for terrestrial ecological receptors, both plant and animal, is expected to be minimal directly on Site 16 and Epic Site F since it is heavily developed. Terrestrial receptors may come into contact with contaminants in Site 16 and Epic Site F surface water by using it as a source of drinking water, although exposure via this route is assumed to be insignificant. Therefore, evaluation of potential risks to terrestrial plants and animals directly on the sites was not applicable. Semi-aquatic and terrestrial organisms inhabiting the wetlands to the north may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic organisms may be exposed to constituents from contaminated groundwater that flows into surface water. However, the absence of significant surface water precludes the existence of an extensive aquatic community in the wetlands.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this site. In particular, contaminants detected in drainage ditch sediments were considered preliminary COPCs. Results of soil borings taken north of Building C-18 and C-19 during the 1993 SI were also evaluated quantitatively, as were surface soil samples collected in the developed areas and groundwater samples collected during 1995 RI activities.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

18.8.1.2 Ecological Effects Assessment

Ecotox threshold (ET) values were utilized for screening potential risks from contaminated sediments. Sediment ET values are presented in Table 2-27.

18.8.2 Preliminary Exposure Assessment and Risk Characterization

18.8.2.1 Preliminary Exposure Assessment

Contaminant concentrations in sediment used for representative exposure point contaminant concentrations in this screening were obtained from 1995 RI samples. One RI sediment sample was collected at the north end of the catch basin area and two were collected in the drainage ditch northeast of Building C-50 to investigate potential contaminant runoff and migration to the wetland areas. The maximum detected contaminant concentrations in sediment were used as conservative representative exposure point concentrations. Surface soil samples were taken during 1995 but were not used for initial screening purposes since they were taken in a highly developed area. These data, along with soil boring data from the SI and groundwater data from the RI, are discussed qualitatively. Background concentrations presented for comparative purposes are the maximum values detected in facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

18.8.2.2 Risk Characterization

No inorganics exceeded ET values in Site 16 and Epic Site F sediments, with the exception of cadmium (HQ = 2.0) and lead (HQ = 1.23) (Table 18-33). Hence, these two inorganics were retained as final COPCs, but they did not exceed less conservative ET values. Aluminum, beryllium, thallium, and vanadium were conservatively retained as final COPCs since no suitable thresholds were available. Some organics exceeded the most conservative ETs in Site 16 and Epic Site F sediments, but did not exceed less stringent values, including 4,4'-DDT, 4,4'-DDE, and several PAHs. The organochlorine 4,4'-DDD exceeded the most conservative ET available and slightly exceeded a less conservative value. The toxicological properties of all final COPCs are summarized in Appendix M.

18.8.3 Summary and Conclusions

There is little ecological habitat on Site 16 and Epic Site F, although a small drainageway leads to forested wetlands approximately 300 feet north of the site. The edge of the wetlands contains some standing water, but the interior of the wetland is forested and rarely contains standing water. The wetland area is probably utilized by a wide variety of wildlife, primarily terrestrial species. Runoff of contaminants to the drainage areas is possible, and one of these drainage areas terminates at the edge of the wetlands. Groundwater contaminant inputs to the drainage areas or edge of the wetlands are also possible.

Five soil borings were taken near the top of the water table in front of Buildings C-18 and C-19 as part of the 1992 SI field activities, and were analyzed for TPH and SVOCs. Five PAHs were detected in elevated concentrations in some samples, along with some slightly elevated levels of one phthalate compound. TPH was also detected in elevated levels. Several subsurface soil samples were taken throughout the site as part of 1995 RI sampling activities. Levels of metals were generally in the range of background in these samples. Several PAHs and VOCs were detected in elevated levels in subsurface soils, and some pesticides and PCBs were detected in low levels. Three surface soil samples were taken from the

TABLE 18-33
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold[1] (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	3/3	3940	4295	NA		Retained-No suitable threshold available
Antimony	1/3	ND	1.5	2	0.75	Eliminated-Does not exceed threshold
Arsenic	3/3	6.2	7.45	8.2	0.91	Eliminated-Does not exceed threshold
Barium	3/3	10.6	22.35	40	0.56	Eliminated-Does not exceed threshold
Beryllium	3/3	0.57	0.36	NA		Retained-No suitable threshold available
Cadmium	3/3	ND	2.4	1.2/9.6	2.0/0.25	Retained-HQ > 1
Chromium	3/3	56	58.7	81	0.72	Eliminated-Does not exceed threshold
Cobalt	3/3	2.1	2.25	50	0.05	Eliminated-Does not exceed threshold
Copper	3/3	13	26.7	34/270	0.79	Eliminated-Does not exceed threshold
Lead	3/3	34.3	57.9	47/218	1.23/0.27	Retained-HQ > 1
Manganese	3/3	9.2	93.05	460	0.20	Eliminated-Does not exceed threshold
Mercury	3/3	0.068	0.06	0.15	0.40	Eliminated-Does not exceed threshold
Nickel	3/3	6	5.5	21	0.26	Eliminated-Does not exceed threshold
Silver	3/3	ND	0.63	1.0	0.63	Eliminated-Does not exceed threshold
Thallium	2/3	ND	1.6	NA		Retained-No suitable threshold available
Vanadium	3/3	42.7	40.75	NA		Retained-No suitable threshold available
Zinc	3/3	26.9	132	150	0.88	Eliminated-Does not exceed threshold
Organics[3]						
2-Methylnapthalene	1/3	ND	119.5	330	0.36	Eliminated-Does not exceed threshold
4,4'-DDD	1/3	21	66.5	1.6/46	41.6/1.45	Retained-HQ > 1
4,4'-DDE	3/3	1.7	16.5	2.2/27	7.5/0.61	Retained-HQ > 1
4,4'-DDT	3/3	19	41	1.6/46	25.6/0.89	Retained-HQ > 1
Acenapthene	1/3	ND	145	620	0.23	Eliminated-Does not exceed threshold
Alpha-BHC	1/3	ND	0.05	3.7	0.01	Eliminated-Does not exceed threshold
Anthracene	1/3	ND	215	330	0.65	Eliminated-Does not exceed threshold
Benzo(a)anthracene	3/3	560	660	330/1600	2.00/0.41	Retained-HQ > 1
Benzo(a)pyrene	3/3	590	590	430/1600	1.37/0.37	Retained-HQ > 1
Benzo(b)fluoranthene	3/3	490	750	330/1700	2.27/0.44	Retained-HQ > 1
Benzo(g,h,i)perylene	3/3	380	350	330/1700	1.06/0.21	Retained-HQ > 1
Benzo(k)fluoranthene	2/3	470	250	330	0.76	Eliminated-Does not exceed threshold

TABLE 18-33
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 16
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold[1] (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Bis(2-ethylhexyl)phthalate	3/3	ND	460	8.90E+08	0.00	Eliminated-Does not exceed threshold
Butylbenzylphthalate	1/3	ND	65	11000	0.00	Eliminated-Does not exceed threshold
Carbazole	1/3	ND	165	330	0.5	Eliminated-Does not exceed threshold
Chrysene	3/3	940	690	330/1700	2.09/0.41	Retained-HQ > 1
Dibenzo(a,h)anthracene	1/3	ND	90	330	0.27	Eliminated-Does not exceed threshold
Dibenzofuran	1/3	ND	79.5	2000	0.04	Eliminated-Does not exceed threshold
Fluoranthene	3/3	1800	1250	2900	0.43	Eliminated-Does not exceed threshold
Fluorene	1/3	190	130	540	0.24	Eliminated-Does not exceed threshold
Gamma-Chlordane	3/3	0.1	3.1	7	0.44	Eliminated-Does not exceed threshold
Indeno(1,2,3-cd)pyrene	3/3	310	290	330	0.88	Eliminated-Does not exceed threshold
Methoxychlor	1/3	ND	9.6	19	0.51	Eliminated-Does not exceed threshold
Napthalene	1/3	ND	72.5	480	0.15	Eliminated-Does not exceed threshold
Phenanthrene	3/3	1900	965	850/1500	1.14/0.64	Retained-HQ > 1
Pyrene	3/3	1900	1800	660/2600	2.73/0.69	Retained-HQ > 1

ND = None detected
NA = No suitable threshold was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

developed areas on the site as part of RI activities. These samples contained elevated concentrations of some metals, PAHs, and phthalates, and some low levels of pesticides. In RI groundwater samples, elevated concentrations of some metals and organics were detected. In particular, a floating product layer is present on shallow groundwater.

In Site 16 and Epic Site F sediments, which were used for quantitative ecological risk assessment, HQs for metals were indicative of low potential risk (Table 18-33). Aluminum, beryllium, thallium, and vanadium were conservatively retained as final COPCs since no suitable ET values were available. Aluminum, beryllium, and vanadium were all detected in concentrations below or comparable to background. Thallium was not detected in background, but was present only in low concentrations at the site. Several organics were detected in Site 16 and Epic Site F sediments, but HQs were indicative of low potential risk, with the exception of 4,4'-DDD and 4,4'-DDT. These two organochlorines had HQs indicative of moderate potential risk. However, 4,4-DDD was only detected in one sample, and was not detected in the sample taken at the edge of the wetlands (16SDO2; Figure 18-1). Also, the maximum concentration of 4,4-DDT was not a relatively high concentration, and although it exceeded the most conservative value available, it did not exceed a less conservative value.

The results of 1995 RI sediment samples indicate that potential risks to ecological receptors in the wetlands from inorganics are relatively low. Although several SVOCs, mainly PAHs, and organochlorine pesticides were detected in drainage areas that lead to the wetland areas, HQ values were generally low. As a result, a cumulative toxic effect is unlikely at the concentrations present. Although 4,4'-DDD and 4,4'-DDT had elevated HQs, they still were not detected in relatively high concentrations, and 4,4'-DDD was not detected in the sediment sample collected closest to the wetlands. The organochlorine pesticides detected also have strong affinities for organic carbon in sediments, and hence, do not have a tendency to migrate significantly. Moreover, the presence of pesticides in sediments near the site is not necessarily indicative of Site 16 or Epic Site F releases since these chemicals were probably used base wide for pest control and are not known to have been stored or disposed of at the site. Additional sediment samples could be taken in the wetland area to further investigate contaminant migration to these areas, but the presence of relatively low levels of contaminants in drainage areas leading to the wetlands suggests limited overland migration. Surface water samples would be difficult to collect and interpret since water levels are ephemeral in the wetlands. However, groundwater to surface water migration of contaminants is possible since groundwater flows in a north-northeast direction towards the wetland areas. A feasibility study for groundwater (floating product) remediation is currently underway. As such, this potential contaminant source to the wetlands will most likely be removed. Again, although some standing water is present at the edge of the wetlands, aquatic habitat is limited, preventing the existence of an extensive aquatic community. Since no drainage occurs from the wetlands, contaminant contributions to the Hockhockson Brook watershed appear to be negligible.

Although there appears to be little measurable impact currently from the site, conditions may change during the course of further investigation/ remediation. Therefore, additional sediment and surface water sampling should be considered in the wetlands to further investigate potential contaminant migration to those areas, and to provide a baseline status for future (post remediation) comparison.

18.9 EVALUATION AND RECOMMENDATIONS

18.9.1 Evaluation Summary

The documented presence of floating product (diesel fuel) on the groundwater indicates that the source of groundwater contaminants is far from depleted. There appears to be sufficient floating product to pump or otherwise physically capture as concentrated waste.

The infrequent low levels of metals in sediments and subsurface soil at concentrations above ARARs and TBCs indicates that the site is apparently not heavily contaminated with mobile metals. Metals found in the surface soils could be associated with the large quantity of slag railroad bed ballast used for the many rail lines in the area.

Surface contaminants, in contrast to the subsurface groundwater borne compounds, do not appear to be dispersing widely in the environment.

Metals in groundwater at levels above regulatory guidelines included aluminum, arsenic, beryllium, cadmium, iron. , manganese, lead, thallium and sodium. In general the highest concentrations of metals were found in the wells with the highest sample endpoint turbidity values [i.e., MW16-06 (>999 NTU) and MW16-03 (529 NTU)]. Filtered sample results for metals concentrations were lower than the corresponding unfiltered sample result. For example, lead in MW16-6 was reduced from 46.5 ug/L (unfiltered) to non detect, estimated.

Organic compounds found at concentrations above regulatory guidelines in groundwater include 1,2-dichloroethene, benzene and chloroform. These compounds are at least partially associated with a fuel oil release in the area.

Results of human health risk assessment concluded that calculated cancer and non-cancer risks were above guideline limits for numerous scenarios due to compounds in surface soil, subsurface soil, and groundwater.

Ecological risk assessment concluded that although there appears to be little measurable impact currently from the site, conditions may change during the course of further investigation/remediation. Therefore, additional sediment and surface water sampling should be considered in the wetlands to further investigate potential contaminant migration to those areas, and to provide a baseline status for future (post remediation) comparison.

18.9.2 Recommendations

A *feasibility study for floating product remediation is underway.*

A comprehensive site management plan, including continued protection of ecological receptors during remedial construction activities, considering all aspects of site remediation should be developed.

Additional sediment and surface water sampling should be considered in the wetlands to further investigate potential contaminant migration to those areas, and to provide a baseline status for future comparison.

19.0 SITE 17: LANDFILL

19.1 SITE BACKGROUND AND PHYSICAL SETTING

The Site 17 Landfill occupies 3 acres in the Waterfront area, adjacent to a tidal marsh in the Ware Creek drainage basin. The site was used for the disposal of wood, forklifts, empty paint cans, and construction debris. The landfill surface is covered with and is currently utilized as a parking area for waterfront personnel. The face of the landfill is 10 to 15 feet higher in elevation than the marsh area and is heavily vegetated. Infiltration is limited to some degree by the nature of the surface cover, and overland flow drains toward the salt marsh north and west of the site. The groundwater flow direction is north-northwest toward the marsh, based upon measured groundwater elevations.

Geo-rectified digital imagery was utilized to interpret the probable extent of disposal areas with respect to the placement of fill material during the early 1940's, upon which the waterfront facilities were originally constructed. Figure 19-1 is a map of the site.

19.2 PREVIOUS INVESTIGATIONS

19.2.1 Summary of Activities and Results

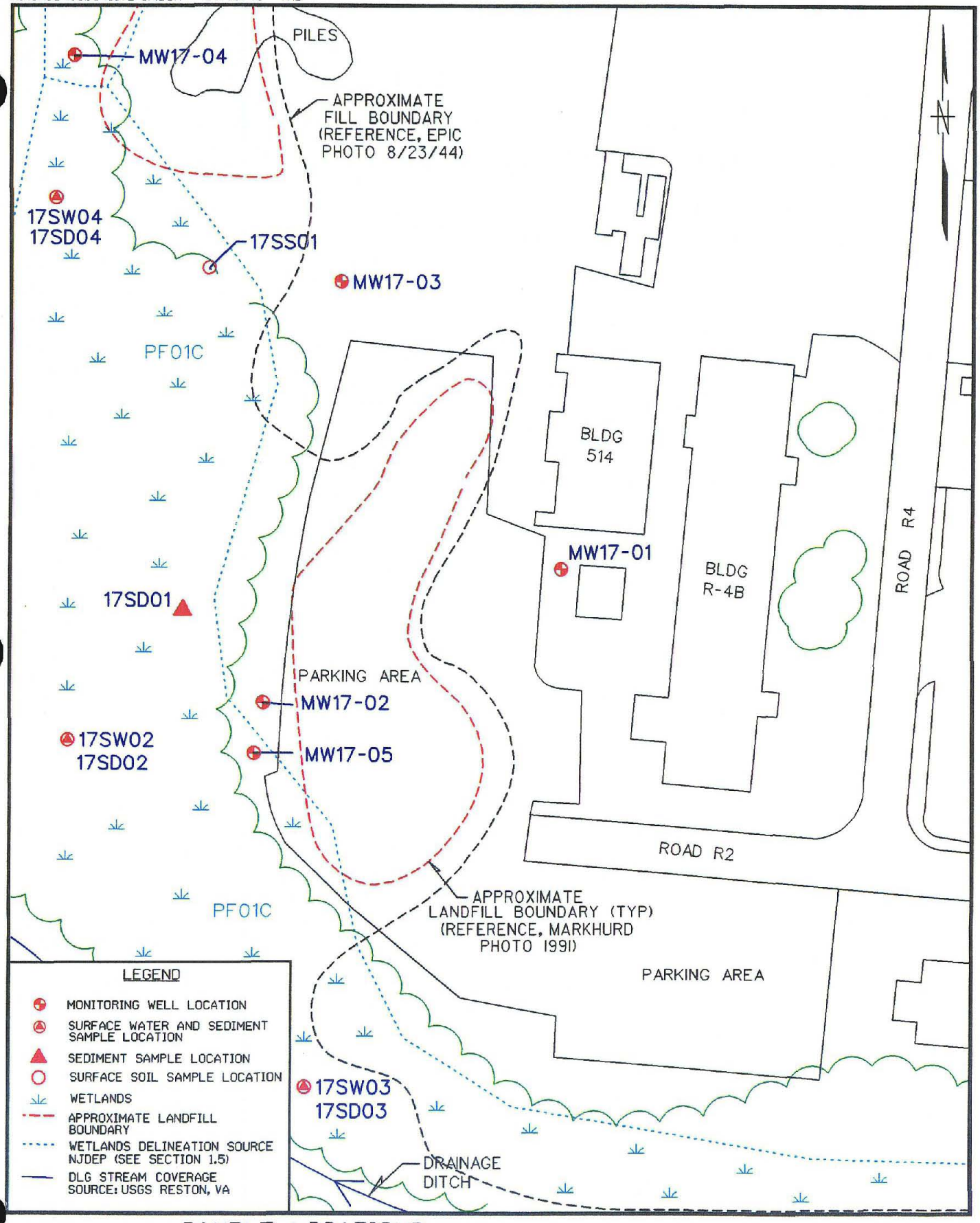
The 1983 IAS consisting of interviews and visual inspection, concluded minimal impact. The site was not recommended for a confirmation study because of the presence of largely inert and immobile materials..

During the 1993 SI, soil samples were collected from three soil borings and two of the four monitoring well borings. Soil borings were completed to the water table and subsurface soil samples were taken from between 5 and 11 feet bgs. Four monitoring wells were installed and screened in the upper water-bearing zone. In addition, four sediment samples were collected from the marsh area downgradient of the site. Soil samples were analyzed for metals and cyanide, and analytical results indicated that no significant concentrations of metals or cyanide were present. Elevated levels of volatiles, semivolatiles, and pesticides were detected in sediment samples. Groundwater samples were analyzed for TAL metals, full scan of TCL compounds, and landfill parameters. Elevated levels of metals and landfill parameter indicators were present in groundwater.

19.2.2 Summary of Conclusions

Construction debris and burnt lumber were encountered in the boring for monitoring well MW17-04. Low

K:\CADD\5803\SITE-17.DGN 07/10/96 TAD



SAMPLE LOCATIONS

SITE 17 - LANDFILL

0 60 120

SCALE IN FEET

FIGURE 19-1

Brown & Root Environmental

levels of volatile organic compounds, semivolatile organic compounds and pesticides were present in the sediment. Elevated metals concentrations were encountered in the groundwater.

19.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations and removal actions, follow-up remedial investigation activities were developed to meet the following objective:

- Determine if adjacent wetlands are being impacted by groundwater flow, surface runoff or soil erosion.
- Perform ecological risk assessment considering all available data.

19.3 RI FIELD INVESTIGATIONS

Between June and October 1995, B&R Environmental conducted the following field investigation activities at Site 17:

- Sampling and analysis of surface water (Section 19.3.1).
- Sampling and analysis of sediment (Section 19.3.2).
- Drilling and installation of one shallow permanent monitoring well (Section 19.3.3).
- Sampling and analysis of groundwater from the newly installed well and existing wells (Section 19.3.3).
- Measurement of static-water levels in the wells (Section 19.3.3).
- Sampling and analysis of surface soil (Section 19.3.4).

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the surface water and sediment samples, the surface soil sample, and the newly installed monitoring well and selected existing wells. Surveying notes are provided in Appendix F.

19.3.1 Surface Water Sampling

The field team collected two surface water samples (17 SW 02 and 17 SW 03) in June 1995 from a drainage seep located west of the landfill area to assess the leachate composition originating from the landfill. Only two flowing seeps were observed along this area. One surface water sample (17 SW 04) was collected from the wetlands area immediately west of and adjacent to the landfill to determine wetlands impact. Due to the dry conditions during the summer, B&R Environmental only collected three surface water samples at Site 17. Figure 19-1 shows sample locations.

The project team collected the surface water samples by dipping the sample bottle directly into the water. Field measurements collected during sampling included pH, specific conductance, temperature, turbidity, dissolved oxygen, and salinity. Sample log sheets are presented in Appendix D.

The three surface water samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TAL metals, ammonia, phosphate, COD, TOC, nitrite/nitrate, turbidity, chloride, BOD, and hardness analyses.

19.3.2 Sediment Sampling

B&R Environmental collected one sediment sample (17 SD 01) in August 1995 from a dry seep along the toe of the landfill to determine if leachate originating from the landfill is impacting sediment quality (Figure 19-1). The sediment material consisted of tan to light brown silty sand. The field team collected two sediment samples (17 SD 02 and 17 SD 03) in June 1995 from a drainage seep located west of the landfill area. The sediment material consisted of dark brown silt with organic material at 17 SD 02 and gray to black silty clay with organic material at 17 SD 03. The team collected one sediment sample (17 SD 04) in June 1995 from the wetlands area located immediately west of and adjacent to the landfill to assess the landfill's impact on the wetlands. The sediment material consisted of light brown sand with trace amounts of silt and organic material.

The four sediment samples (17 SD 01 through 17 SD 04) were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, TOC, moisture, and pH analyses. Sample log sheets are presented in Appendix D.

B&R Environmental collected the sediment samples using a stainless-steel trowel from 0 to 6 inches below the sediment/water interface or ground surface. The sediment material was placed directly into the required bottleware via the stainless-steel trowel.

19.3.3 Permanent Monitoring Wells, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

One shallow permanent monitoring well (MW17-05) was installed during RI activities at the site in July 1995 (Figure 19-1) to define groundwater quality at that point. The boring had a total depth of 18 feet. Water was encountered at approximately 9 feet below grade during drilling. The boring was drilled to approximately 8 feet below the water table and completed as a cased well screened across the water table. The monitoring well characteristics are summarized in Table 19-1.

Subsurface soil samples were collected continuously to the water table by driving a 2-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining or odors) and for lithologic description. HNu readings were 0 ppm throughout the MW17-05 boring with no stains or odors observed. A soil boring log sheet was prepared for the boring to evaluate subsurface lithologies (see Appendix C).

The well was constructed with 2-inch-diameter, flush jointed and threaded, Schedule 40 PVC well casing and 2-inch-diameter, Schedule 40, 0.10-foot slotted well screen fitted with a PVC bottom cap. A 10-foot screen was installed in the well. The annular space between the well screen and borehole was packed with Morie No. 1 sand to a height of approximately 2 feet above the top of screen. A 2-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height of approximately 1 foot below the ground surface. The well was completed with a 2-foot-high stick-up. A 4- by 4-foot pad was placed at the ground surface surrounding the well, keyed 1 foot into the well annulus. The monitoring well construction sheet is in Appendix C.

The well was developed 24 hours after installation. Groundwater temperature, pH, specific conductance, dissolved oxygen, salinity, and turbidity were monitored during development. Approximately 200 gallons of water were removed from the well during well development.

Static-Water-Level Measurements

To define groundwater flow directions and horizontal and vertical groundwater gradients, two rounds of static-water-level measurements were collected. The first round of water-level measurements was collected on August 7, 1995, the second on October 17, 1995. However, the team collected the water level measurement for MW17-02 on October 18, 1995. Static-water levels were measured from the top of PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation ranged from approximately 6.32 to 7.17 feet above MSL during the

Table 19-1
Site 17 - Monitoring Well Characteristics Summary
NWS Earle, Colts Neck, New Jersey

Monitoring Well Number	Total Depth[1] (feet)	Ground Surface Elevation[2]			Diameter (inches)	Screened Interval Depth[1] (feet)	Filter Pack Interval Depth[1][3] (feet)	Date Installed
		Top of Concrete Pad	Top of PVC Riser	Top of Standpipe				
MW17-01	19	16.88	18.58	18.82	4	9 - 19	8 - 19.5	5/13/92
MW17-02[4]	16	12.10	11.55	12.04	4	11 - 16	9 - 13	5/11/92
MW17-03	16	11.84	14.09	14.24	4	11 - 16	10 - 17.5	5/12/92
MW17-04	15.8	12.58	14.95	15.15	4	3.8 - 15.8	2.5 - 16	5/12/92
MW7-05	18	15.24	14.56	14.70	2	7 - 17	5 - 18	7/12/95

Note: All wells were constructed with Schedule 40 polyvinyl chloride (PVC) well casing.

(1) In feet below grade. Reading obtained during monitoring well installation. See Table 19-2 for more accurate measurements.
(2) In feet above mean sea level.
(3) Filter pack extends beneath screened interval.
(4) Well is flush mounted.

first round of measurements and from approximately 6.41 to 7.55 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 19-2.

Groundwater Sampling

Groundwater in the newly installed well and the existing wells was analyzed to evaluate groundwater quality and to provide data for use in the risk assessment and the evaluation of remedial action alternatives. MW17-02 could not be found and was therefore not sampled. Four monitoring wells (MW17-01, MW17-03, MW17-04, and MW17-05) were sampled in late July and early August 1995. Field measurements collected during purging were pumping rate, water-level measurements, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity. Prior to sampling, B&R Environmental purged the wells, using the micro-purge protocol, to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure little or no drawdown in water levels occurred throughout the purging and sampling processes.

Four groundwater samples (17 GW 01, 17 GW 03, 17 GW 04, and 17 GW 05) were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TAL metals, TOC, COD, phosphate, ammonia, chloride, sulfate, nitrite/nitrate, and BOD analyses. TCL pesticides/PCBs analysis was performed on 17 GW 01, and turbidity was performed on 17 GW 03 and 17 GW 04. Sample log sheets are presented in Appendix D.

19.3.4 Surface Soil Sampling

One surface soil sample (17 SS 01) was collected in August 1995, in an eroded area of deposition, to gauge impacts to soil being transported into the marsh (Figure 19-1). The surface soil material, which consisted of light brown/tan silty sand with some trash, was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, and TAL metals analyses. Sample log sheets are presented in Appendix D. The sample was collected from 0 to 6 inches bgs using a stainless-steel trowel and was placed directly into the appropriate bottleware. The surface vegetation was removed before sampling.

19.4 SITE CHARACTERISTICS

19.4.1 Geology

Regional mapping places Site 17 within the outcrop area of the Englishtown Formation. The Englishtown Formation ranges between 35 and 150 feet in thickness and the soil borings are no more than 20 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the

TABLE 19-2
SITE 17 STATIC WATER-LEVEL MEASUREMENT SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY

Monitoring Well Number	August 7, 1995			October 17, 1995		
	Depth to Water Table(1) (feet)	Top of PVC Riser(2)	Elevation of Water Table(2)	Depth to Water Table(1) (feet)	Top of PVC Riser(2)	Elevation of Water Table(2)
MW17-01	11.41	18.58	7.17	11.75	18.58	6.83
MW17-02	not found	11.55	-	4.89*	11.55	6.66
MW17-03	7.29	14.09	6.80	7.68	14.09	6.41
MW17-04	8.63	14.95	6.32	7.40	14.95	7.55
MW17-05	7.50	14.56	7.06	7.79	14.56	6.77

(1) In feet below top of riser
(2) In feet above mean sea level
* Water-level measurement taken on October 18, 1995.

published description of the Englishtown Formation. In general, the borings encountered fill material and yellowish-brown, olive brown, and gray silty sand, clayey sand and sand, olive brown silt, and gray clay.

Based upon the boring log descriptions, the wells and borings penetrated fill material and the Englishtown Formation.

19.4.2 Hydrogeology

Groundwater in the fill material and the Englishtown aquifer beneath the site occurs under unconfined conditions and the fill material and formation are interpreted to be hydraulically interconnected. Static-water-level measurements and water-table elevations are summarized in Table 19-2. Groundwater elevations for August 1995 and October 1995 are contoured on Figures 19-2 and 19-3, respectively. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October groundwater contour maps, is toward the northwest. There does not appear to be a significant seasonal variation in groundwater flow direction.

Based upon the boring log descriptions, the wells are screened across the contact between the fill material and the Englishtown Formation.

19.5 NATURE AND EXTENT OF CONTAMINATION

19.5.1 Surface Soils

One site-related surface soil sample (17 SS 01) was collected at Site 17 (Figure 19-1). Tables 19-3 and 19-4 present the occurrence and distribution of inorganic chemicals detected in site-related surface soil samples and compares them to background as presented in Section 31. Table 19-3a presents a comparison of detected compounds to ARARs and TBCs. Figure 19-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

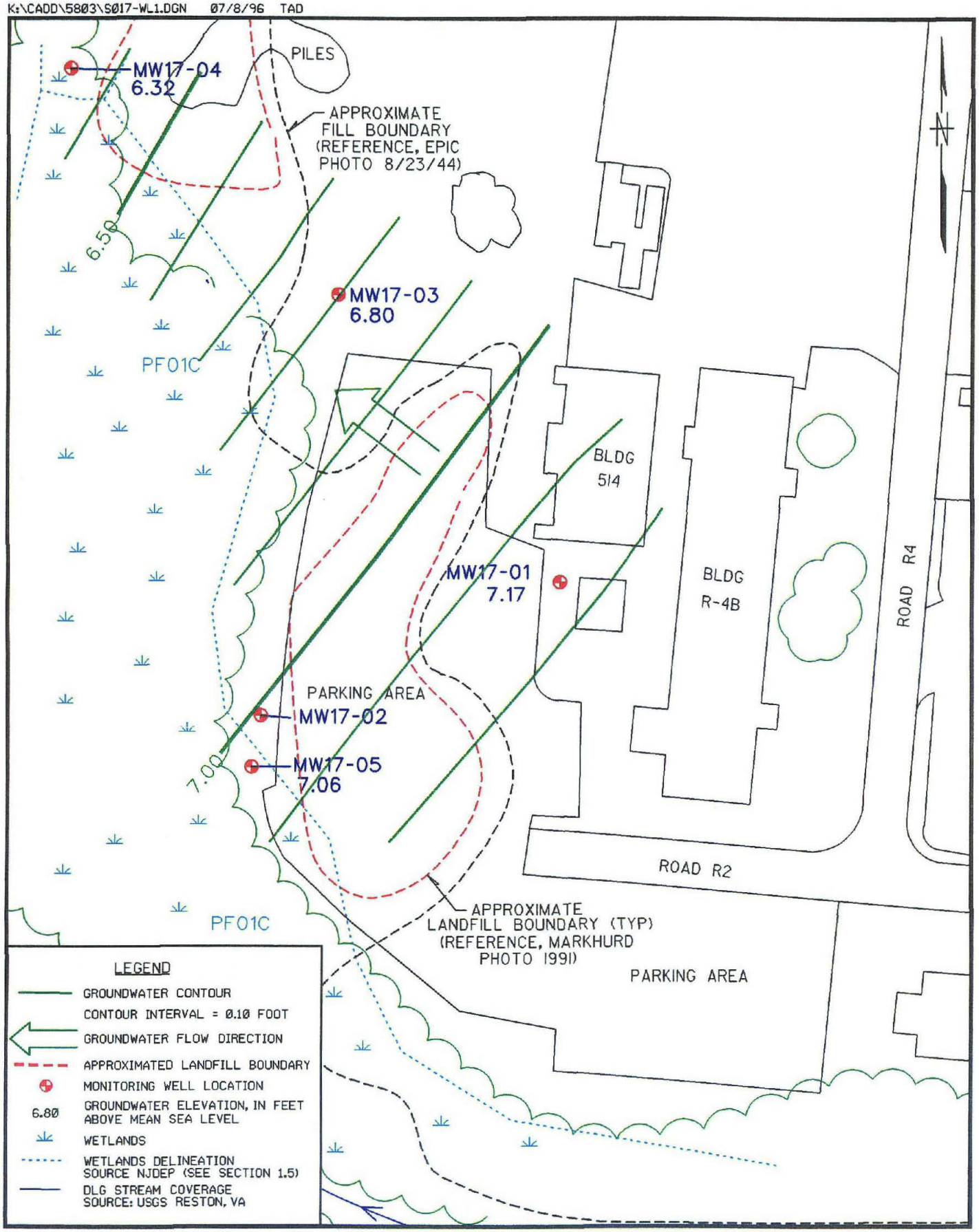
19.5.1.1 Inorganics

Concentrations of metals in 17 SS 01 were within the ranges found in background samples.

19.5.1.2 Organics

4,4'-DDT was detected in background surface soil samples in the concentration range of 43 ug/kg to 420 ug/kg. The pesticide compound was detected in the surface soil sample at Site 17 at a much lower concentration of 1.2 ug/kg.

K:\CADD\5803\S017-WL1.DGN 07/8/96 TAD



GROUNDWATER CONTOUR MAP AUGUST 7, 1995

FIGURE 19-2

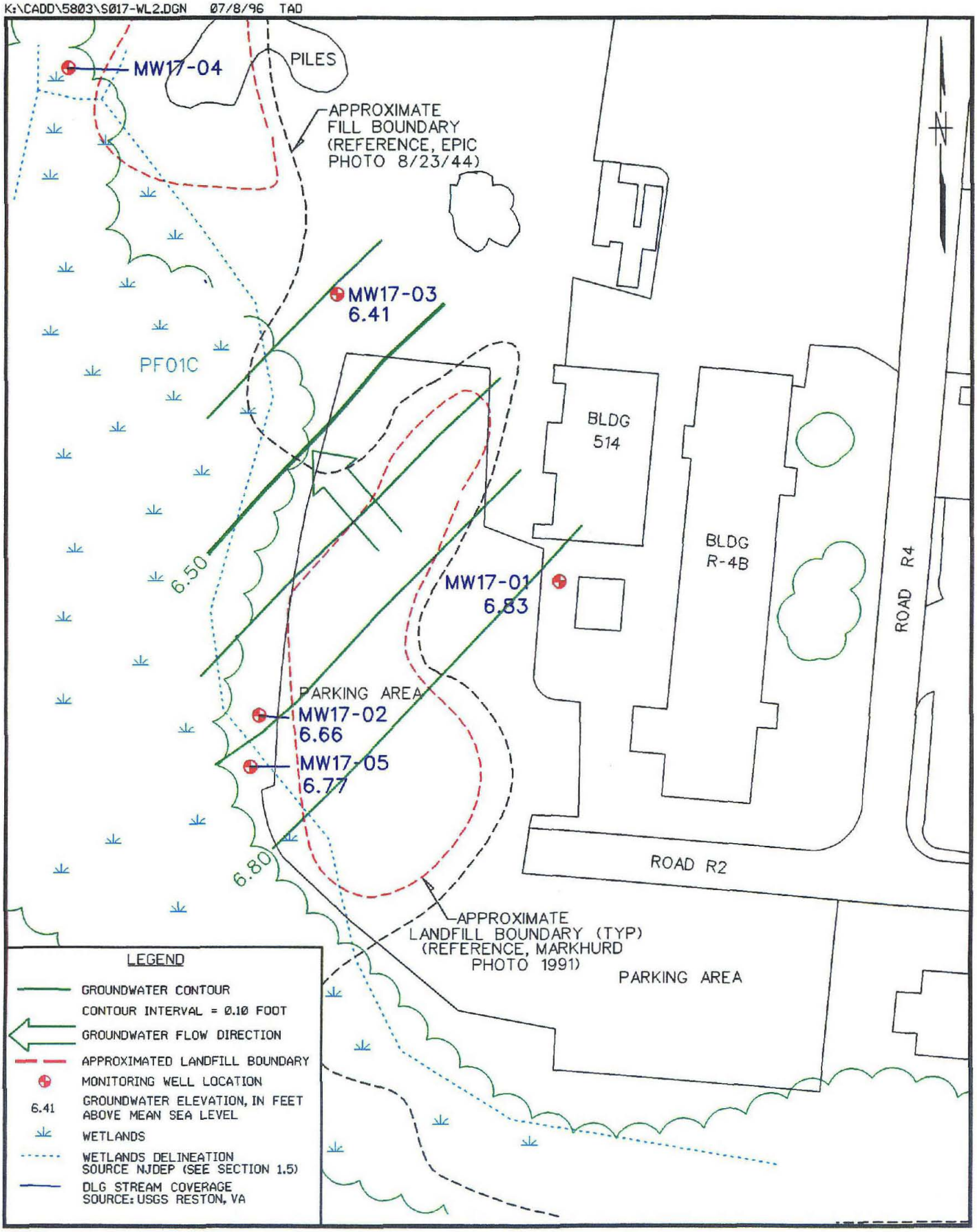
SITE 17 - LANDFILL

0 60 120

SCALE IN FEET

Brown & Root Environmental

K:\CADD\5803\S017-WL2.DGN 07/8/96 TAD



GROUNDWATER CONTOUR MAP OCTOBER 17, 1995

SITE 17 - LANDFILL

FIGURE 19-3

0 60 120

SCALE IN FEET

Brown & Root Environmental

TABLE 19-3
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOILS AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	1710 - 5310	6152.50	1 / 1	525	525	NO	525
ARSENIC	4 / 4	1.35 - 14.4	13.43	1 / 1	2.3	2.3	NO	2.3
BARIUM	4 / 4	1.85 - 31	22.53	1 / 1	3.2	3.2	NO	3.2
BERYLLIUM	1 / 4	0.28	0.39	1 / 1	0.049	0.049	NO	0.049
CADMIUM	1 / 4	0.57	0.67	1 / 1	0.098	0.098	NO	0.098
CALCIUM	4 / 4	40.1 - 519	551.80	1 / 1	129	129	NO	129
CHROMIUM	4 / 4	7.8 - 59.5	69.05	1 / 1	5.4	5.4	NO	5.4
COBALT	2 / 4	0.75 - 5	3.15	1 / 1	0.27	0.27	NO	0.27
COPPER	4 / 4	0.97 - 8.4	10.06	1 / 1	2.2	2.2	NO	2.2
IRON	4 / 4	3745 - 62500	52402.50	1 / 1	3060	3060	NO	3060
LEAD	4 / 4	1.8 - 39.4	37.30	1 / 1	7.5	7.5	NO	7.5
MAGNESIUM	4 / 4	71.7 - 619	578.85	1 / 1	95.5	95.5	NO	95.5
MANGANESE	4 / 4	3.45 - 214	128.33	1 / 1	9.9	9.9	NO	9.9
MERCURY	4 / 4	0.035 - 0.17	0.18	1 / 1	0.019	0.019	NO	0.019
NICKEL	2 / 4	1.8 - 7.2	5.18	1 / 1	1.3	1.3	NO	1.3
POTASSIUM	4 / 4	95 - 792	912.50	1 / 1	104	104	NO	104
SODIUM	4 / 4	17.5 - 86.2	78.30	1 / 1	444	444	YES	444
VANADIUM	4 / 4	11.05 - 64	70.13	1 / 1	6	6	NO	6
ZINC	3 / 4	1.1 - 27.6	22.80	1 / 1	10.4	10.4	NO	10.4

Note: Selected COPCs are indicated in boldface type.

TABLE 19-4
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDT	2 / 4	43 - 420	355.71	1 / 1	1.2	1.2

TABLE 19-3a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SS01	---	---	---	---	---	ARARS & TBCs		
LOCATION:	17SS01	---	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI								
INORGANICS	**mg/kg**						**mg/kg**	**mg/kg**	**mg/kg**
aluminum	525						-	-	-
arsenic	2.3						20.0	20.0	-
barium	3.2						700	47000	-
beryllium	0.049						1.00	1.00	-
cadmium	0.10						1.00	100	-
calcium	129						-	-	-
chromium, total	5.4 J						-	500	-
cobalt	0.27						-	-	-
copper	2.2						600	600	-
iron	3060						-	-	-
lead	7.5						400	600	-
magnesium	95.5						-	-	-
manganese	9.9						-	-	-
mercury	0.019						14.0	270	-
nickel	1.3						250	2400	-
potassium	104						-	-	-
sodium	444						-	-	-
vanadium	6.0						370	7100	-
zinc	10.4 J						1500	1500	-
PESTICIDES	**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDT	1.2 J						2000	9000	500000
dieldrin	0.085 R						42.0	180	50000

TABLE 19-3a
COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- No standard is available for this chemical in this classification.

19.5.2 Sediment

Four site-related sediment samples (17 SD 01 through 17 SD 04) were collected in Site 17 (Figure 19-1). Tables 19-5 and 19-6 present the occurrence and distribution of inorganic and organic chemicals in site-related samples and compare them to background. Table 19-6 presents the occurrence and distribution of organic chemicals in Site 17 background and site-related samples. Tables 19-5a and 19-5b present a comparison of detected compounds to ARARs and TBCs. Figure 19-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

19.5.2.1 Inorganics

Slightly higher concentrations of several metals were seen in two of the three sediment samples collected at Site 17. 17 SD 02 and 17 SD 03 exhibited concentrations greater than background for the following metals: arsenic, barium, iron, lead, and manganese. Sample 17 SD 02 revealed elevated levels of copper, nickel, selenium, and zinc. Low concentrations, near the instrument detection limit, were observed in sample 17 SD 02 for cadmium and selenium (these metals were not found in background sediment samples).

19.5.2.2 Organics

The PAH compounds dibenz(a,h)anthracene, acenaphthene, acenaphthylene, naphthalene, and anthracene (concentration range 4 ug/kg to 1,000 ug/kg) were found in at least one site-related sediment sample but were not detected in the associated background sediment samples. The maximum concentrations of PAHs were observed in sample 17 SD 03. 17 SD 03 exhibited PAH levels greater than the range of background samples; levels in 17 SD 02 were similar to slightly greater than background, and levels in 17 SD 01 were within the range of background.

Bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, diethyl phthalate, and butylbenzyl phthalate were detected in site-related sediment samples but were not detected in the associated background sediment samples. Bis(2-ethylhexyl) phthalate was present at the highest concentrations (9,400 ug/kg in sample 17 SD 03 and 4,400 ug/kg in 17 SD 02). Aroclor 1260 was detected in 17 SD 02 at 80 ug/kg and 17 SD 03 at 31 ug/kg but was not detected in background samples. The Aroclor 1260 result for 17 SD 03 was qualified (R), rejected, based on data validation, and cannot be used for risk assessment. 4-Methylphenol (420 ug/kg to 820 ug/kg), isophorone (75 ug/kg), endosulfan II, alpha-chlordane, and methoxychlor were detected in at least one site-related sediment sample but were not detected in the associated background sediment samples. The following pesticide compounds were detected at concentrations greater than the ranges of background samples in one or more site-related sediment samples: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and gamma chlordane.

TABLE 19-5
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	5492.67	4 / 4	745 - 19300	7306.25	YES	19300
ARSENIC	2 / 3	2.4 - 6.2	5.95	4 / 4	4 - 36.3	16.225	YES	36.3
BARIUM	3 / 3	3.9 - 10.6	14.07	4 / 4	2.4 - 71.8	27.425	YES	71.8
BERYLLIUM	1 / 3	0.57	0.67	3 / 4	0.11 - 1.2	0.52875	NO	1.2
CADMIUM	NOT DETECTED	-	-	2 / 4	0.23 - 3.1	1.0475	YES	2.67
CALCIUM	3 / 3	179 - 518	685.33	4 / 4	125 - 4660	1595.25	YES	4660
CHROMIUM	3 / 3	4.3 - 56	43.13	4 / 4	6.8 - 53.5	22.825	NO	53.5
COBALT	1 / 3	2.1	3.30	3 / 4	0.58 - 6.4	2.595	NO	6.4
COPPER	3 / 3	1.5 - 13	12.47	4 / 4	2 - 99.1	32.8	YES	99.1
IRON	3 / 3	228 - 7650	6578.67	4 / 4	5640 - 49700	20907.5	YES	49700
LEAD	3 / 3	4.6 - 34.3	30.60	4 / 4	5.2 - 126	54.5	YES	126
MAGNESIUM	3 / 3	60.7 - 256	306.47	4 / 4	117 - 3120	1094	YES	3120
MANGANESE	3 / 3	4.6 - 9.2	13.80	4 / 4	4 - 74.8	32.075	YES	74.8
MERCURY	1 / 3	0.068	0.05	3 / 4	0.02 - 0.32	0.126	YES	0.32
NICKEL	2 / 3	2.1 - 6	7.93	3 / 4	2.9 - 27.6	9.6625	YES	27.6
POTASSIUM	2 / 3	86.1 - 681	589.40	4 / 4	235 - 3350	1377.75	YES	3350
SELENIUM	NOT DETECTED	-	-	4 / 4	0.93 - 7.4	2.9075	YES	7.4
SODIUM	3 / 3	26.6 - 116	115.27	4 / 4	50.2 - 870	445.05	YES	870
THALLIUM	NOT DETECTED	-	-	1 / 4	1.5	1.08	YES	1.5
VANADIUM	3 / 3	5.9 - 42.7	36.93	4 / 4	9.4 - 101	42.5	YES	101
ZINC	3 / 3	14.2 - 26.9	37.33	4 / 4	7.3 - 242	79.675	YES	242

Note: Selected COPCs are indicated in boldface type.

TABLE 19-6
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
2-METHYLNAPHTHALENE	NOT DETECTED	-	-	1 / 4	170	170
4,4'-DDD	2 3	4.9 - 21	21	2 / 4	26 - 58	58
4,4'-DDE	1 3	1.7 - 1.7	1.7	3 / 4	27 - 98	98
4,4'-DDT	1 3	19 - 19	19	3 / 4	13 - 59	59
4-METHYLPHENOL	NOT DETECTED	-	-	2 / 4	420 - 820	820
ACENAPHTHENE	NOT DETECTED	-	-	1 / 4	340	340
ACENAPHTHYLENE	NOT DETECTED	-	-	1 / 4	89	89
ALPHA-CHLORDANE	NOT DETECTED	-	-	2 / 4	4.5 - 8.1	8.1
ANTHRACENE	NOT DETECTED	-	-	1 / 4	1000	1000
AROCLOR-1260	NOT DETECTED	-	-	2 / 3	31 - 80	80.00
BENZO(A)ANTHRACENE	2 3	140 - 560	560	2 / 4	500 - 2600	2238.12
BENZO(A)PYRENE	2 3	160 - 590	590	3 / 4	41 - 2600	2600
BENZO(B)FLUORANTHENE	2 3	150 - 490	490	3 / 4	62 - 5000	5000
BENZO(G,H,I)PERYLENE	2 3	130 - 380	380	2 / 4	530 - 3100	2658.84
BENZO(K)FLUORANTHENE	2 3	150 - 470	470	2 / 4	260 - 1300	1125.81
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	2 / 4	4400 - 9400	9400
BUTYLBENZYLPHTHALATE	NOT DETECTED	-	-	1 / 4	610	610
CARBAZOLE	NOT DETECTED	-	-	1 / 4	630	630
CHRYSENE	2 3	250 - 940	940	4 / 4	52 - 3100	3100
DI-N-BUTYLPHTHALATE	NOT DETECTED	-	-	1 / 4	140	140
DIBENZ(A,H)ANTHRACENE	NOT DETECTED	-	-	1 / 4	820	820
DIBENZOFURAN	NOT DETECTED	-	-	1 / 4	220	220
DIETHYLPHTHALATE	1 3	44 44	44	2 / 4	43 - 100	100
ENDOSULFAN II	NOT DETECTED	-	-	1 / 4	0.21	0.21
FLUORANTHENE	2 3	300 - 1800	1800	4 / 4	96 - 4700	4700
FLUORENE	1 3	190 190	190	1 / 4	590	590
GAMMA-CHLORDANE	1 3	0.095 0.095	0.095	2 / 4	5 - 7.8	7.8
INDENO(1,2,3-CD)PYRENE	2 3	110 - 310	310	2 / 4	420 - 2200	1894.78
ISOPHORONE	NOT DETECTED	-	-	1 / 4	75	75
METHOXYCHLOR	NOT DETECTED	-	-	2 / 4	1.6 - 3.9	3.90
NAPHTHALENE	NOT DETECTED	-	-	1 / 4	160	160
PHENANTHRENE	2 3	200 - 1900	1900	2 4	510 - 4200	3576.05
PYRENE	2 3	350 - 1900	1900	4 4	80 - 7000	5978.13
TOLUENE	1 3	480 - 480	480	1 4	4	4

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TABLE 19-5a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD01	17SD02	17SD03	17SD04	---	---	---	ARARS & TBCs
LOCATION:	17SD01	17SD02	17SD03	17SD04	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI				
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**				**mg/kg**
aluminum	1410	19300 J	7770 J	745				-
arsenic	11.4 E J	36.3 E J	13.2 E J	4.0				8.20 L
barium	3.3	71.8 E J	32.2 J	2.4				40.0 B
beryllium	0.11	1.2 J	0.72 J	0.17 U				-
cadmium	0.23	3.1 E J	1.1 UJ	0.62 U				1.20 L
calcium	336	4660 J	1260 J	125				-
chromium, total	10.8 J	53.5 J	20.2 J	6.8				81.0 L
cobalt	0.58	6.4 J	2.8 J	1.2 U				50.0 T
copper	4.0	99.1 E J	26.1 J	2.0				34.0 L
iron	7790	49700 J	20500 J	5640				-
lead	10.9	126 E J	75.9 E J	5.2 J				47.0 L
magnesium	241	3120 J	898 J	117				-
manganese	15.7	74.8 J	33.8 J	4.0				460 O
mercury	0.020	0.32 E J	0.16 E J	0.0080 U				0.150 L
nickel	2.9	27.6 E J	7.2 J	1.9 U				21.0 L
potassium	606	3350 J	1320 J	235				-
selenium	1.1 J	7.4 J	2.2 J	0.93 J				-
sodium	50.2	695 J	165 J	870				-
thallium	1.5	3.6 UJ	1.3 UJ	0.74 U				-
vanadium	16.9	101 J	42.7 J	9.4				-
zinc	12.0 J	242 E J	57.4 J	7.3 J				150 L
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
2-methylnaphthalene	360 U	2100 UJ	170 J	410 U				330 F
4-methylphenol	360 U	420 J	820 J	410 U				-
acenaphthene	360 U	2100 UJ	340 J	410 U				620 Q
acenaphthylene	360 U	2100 UJ	89.0 E J	410 U				44.0 L
anthracene	360 U	2100 UJ	1000 E J	410 U				330 F
benzo(a)anthracene	360 U	500 E J	2600 E J	410 U				330 F

TABLE 19-5a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD01	17SD02	17SD03	17SD04	---	---	---	ARARS & TBCs
LOCATION:	17SD01	17SD02	17SD03	17SD04	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI				
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
benzo(a)pyrene	360 U	490 E J	2600 E J	41.0 J				430 L
benzo(b)fluoranthene	360 U	1000 E J	5000 E J	62.0 J				330 F
benzo(g,h,i)perylene	360 U	530 E J	3100 E J	410 U				330 F
benzo(k)fluoranthene	360 U	260 J	1300 E J	410 U				330 F
bis(2-ethylhexyl)phthalate	360 U	4400 J	9400 J	410 U				890000000 S
butylbenzylphthalate	360 U	2100 UJ	610 J	410 U				11000 Q
carbazole	360 U	2100 UJ	630 E J	410 U				330 F
chrysene	68.0 J	690 E J	3100 E J	52.0 J				330 F
di-n-butylphthalate	360 U	2100 UJ	140 J	410 U				11000 P
dibenz(a,h)anthracene	360 U	2100 UJ	820 E J	410 U				330 F
dibenzofuran	360 U	2100 UJ	220 J	410 U				2000 P
diethylphthalate	360 U	2100 UJ	100 J	43.0 J				630000 P
fluoranthene	130 J	930 J	4700 E J	96.0 J				2900 Q
fluorene	360 U	2100 UJ	590 E J	410 U				540 P
indeno(1,2,3-cd)pyrene	360 U	420 E J	2200 E J	410 U				330 F
isophorone	360 U	2100 UJ	75.0 J	410 U				-
naphthalene	360 U	2100 UJ	160 J	410 U				480 P
phenanthrene	360 U	510 J	4200 E J	410 U				850 Q
pyrene	120 J	1100 E J	7000 E J	80.0 J				660 L
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
toluene	11.0 U	62.0 UJ	4.0 J	12.0 U				670 P
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**
4,4'-DDD	1.6 R	58.0 E J	26.0 E J	4.1 U				1.60 L
4,4'-DDE	27.0 E	98.0 E J	98.0 E J	0.36 R				2.20 L
4,4'-DDT	59.0 E	30.0 E J	13.0 E J	4.1 U				1.60 L
Aroclor-1260	n/a	80.0 J	31.0 J	41.0 U				-
alpha-chlordane	1.8 U	8.1 E JN	2.2 R	4.5 J				7.00 O
delta-BHC	1.8 U	11.0 UJ	3.8 UJ	0.094 R				-

TABLE 19-5a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SD01		17SD02		17SD03		17SD04		---	---	---	ARARS & TBCs
LOCATION:	17SD01		17SD02		17SD03		17SD04		---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI					
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**					**ug/kg**
dieldrin	3.6	U	21.0	UJ	7.3	UJ	0.026	R				52.0 Q
endosulfan II	3.6	U	21.0	UJ	7.3	UJ	0.21	JN				5.40 P
gamma-BHC (Lindane)	0.037	R	11.0	UJ	3.8	UJ	2.1	U				-
gamma-chlordane	1.8	U	7.8	E JN	2.0	R	5.0					7.00 O
heptachlor epoxide	1.8	U	0.63	R	3.8	UJ	2.1	U				5.00 O
methoxychlor	18.0	U	3.9	J	1.6	J	21.0	U				19.0 P

TABLE 19-5a
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 19-5b

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		17SD01	17SD02	17SD03	17SD04	---	---	---	ARARS & TBCs
LOCATION:		17SD01	17SD02	17SD03	17SD04	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI				
MISCELLANEOUS									
moisture	%	7.5	83.5	54.9	18.7				-
pH		7.0	5.7 J	6.0 J	6.6				-
total organic carbon	mg/kg	740	110000 J	30000 J	680				-

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

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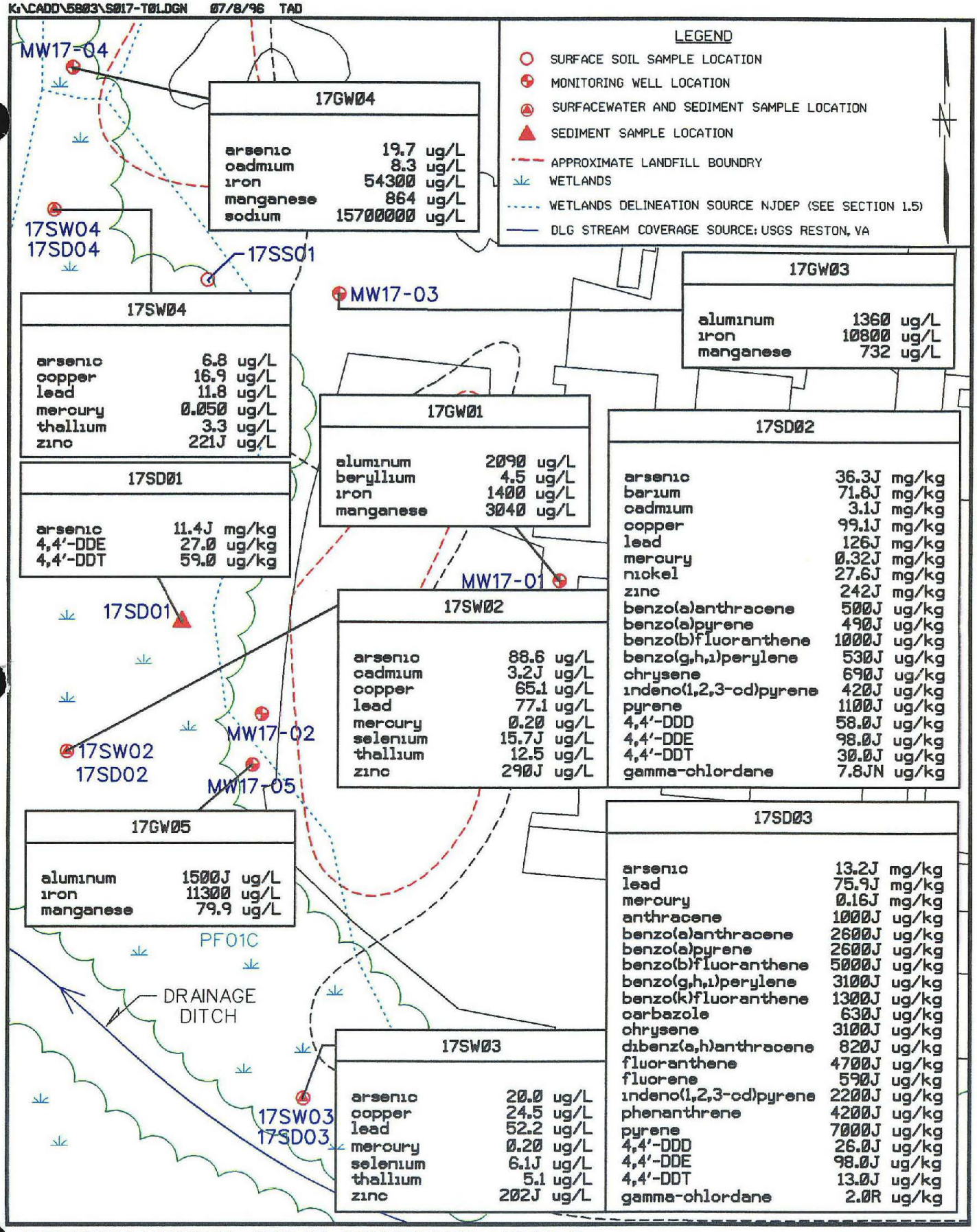

CONCENTRATIONS ABOVE SCREENING LEVELS

SITE 17 - LANDFILL

FIGURE 19-4

Brown & Root Environmental

19.5.2.3 Miscellaneous Parameters

Four sediment samples collected at Site 17 were analyzed for moisture, pH, and TOC. Two sediment samples (17 SD 01 and 17 SD 04) contained pH levels exceeding maximum sediment background levels.

19.5.3 Groundwater

Four site-related groundwater samples (17 GW 01, 17 GW 03, 17 GW 04, and 01 GW 05) were collected at Site 17 (Figure 19-1). Table 19-7 presents the occurrence and distribution of inorganic chemicals detected in site-related groundwater samples and compares them to background. No organic compounds were detected in site-related groundwater samples. Tables 19-7a and 19-7b present a comparison of detected compounds to ARARs and TBCs. Figure 19-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

19.5.3.1 Inorganics

Most metals were present in site-related samples at concentrations similar to background. Arsenic, barium, cadmium, and iron were detected at levels greater than the range of background samples in sample 17 GW 04. This sample contained a very high sodium level (1.6 percent).

19.5.3.2 Miscellaneous Parameters

Miscellaneous parameter analyses of four groundwater samples at Site 17 consisted of ammonia, BOD, COD, chlorides, sulfates, TOC, phosphates, and turbidity. Results are presented in Appendix A. MW17-03 and MW17-01 (downgradient) along with MW17-05 (crossgradient and adjacent to the landfill) revealed greater concentrations of indicator parameters than MW17-01 (upgradient). COD, TOC, and phosphates were detected in MW17-04 and MW17-05 in concentrations greater than maximum background levels. MW17-04 also contained ammonia, chloride, and sulfate concentrations above background. Chloride concentrations in MW17-04 were very high (31,000 mg/L). Sulfate was detected at levels exceeding maximum background levels in MW17-01, MW17-03, and MW17-04. With the exception of very high chloride concentrations in MW17-04, none of the other indicator parameters were high enough to be within a range typically associated with concentrated landfill leachate (Chian and DeWalle, 1976; ASCE, 1976; Brunner and Keller, 1972).

19.5.4 Surface Water

Four site-related surface water samples (17 SW 02 through 17 SW 04) were collected at Site 17 (Figure 19-1). Table 19-8 presents the occurrence and distribution of inorganic chemicals detected in site-related

TABLE 19-7
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	REPRESENTATIVE CONCENTRATION
ALUMINUM*	3 / 3	1320 - 2090	3386.67	4 / 4	96.8 - 2090	1261.70	NO	2090
ARSENIC	1 / 3	5.1 - 5.1	5.60	3 / 4	4.2 - 19.7	8.14	YES	19.7
BARIUM	3 / 3	30.4 - 78.1	105.47	4 / 4	16 - 590	193.43	YES	590
BERYLLIUM*	2 / 3	0.23 - 4.5	3.19	2 / 4	1.4 - 4.5	1.50	NO	4.5
CADMIUM*	3 / 3	0.43 - 7	5.29	3 / 4	0.43 - 8.3	2.45	NO	7.05
CALCIUM	3 / 3	11000 - 24100	38066.67	4 / 4	1700 - 517000	134247.50	YES	434535.21
CHROMIUM	NOT DETECTED	-	-	2 / 4	1.1 - 4.6	1.67	YES	3.99
COBALT*	3 / 3	3.2 - 24.7	23.67	4 / 4	0.72 - 24.7	10.41	NO	24.7
COPPER	NOT DETECTED	-	-	3 / 4	0.83 - 2.5	1.18	YES	2.5
IRON*	3 / 3	1400 - 95200	66846.67	4 / 4	1400 - 54300	19450.00	NO	54300
LEAD	NOT DETECTED	-	-	2 / 4	3.8 - 5.7	2.75	YES	5.7
MAGNESIUM	3 / 3	8610 - 17300	26940.00	4 / 4	1440 - 89900	28207.50	YES	77010.79
MANGANESE*	3 / 3	720 - 3040	3720.00	4 / 4	79.9 - 3040	1178.98	NO	3040
MERCURY	1 / 3	0.044 - 0.044	0.03	1 / 4	0.054	0.02	NO	0.054
NICKEL*	3 / 3	3.7 - 43.2	38.33	3 / 4	3.2 - 43.2	15.64	NO	43.2
POTASSIUM	3 / 3	3000 - 3620	6780.00	4 / 4	2460 - 92700	25300.00	YES	78173.52
SODIUM	3 / 3	15800 - 92500	127600.00	4 / 4	4780 - 15700000	3937370.00	YES	13164690.02
VANADIUM	1 / 3	1.1 - 1.1	1.14	3 / 4	1.1 - 18.1	7.43	YES	18.1
ZINC	2 / 2	18.9 - 30.9	49.80	2 / 4	3.8 - 10.5	43.81	NO	10.5

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 19-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17GW01	17GW03	17GW04	17GW05	---	---	ARARS & TBCs		
LOCATION:	17GW01	17GW03	17GW04	17GW05	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	ug/L	ug/L	ug/L	ug/L			ug/L	ug/L	ug/L
aluminum	2090 E	1360 E	96.8	1500 E J			-	-	200
arsenic	3.3 U	4.2	19.7 E	7.0			50.0	-	8.00
barium	49.7	118	590	16.0			2000	2000 a	2000
beryllium	4.5 E	1.4	0.11 U	0.11 U			4.00	4000 e	20.0
cadmium	0.43	0.87	8.3 E	0.38 U			5.00	5.00 e	4.00
calcium	11000	7290	517000	1700			-	-	-
chromium, total	1.1	1.0 U	1.0 U	4.6			100 *	100 a	100
cobalt	24.7	14.0	0.72	2.2			-	-	-
copper	0.77 U	0.83	1.0	2.5			1300	-	1000
iron	1400 E	10800 E	54300 E	11300 E			-	-	300
lead	1.5 UJ	5.7 J	1.5 UJ	3.8 J			15.0	-	10.0
magnesium	14500	6990	89900	1440			-	-	-
manganese	3040 E	732 E	864 E	79.9 E			-	-	50.0
mercury	0.0040 UJ	0.0040 UJ	0.0040 UJ	0.054			2.00	2.00 b	2.00
nickel	43.2	15.8	0.75 U	3.2			100	100 a	100
potassium	3000	3040	92700	2460			-	-	-
sodium	15800	28900	15700000 E	4780			-	-	50000
vanadium	1.1	10.2	0.61 U	18.1			-	-	-
zinc	253 R	68.9 R	3.8	10.5			-	2000 a	5000

TABLE 19-7a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

• - Criteria are for total chromium.

•• - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 19-7b

COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		17GW01		17GW03		17GW04		17GW05		---	ARARS & TBCs		
LOCATION:		17GW01		17GW03		17GW04		17GW05		---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:		1995 RI		1995 RI		1995 RI		1995 RI					
MISCELLANEOUS													
ammonia nitrogen	mg/L	1.0	U	1.0	U	5.0	E	1.0	U		-	30.0	0.500
biochemical oxygen demand	mg/L	1.3	J	1.4	J	4.0		4.0			-	-	-
chemical oxygen demand	mg/L	7.0	U	4.0	J	150		18.0			-	-	-
chloride	mg/L	120		80.0		31000	E	9.0			-	-	250
sulfate	mg/L	180		41.0		550	E	16.0			500	-	250
total organic carbon	mg/L	0.50	J	0.90	J	14.0		2.0			-	-	-
total phosphorus as PO4	mg/L	0.20	U	0.20	U	1.2		0.20			-	-	-
turbidity	ntu	n/a		14.4		645		n/a			-	-	-

TABLE 19-7b
COMPARISON OF GROUNDWATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 19-8
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	265 - 409	705.33	3 / 3	1510 - 9680	5846.67	YES	9680
ARSENIC	NOT DETECTED	-	-	3 / 3	6.8 - 88.6	38.47	YES	88.6
BARIUM	3 / 3	16.3 - 34	53.73	3 / 3	274 - 331	302.67	YES	331
BERYLLIUM	2 / 3	0.22 - 0.33	0.41	1 / 3	1.3	0.48	YES	1.3
CADMIUM	1 / 3	0.18	0.23	1 / 3	3.2	1.80	YES	3.2
CALCIUM	3 / 3	462 - 10100	9128.00	3 / 3	16500 - 52600	30233.33	YES	52600
CHROMIUM	3 / 3	0.72 - 2.6	2.71	2 / 3	13.9 - 20.4	12.85	YES	20.4
COBALT	3 / 3	0.81 - 1.9	2.54	2 / 3	3.6 - 6.2	3.72	YES	6.2
COPPER	2 / 3	1.1 - 9.8	7.40	3 / 3	16.9 - 65.1	35.50	YES	65.1
IRON	3 / 3	160 - 702	1040.00	3 / 3	32200 - 170000	81433.33	YES	170000
LEAD	1 / 3	4.4	3.43	3 / 3	11.8 - 77.1	47.03	YES	77.1
MAGNESIUM	3 / 3	369 - 2770	2525.33	3 / 3	6430 - 19400	10866.67	YES	19400
MANGANESE	3 / 3	14 - 55.5	59.93	3 / 3	176 - 646	404.33	YES	646
MERCURY	2 / 3	0.023 - 0.028	0.04	3 / 3	0.05 - 0.2	0.15	YES	0.2
NICKEL	3 / 3	2.1 - 7.1	8.60	3 / 3	8.5 - 11	9.90	YES	11
POTASSIUM	2 / 3	251 - 1850	1482.33	3 / 3	4020 - 11300	7020.00	YES	11300
SELENIUM	1 / 3	3.5	4.00	2 / 3	6.1 - 15.7	7.68	YES	15.7
SODIUM	NOT DETECTED	-	-	3 / 3	50600 - 3000000	1035533.33	YES	3000000
THALLIUM	2 / 3	3.5 - 5.5	7.00	3 / 3	3.3 - 12.5	6.97	NO	12.5
VANADIUM	2 / 3	0.89 - 0.9	1.32	3 / 3	7.4 - 73.6	35.03	YES	73.6
ZINC	3 / 3	7.6 - 29.4	32.67	3 / 3	202 - 290	237.67	YES	290

Note: Selected COPCs are indicated in boldface type.

surface water samples and compares them to background. No organics were found in surface water. Tables 19-8a and 19-8b present a comparison of detected compounds to ARARs and TBCs. Figure 19-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

19.5.4.1 Inorganics

Higher concentrations of most metals were seen in site-related sample 17 SW 02. Metals present in this sample at levels greater than background include aluminum, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, selenium, vanadium, and zinc. Slightly elevated levels were also observed for arsenic, barium, iron, manganese, vanadium, and zinc in 17 SW 03 and 17 SW 04 and aluminum, chromium, and lead in 17 SW 03. The presence of elevated levels of aluminum in 17 SW 02 and 17 SW 03 suggests that a significant portion of the metals in these samples may be present in a suspended rather than dissolved form.

19.5.4.2 Miscellaneous Parameters

Miscellaneous parameter analyses for three surface water samples at Site 17 consisted of ammonia, BOD, COD, chlorides, nitrates, hardness, TOC, phosphates, and turbidity. Results are presented in Appendix A. All the indicator parameters, except for nitrates, were detected above maximum surface water background concentrations in all samples. Nitrate nitrogen concentrations in sample 17 SW 04 exceeded background levels. None of the indicator parameters detected in the surface water samples were high enough to be within range typically associated with concentrated landfill leachate (Chian and DeWalle, 1976; ASCE, 1976; Brunner and Keller, 1972).

19.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 17 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 17.6.1. Persistence of detected chemicals in the environment is discussed in Section 17.6.2. Section 17.6.3 presents a brief discussion of contaminant trends.

19.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 17 indicate detectable amounts of PAHs, pesticides, and PCB compounds in sediment and several inorganics present in groundwater, sediment, and surface water. The physical transport data for the detected contaminants are presented in Table 2-10. Additional

TABLE 19-8a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	17SW02	17SW03	17SW04	---	ARARS & TBCs				
LOCATION:	17SW02	17SW03	17SW04	---	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI						
INORGANICS	ug/L	ug/L	ug/L		ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	9680	6350	1510		-	-	-	-	-
arsenic	88.6 E	20.0 E	6.8 E		189	0.0180	0.140	-	0.0170
barium	331 J	274 J	303 J		-	-	-	-	2000
beryllium	1.3	0.14 U	0.14 U		-	-	-	-	-
cadmium	3.2 E J	2.2 U	2.2 U		1.10 +	-	-	-	-
calcium	21600	16500	52600		-	-	-	-	-
chromium, total	20.4	13.9	8.5 U		209 +	-	-	-	160
cobalt	6.2	2.7 U	3.6		-	-	-	-	-
copper	65.1 E	24.5 E	16.9 E		11.0 +	-	-	-	-
iron	170000	32200	42100		-	-	-	-	-
lead	77.1 E	52.2 E	11.8 E		3.20 +	-	-	-	5.00
magnesium	6430	6770	19400		-	-	-	-	-
manganese	176	646	391		-	-	-	-	-
mercury	0.20 E	0.20 E	0.050 E		0.0120	0.140	0.150	-	-
nickel	11.0	10.2	8.5		160 +	610	4600	-	516
potassium	4020	5740	11300		-	-	-	-	-
selenium	15.7 E J	6.1 E J	2.5 U		5.00	-	-	-	10.0
sodium	50600	56000	3000000		-	-	-	-	-
thallium	12.5 E	5.1 E	3.3 E		-	1.70	6.30	-	1.70
vanadium	73.6	24.1	7.4		-	-	-	-	-
zinc	290 E J	202 E J	221 E J		101 +	-	-	-	-
SEMIVOLATILES	ug/L	ug/L	ug/L		ug/L	ug/L	ug/L	ug/L	ug/L
bis(2-ethylhexyl)phthalate	10.0 U	1.0 J	10.0 U		3.00	1.80	5.90	-	1.76

TABLE 19-8a
COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

· - No standard is available for this chemical in this classification.

+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L.

TABLE 19-8b

COMPARISON OF SURFACE WATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		17SW02	17SW03	17SW04	ARARS & TBCs				
LOCATION:		17SW02	17SW03	17SW04	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1995 RI	1995 RI	1995 RI					
MISCELLANEOUS									
ammonia nitrogen	mg/L	2.0 E	2.0 E	3.0 E	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	15.0	12.0	14.0	-	-	-	-	-
chemical oxygen demand	mg/L	250	80.0	130	-	-	-	-	-
chloride	mg/L	70.0	112	4200 E	-	-	-	230	230
nitrate nitrogen	mg/L	0.50 U	0.19 J	1.9	-	10.0	-	-	10.0
total hardness	mg/L	46.0	54.0	193	-	-	-	-	-
total organic carbon	mg/L	39.0	13.0	39.0	-	-	-	-	-
total phosphorus as PO4	mg/L	3.1	1.4	0.90	-	-	-	-	-
turbidity	ntu	146	90.0	74.0	-	-	-	-	-

TABLE 19-8b
COMPARISON OF SURFACE WATER MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 13
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

. - No standard is available for this chemical in this classification.

+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L

& - Value represents the more stringent of criteria for freshwaters classified as FW2-NT, FW2-TP, and FW2-TM

discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

Low levels of PCBs, PAHs, phthalate, and certain pesticides were detected in sediment. The detected PAHs and PCBs are typically strongly bound to organic matter and are not expected to migrate significantly except in conjunction with surface water erosional patterns. Pesticides are also considered of low mobility when absorbed onto high-carbon content substrates such as natural organic material in soil or sediments.

Bis(2-ethylhexyl) phthalate was detected at a maximum concentration in 17 SD 03 and was also detected in the surface water from the same location. This compound possesses a high soil-water distribution constant (K_d) and fairly low solubility. Adsorption onto suspended solids and particulate matter and complexation with natural organic substances are probably the most important environmental transport processes for bis(2-ethylhexyl) phthalate. Phthalate esters are commonly found in freshwater and saltwater sediment samples and readily interact with the fulvic acid present in humic substances in water and soil, forming a complex that is readily soluble in water (Clement Associates, 1985).

Levels of metals were slightly greater than background in one site-related sediment sample and in a corresponding surface water sample. These metals may or may not be present in soluble form because the surface water sample exhibited several minerals that are normally insoluble, which suggests that transport as suspended solids is possible. Organic compounds have a strong tendency to adsorb onto soil/sediment particles, a factor that greatly reduces their mobility. Surface water erosional transport may be the principal mechanism for migration of the detected organic compounds and metals in sediment.

One groundwater sample, 17 GW 04, exhibited slightly elevated levels of several metals. In this well and others at Site 17, low turbidity readings were achieved by sampling using dedicated low-flow bladder pumps, so that results should represent the presence of dissolved metals. Very high levels of sodium chloride (approximately five percent by weight) were present in this groundwater sample, which was collected from monitoring well MW17-04.

19.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

PCBs and pesticides found at the site are considered highly persistent and undergo biodegradation at slow

rates that vary according to the chlorinated isomer substitution pattern for each type or PCB congener in Aroclor mixtures.

PAHs can be biodegraded but the rate of degradation is slower for the higher molecular weight compounds. The rate of degradation depends on a number of factors including oxygen, carbon sources, nutrients, pH, moisture, and appropriate acclimatized organisms.

A variety of unicellular and multicellular organisms take up and accumulate phthalate esters, and bioaccumulation is considered an important fate process (Clement Associates, 1985). Biodegradation is also considered an important fate process. Because phthalate esters are degraded under most conditions and can be metabolized by multicellular organisms, it is unlikely that long-term bioaccumulation or biomagnification occurs.

19.6.3 Observed Chemical Contaminant Trends

No VOCs were detected in the groundwater, surface soil, surface water, and sediment. Organic contaminant species of low solubility and mobility (PAHs, pesticides, and PCBs) were detected at low levels in sediment but were not found in surface water or surface soil. Phthalate were detected at elevated levels in two sediment samples, with a corresponding phthalate present at a trace level in one of the surface water samples from the same location.

Elevated levels of certain metals were noted in two sediment samples and in three surface water samples. These locations are all within the marsh area that is downslope and west of the edge of the landfill. Overland flow drains toward the salt marsh north of the site.

Most inorganic constituents detected in Site 17 groundwater samples were within concentration ranges similar to background groundwater samples. One monitoring well (MW17-04) showed slightly elevated levels of arsenic, barium, cadmium, and iron, which, given the low turbidity readings observed, may indicate the potential for groundwater transport for one or more of these metals. The same well also exhibited sodium chloride at levels of approximately five percent (a concentration comparable to that of seawater, which is approximately 2.8 percent).

19.6.4 Conclusions

Several classes of organic compounds detected in sediment are considered to be species of low mobility (PAHs, pesticides, and PCBs) that are not expected to transport quickly from source areas. The occurrence of these compounds in sediment may be the result of gradual migration from the landfill through seeps and erosional dispersion; however, surface water did not reveal the presence of these contaminants.

Phthalate esters detected in two sediments and one surface water exhibit a tendency to bind to organic matter in soil. These compounds can be rendered mobile in surface water when complexed with soluble forms of humic substances. Phthalate esters are commonly detected in sediments and might be related to migration from the landfill through seeps or overland flow.

Elevated levels of metals were detected at three surface water locations. Several of the same metals were present at elevated levels in sediment samples from the same locations. Elevated levels of aluminum in these surface water locations suggest that metals may be present in association with suspended solids. The presence of these metals might be related to migration from the landfill through seeps or overland flow.

One monitoring well (MW17-04) at the northwestern end of the landfill revealed slightly elevated levels of several metals present in dissolved form. This well was also found to contain concentrations of sodium chloride in the same general range as seawater. Arsenic, barium, and iron were detected at elevated levels in this well (and were also found at elevated levels in two sediment and three surface water samples). Monitoring wells near the western edge of the landfill did not reveal elevated levels of metals.

19.7 BASELINE RISK ASSESSMENT

This section of the RI report presents the results of the baseline risk assessment for Site 17. The risk assessment was performed using the approach outlined in Section 2.4. Tables 19-9 through 19-12 provide the selected COPCs and representative concentrations of inorganics and organics in site-related surface soil, sediment, groundwater (inorganics only), surface water (inorganics only), respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors uncertainties and conclusions are also discussed.

The result of the conservative baseline risk assessment was greater than the guideline target acceptable cancer risk range and greater than a value of 1.0 for non-cancer risk; therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. Section 19.7.1.6 discusses the modifications made to the conservative preliminary baseline risk assessment.

The risk assessment only identifies exposures and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation alternatives are identified for a site.

19.7.1 Risk Characterization

The results of the risk assessment are presented on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of current land use (industrial employee) and hypothetical future land use (residential, recreational, and industrial receptors).

TABLE 19-9
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SURFACE SOIL - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ARSENIC	2.3	NONPARAMETRIC
BERYLLIUM	0.049	NONPARAMETRIC
CADMIUM	0.098	NONPARAMETRIC
CHROMIUM	5.4	NONPARAMETRIC
LEAD	7.5	NONPARAMETRIC
4,4'-DDT*	1.2	NONPARAMETRIC

* - UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 19-10
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SEDIMENT - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ALUMINUM	19300	NONPARAMETRIC
ARSENIC	36.3	NONPARAMETRIC
BARIUM	71.8	NONPARAMETRIC
BERYLLIUM	1.2	NONPARAMETRIC
CADMIUM	2.67	NORMAL
COBALT	6.4	NONPARAMETRIC
COPPER	99.1	NONPARAMETRIC
IRON	49700	NONPARAMETRIC
LEAD	126	NONPARAMETRIC
MANGANESE	74.8	NONPARAMETRIC
MERCURY	0.32	NONPARAMETRIC
NICKEL	27.6	NONPARAMETRIC
SELENIUM	7.4	NONPARAMETRIC
THALLIUM	1.5	NONPARAMETRIC
VANADIUM	101	NONPARAMETRIC
ZINC	242	NONPARAMETRIC
2-METHYLNAPHTHALENE*	170	NORMAL
4,4'-DDD*	58	NORMAL
4,4'-DDE*	98	NORMAL
4,4'-DDT*	59	NONPARAMETRIC
4-METHYLPHENOL*	820	NONPARAMETRIC
ACENAPHTHENE*	340	NONPARAMETRIC
ACENAPHTHYLENE*	89	NORMAL
ALPHA-CHLORDANE*	8.1	NORMAL
ANTHRACENE*	1000	NONPARAMETRIC
AROCLOR-1260*	80	NONPARAMETRIC
BENZO(A)ANTHRACENE*	2238.12	NORMAL
BENZO(A)PYRENE*	2600	NONPARAMETRIC
BENZO(B)FLUORANTHENE*	5000.00	NONPARAMETRIC
BENZO(G,H,I)PERYLENE*	2658.84	NORMAL
BENZO(K)FLUORANTHENE*	1125.81	NORMAL
BIS(2-ETHYLHEXYL)PHTHALATE*	9400	NONPARAMETRIC
BUTYLBENZYLPHTHALATE*	610	NONPARAMETRIC
CARBAZOLE*	630	NONPARAMETRIC
CHRYSENE*	3100	NONPARAMETRIC
DI-N-BUTYLPHTHALATE*	140	NORMAL
DIBENZ(A,H)ANTHRACENE*	820	NONPARAMETRIC
DIBENZOFURAN*	220	NORMAL
DIETHYLPHTHALATE*	100	NORMAL
ENDOSULFAN II*	0.21	NONPARAMETRIC
FLUORANTHENE*	4700	NONPARAMETRIC
FLUORENE*	590	NONPARAMETRIC
GAMMA-CHLORDANE*	7.8	NONPARAMETRIC
INDENO(1,2,3-CD)PYRENE*	1894.78	NORMAL
ISOPHORONE*	75	NORMAL
METHOXYCHLOR*	3.9	NONPARAMETRIC
NAPHTHALENE*	160	NORMAL
PHENANTHRENE*	3576.05	NORMAL
PYRENE*	5978.13	NORMAL
TOLUENE*	4	NORMAL

* = UNITS FOR ORGANICS ARE IN ug/kg

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TABLE 19-11
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
GROUNDWATER - SITE 17 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	2090	LOGNORMAL
ARSENIC	19.7	NONPARAMETRIC
BARIUM	590	NONPARAMETRIC
BERYLLIUM	4.5	NONPARAMETRIC
CADMIUM	7.05	NORMAL
COBALT	24.7	NONPARAMETRIC
COPPER	2.5	NONPARAMETRIC
IRON	54300	NONPARAMETRIC
LEAD	5.7	NONPARAMETRIC
MANGANESE	3040	NONPARAMETRIC
NICKEL	43.2	NONPARAMETRIC

TABLE 19-12
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SURFACE WATER - SITE 17 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	9680	NONPARAMETRIC
ARSENIC	88.6	NONPARAMETRIC
BARIUM	331	NONPARAMETRIC
BERYLLIUM	1.3	LOGNORMAL
CADMIUM	3.2	LOGNORMAL
CHROMIUM	20.4	NONPARAMETRIC
COBALT	6.2	NONPARAMETRIC
COPPER	65.1	NONPARAMETRIC
IRON	170000	NONPARAMETRIC
LEAD	77.1	NONPARAMETRIC
MANGANESE	646	NONPARAMETRIC
MERCURY	0.2	LOGNORMAL
NICKEL	11	NONPARAMETRIC
SELENIUM	15.7	NONPARAMETRIC
THALLIUM	12.5	NONPARAMETRIC
VANADIUM	73.6	NONPARAMETRIC
ZINC	290	NONPARAMETRIC

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19.7.1.1 Current Industrial Employee

The estimated total cancer risks for the current industrial employee for exposure to COPCs in surface soil at Site 17 are 1.3E-06 (ingestion), 2.7E-06 (dermal contact), and 3.6E-09 (inhalation of COPCs in fugitive dust). The total surface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion, 95 percent of the cancer risk for this pathway) and beryllium (dermal contact, 86 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the current industrial employee, assuming exposure to surface soil, are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic health effects are not expected when the HQs are below 1.0. Estimated carcinogenic risks and noncarcinogenic HQs are presented for current industrial receptors exposed to surface soils at Site 17 in Tables 19-13 and 19-14, respectively.

19.7.1.2 Future Industrial Employee

The conservative preliminary baseline risk assessment yielded estimated total cancer risks of greater than 1E-04 for the future industrial employee assuming exposure to COPCs in groundwater at Site 17. In addition, this risk assessment yielded estimated noncarcinogenic HIs with values greater than 1.0 for the future child resident for exposures to groundwater. (Ingestion exposures contributed to the significant portion of these risks.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for industrial exposure to groundwater are discussed in Section 19.7.1.6 and presented for groundwater in Tables 19-15, 19-15a, and 19-16.

19.7.1.3 Future Residential Receptor

The estimated total cancer risks for the future lifetime resident assuming exposure to COPCs in surface soil at Site 17 are 5.7E-06 (ingestion), 8.9E-06 (dermal contact), and 2.2E-09 (inhalation of COPCs in fugitive dust). The surface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion) and beryllium (ingestion and dermal contact).

The estimated individual noncarcinogenic HQs for the future child resident assuming exposure to COPCs in surface soil, are less than 1.0 for the ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

TABLE 19-13
RME CARCINOGENIC RISK TO CURRENT INDUSTRIAL RECEPTORS - SITE 17
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDT	1.4E-10	2.8E-10	3.2E-14
ARSENIC	1.2E-06	4.0E-07	6.7E-10
BERYLLIUM	7.4E-08	2.3E-06	1.4E-11
CADMIUM	N/A	N/A	8.0E-12
CHROMIUM	N/A	N/A	2.9E-09
LEAD	N/A	N/A	N/A
TOTAL RISK	1.3E-06	2.7E-06	3.6E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-14
RME NONCARCINOGENIC HQS, CURRENT INDUSTRIAL RECEPTORS - SITE 17
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDT	2.3E-06	4.6E-06	4.3E-10
ARSENIC	7.5E-03	2.5E-03	1.4E-06
BERYLLIUM	9.6E-06	3.0E-04	1.8E-09
CADMIUM	1.9E-04	1.2E-03	9.8E-08
CHROMIUM	1.1E-03	1.6E-02	2.0E-07
LEAD	N/A	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-15
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 17
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ARSENIC	1.0E-04	4.5E-08
BARIUM	N/A	N/A
COPPER	N/A	N/A
LEAD	N/A	N/A
TOTAL RISK	1.0E-04	4.5E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-15a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 17
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ARSENIC	4.7E-06	2.9E-09
BARIUM	N/A	N/A
COPPER	N/A	N/A
LEAD	N/A	N/A
TOTAL RISK	4.7E-06	2.9E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-16
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 17
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ARSENIC	6.4E-01	2.8E-04
BARIUM	8.2E-02	8.5E-04
COPPER	6.1E-04	4.2E-07
LEAD	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to surface soil at Site 17 in Tables 19-17 and 19-18, respectively.

The conservative preliminary baseline risk assessment yielded estimated total cancer risks greater than 1E-04 for the future lifetime resident assuming exposure to COPCs in groundwater at Site 17. In addition, this risk assessment yielded estimated noncarcinogenic HIs with values greater than 1.0 for the future child resident for exposures to groundwater. (Ingestion exposures contributed to the significant portion of cancer risks; ingestion and dermal contact contributed to non-cancer risks.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for residential exposure to groundwater are discussed in Section 19.7.1.6 and presented for groundwater in Tables 19-19, 19-19a, 19-20, and 19-20a.

19.7.1.4 Future Recreational Receptor

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 17 are 1.0E-06 (ingestion) and 2.5E-07 (dermal contact). This sediment cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The cancer risks for exposure to COPCs in surface water during wading at Site 17 are 1.5E-06 (ingestion) and 3.6E-07 (dermal contact). This surface water cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the sediment cancer risk were Aroclor 1260 (ingestion, 14 percent if the cancer risk for this pathway), benzo(a)pyrene (ingestion, 30 percent of the cancer risk for this pathway), and arsenic (ingestion, 45 percent of the cancer risk for this pathway). The principal COPCs contributing to the surface water cancer risk were arsenic (ingestion, 96 percent of the cancer risk for this pathway) and beryllium (dermal contact, 80 percent of the cancer risk for this pathway).

The estimated individual HQs for the future recreational child, assuming exposure to COPCs in sediment during wading, are less than 1.0 for ingestion and dermal contact exposure pathways. The estimated individual HQs for the future recreational child assuming exposure to COPCs in surface water during wading are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 17 in Tables 19-21 and 19-22, respectively. Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to surface water at Site 17 in Tables 19-23 and 19-24, respectively.

TABLE 19-17
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 17
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDT	6.4E-10	9.2E-10	1.9E-14
ARSENIC	5.4E-06	1.3E-06	4.1E-10
BERYLLIUM	3.3E-07	7.6E-06	8.4E-12
CADMIUM	N/A	N/A	4.9E-12
CHROMIUM	N/A	N/A	1.8E-09
LEAD	N/A	N/A	N/A
TOTAL RISK	5.7E-06	8.9E-06	2.2E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-18
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 17
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - CHILD	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
4,4'-DDT	3.1E-05	3.7E-05	4.6E-10
ARSENIC	9.8E-02	2.0E-02	1.5E-06
BERYLLIUM	1.3E-04	2.4E-03	1.9E-09
CADMIUM	2.5E-03	9.8E-03	1.0E-07
CHROMIUM	1.4E-02	1.3E-01	2.1E-07
LEAD	N/A	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-19
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 17
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ARSENIC	4.4E-04	1.0E-06	N/A
BARIUM	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
TOTAL RISK	4.4E-04	1.0E-06	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-19a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 17
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ARSENIC	2.6E-05	5.7E-08	N/A
BARIUM	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
TOTAL RISK	2.6E-05	5.7E-08	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-20
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 17
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN									
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
ARSENIC	4.2E+00		4.2E+00							8.6E-03	N/A
BARIUM	5.4E-01	5.4E-01				5.4E-01		5.4E-01	5.4E-01	2.6E-02	N/A
COPPER	4.0E-03	4.0E-03		4.0E-03	4.0E-03					1.3E-05	N/A
LEAD	N/A	N/A					N/A			N/A	N/A
	HI BY TARGET ORGAN	5.4E-01	4.2E+00	4.0E-03	4.0E-03	5.4E-01		5.4E-01	5.4E-01		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-20a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 17
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN									
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
ARSENIC	8.1E-01		8.1E-01							2.4E-03	N/A
BARIUM	8.3E-02	8.3E-02				8.3E-02		8.3E-02	8.3E-02	5.8E-03	N/A
COPPER	8.8E-04	8.8E-04		8.8E-04	8.8E-04					4.1E-06	N/A
LEAD	N/A	N/A					N/A			N/A	N/A
	HI BY TARGET ORGAN	8.4E-02	8.1E-01	8.8E-04	8.8E-04	8.3E-02		8.3E-02	8.3E-02		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-21
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 17
SEDIMENT, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
2-METHYLNAPHTHALENE	N/A	N/A
4,4'-DDD	1.5E-10	3.8E-11
4,4'-DDE	3.7E-10	9.0E-11
4,4'-DDT	2.2E-10	5.4E-11
4-METHYLPHENOL	N/A	N/A
ACENAPHTHENE	N/A	N/A
ACENAPHTHYLENE	N/A	N/A
ALPHA-CHLORDANE	1.2E-10	2.9E-11
ANTHRACENE	N/A	N/A
AROCLOR-1260	6.8E-09	1.9E-09
BENZO(A)ANTHRACENE	1.8E-08	7.1E-09
BENZO(A)PYRENE	2.1E-07	2.7E-07
BENZO(B)FLUORANTHENE	4.0E-08	1.6E-08
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	9.0E-10	3.6E-10
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-09	5.7E-10
BUTYLBENZYLPHTHALATE	N/A	N/A
CARBAZOLE	1.4E-10	2.7E-11
CHRYSENE	2.5E-10	9.8E-11
DI-N-BUTYLPHTHALATE	N/A	N/A
DIBENZ(A,H)ANTHRACENE	6.6E-08	1.3E-07
DIBENZOFURAN	N/A	N/A
DIETHYLPHTHALATE	N/A	N/A
ENDOSULFAN II	N/A	N/A
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
GAMMA-CHLORDANE	1.1E-10	2.8E-11
INDENO(1,2,3-CD)PYRENE	1.5E-08	6.0E-09
ISOPHORONE	7.8E-13	1.5E-13
METHOXYCHLOR	N/A	N/A
NAPHTHALENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
TOLUENE	N/A	N/A
ALUMINUM	N/A	N/A
ARSENIC	6.0E-07	2.5E-08
BARIUM	N/A	N/A
BERYLLIUM	5.7E-08	2.2E-07
CADMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
MERCURY	N/A	N/A
NICKEL	N/A	N/A
SELENIUM	N/A	N/A
THALLIUM	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	1.0E-06	6.9E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 19-22
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 17
SEDIMENT, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
2-METHYLNAPHTHALENE	NA	NA
4,4'-DDD	NA	NA
4,4'-DDE	NA	NA
4,4'-DDT	1.5E-05	3.7E-06
4-METHYLPHENOL	2.1E-05	6.9E-06
ACENAPHTHENE	7.2E-07	2.9E-07
ACENAPHTHYLENE	NA	NA
ALPHA-CHLORDANE	1.7E-05	4.3E-06
ANTHRACENE	4.3E-07	1.7E-07
AROCLOR-1260	NA	NA
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	6.0E-05	2.4E-05
BUTYLBENZYLPHTHALATE	3.9E-07	7.7E-08
CARBAZOLE	NA	NA
CHRYSENE	NA	NA
DI-N-BUTYLPHTHALATE	1.8E-07	3.9E-08
DIBENZ(A,H)ANTHRACENE	NA	NA
DIBENZOFURAN	7.0E-06	1.4E-06
DIETHYLPHTHALATE	1.6E-08	6.3E-09
ENDOSULFAN II	4.5E-09	1.5E-09
FLUORANTHENE	1.5E-05	5.9E-06
FLUORENE	1.9E-06	7.5E-07
GAMMA-CHLORDANE	1.7E-05	4.1E-06
INDENO(1,2,3-CD)PYRENE	NA	NA
ISOPHORONE	4.8E-08	9.5E-09
METHOXYCHLOR	1.0E-07	2.2E-08
NAPHTHALENE	5.1E-07	2.0E-07
PHENANTHRENE	NA	NA
PYRENE	2.5E-05	NA
TOLUENE	2.6E-09	NA
ALUMINUM	2.5E-03	2.0E-03
ARSENIC	1.5E-02	6.4E-04
BARIUM	1.3E-04	1.3E-04
BERYLLIUM	3.1E-05	1.2E-04
CADMIUM	6.8E-04	5.4E-04
COBALT	1.4E-05	1.1E-05
COPPER	3.2E-04	2.1E-05
IRON	2.1E-02	1.7E-02
LEAD	NA	NA
MANGANESE	1.9E-03	2.5E-03
MERCURY	1.4E-04	7.7E-05
NICKEL	1.8E-04	4.7E-05
SELENIUM	1.9E-04	9.4E-06
THALLIUM	2.4E-03	1.9E-03
VANADIUM	1.8E-03	7.3E-03
ZINC	1.0E-04	1.6E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-23
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 17
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
ALUMINUM	N/A	N/A
ARSENIC	1.5E-06	7.1E-08
BARIUM	N/A	N/A
BERYLLIUM	6.1E-08	2.9E-07
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
MERCURY	N/A	N/A
NICKEL	N/A	N/A
SELENIUM	N/A	N/A
THALLIUM	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	1.5E-06	3.6E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 19-24
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 17
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
ALUMINUM	1.2E-03	1.2E-03
ARSENIC	3.8E-02	1.8E-03
BARIUM	6.0E-04	7.0E-05
BERYLLIUM	3.3E-05	1.5E-04
CADMIUM	8.2E-04	7.6E-05
CHROMIUM	5.2E-04	1.2E-03
COBALT	1.3E-05	1.2E-05
COPPER	2.1E-04	1.6E-05
IRON	7.2E-02	6.7E-02
LEAD	N/A	N/A
MANGANESE	1.7E-02	2.6E-02
MERCURY	8.5E-05	5.7E-05
NICKEL	7.0E-05	2.2E-05
SELENIUM	4.0E-04	2.3E-05
THALLIUM	2.0E-02	1.9E-02
VANADIUM	1.3E-03	6.3E-03
ZINC	1.2E-04	2.3E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

19.7.1.5 Lead Results

Lead was not found above the EPA level of concern (400 mg/kg) in soil or sediment samples taken during RI or previous sampling, but was found at a concentration above the EPA action level (15 ug/L) in groundwater samples taken previous to the RI. No lead concentrations above the EPA action level were found during the RI, which used low flow sampling techniques for groundwater sampling. Only groundwater results from the RI were used in risk assessment.

The IEUBK Lead Model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 17 exposures are presented in Appendix I.

19.7.1.6 Amended Risk Assessment

The amended risk assessment recalculated the cancer and non-cancer risks at Site 17 for future residential and future industrial receptors assuming exposure to COPCs in groundwater.

Comparison to Background

Aluminum, beryllium, cadmium, cobalt, iron, manganese, and nickel were eliminated from consideration as groundwater COPCs based on a comparison of average levels to twice the background level. Table 19-7 presents the comparison of COPCs to background concentrations. No other metals could be eliminated based on comparison to background upper 95 percent UTLs. Arsenic was found to be at a level lower than the calculated statistical UTL background concentration, but this element is a class A carcinogen and therefore cannot be eliminated from consideration.

As noted in the groundwater discussion of Nature and Extent, the estimated HQs may not be representative of dissolved phase metals contamination receptor impacts because of the use of unfiltered sample results.

Consideration of Modified Dermal Absorption and Target Organ Grouping

As discussed in Section 2.4.6.2, groundwater cancer and non-cancer risks were recalculated using a modified gastrointestinal absorption factor for one chemical. After these steps, the final RME cancer risks are still greater than the 1E-04 to 1E-06 target acceptable range for the future residential receptor (4.4E-04, via groundwater ingestion) and are approximately 1E-04 for the future industrial receptor (via groundwater ingestion). Arsenic is the COPC contributing to groundwater RME cancer risks. Estimated

RME carcinogenic risks are presented for future industrial receptors exposed to groundwater at Site 17 in Table 19-15 and for future residential receptors exposed to groundwater at Site 17 in Table 19-19.

The revised RME HIs are less than 1.0 for the future industrial receptor but are greater than 1.0 for the residential child. Therefore, for the future residential child, noncarcinogenic risks (via groundwater ingestion) were grouped according to target organ. The resulting final RME HIs are greater than 1.0 for arsenic (HI of 4.2; target organ - skin). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0. RME noncarcinogenic HIs are presented for future industrial receptors exposed to groundwater at Site 17 in Table 19-16 and for future residential receptors exposed to groundwater at Site 17 in Table 19-20.

Application of Central Tendencies Guidance

Central tendency assumptions were applied to calculate groundwater cancer and non-cancer risks for future residential receptors and groundwater cancer risks for the future industrial employee. Estimated total central tendency cancer risks for exposure to groundwater (future residential and future industrial receptors) are within the 1E-04 to 1E-06 target acceptable risk range. Central tendency generates a lower risk estimate than RME because it assumes typical rather than upper range receptor behavior patterns related to the ingested dose.

The estimated central tendency noncarcinogenic HIs are less than 1.0 for the future residential child. Adverse noncarcinogenic effects are not expected when the HI is less than 1.0.

Estimated central tendency carcinogenic risks are presented for exposure to groundwater for future industrial receptors in Table 19-15a and for future residential receptors in Table 19-19a. Estimated central tendency noncarcinogenic risks are presented for exposure to groundwater for the future residential child in Table 9-20a.

19.7.2 Conclusions

Surface soil, sediment, groundwater, and surface water were sampled at Site 17. The potential receptors for this site were current industrial and future industrial, residential, and recreational receptors. The RME cancer risk associated with the future residential (groundwater) exposure scenario is greater than 1E-04, the upper end of the target acceptable risk range. Arsenic (via ingestion of groundwater) is the principal COPC responsible for this cancer risk. However, the RME estimate for the future residential receptor is probably overconservative because a central tendency calculation shows that cancer risks are more likely to be within the mid-range of the target acceptable risk range. Central tendency generates a lower risk

estimate than RME because it assumes typical rather than upper range receptor behavior patterns related to the ingested dose.

RME estimates for noncarcinogenic HIs associated with the future residential (groundwater) exposure scenario exceeded 1.0; adverse noncarcinogenic effects cannot be ruled out when HIs are greater than 1.0. Arsenic is the COPC that exceeded 1.0 for this exposure scenario. The RME estimates of noncancer risk from exposure to groundwater for the future residential child receptor are probably overconservative because associated central tendency HIs are less than 1.0.

Lead groundwater concentrations at the site were below the EPA action level for public water supplies and lead soil concentrations were below EPA guidelines. These lead concentrations are not expected to be associated with significant increases in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

The amended risk assessment procedure resulted in the elimination of all cancer and non-cancer risks above target guideline limits.

Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 17 in Table 19-25 for surface soil, sediment, groundwater, and surface water. Table 19-25a presents the relevant central tendency risk estimates associated with potential receptors for groundwater.

19.8 ECOLOGICAL RISK ASSESSMENT

19.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

The former landfill is approximately three acres in size and most of the landfill is now covered by a paved parking lot. Developed areas are located to the east and north, including Buildings 514 and R-4B. An extensive *Phragmites* salt marsh is located northwest of the site, and the toe of the landfill, which is covered by vegetation, extends into the marsh. The marsh is connected to Sandy Hook Bay approximately 4,000 feet northwest of the site. As a result, it is influenced by tides. Forested wetlands are located south and west of the site. The forested wetlands are dominated by red maple and sweetgum. The paved area is 10 to 15 feet higher in elevation than the wetlands. Hence, runoff from the developed areas flows into the wetlands and marsh. In addition, a small stream is a tributary of Ware Creek. Site 15 is located approximately 500 feet southeast of the landfill, and Sites 12 and 16 are located 400 feet and 500 feet to

TABLE 19-25
SUMMARY OF RME ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	1.3E-06	N/A	5.7E-06	N/A	8.8E-03	N/A	1.1E-01	N/A	N/A
	Dermal Contact	2.7E-06	N/A	8.9E-06	N/A	2.0E-02	N/A	1.7E-01	N/A	N/A
	Inhalation of Fugitive Dust	3.6E-09	N/A	2.2E-09	N/A	1.7E-06	N/A	1.8E-06	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	1.0E-06	N/A	N/A	N/A	N/A	4.7E-02
	Dermal Contact	N/A	N/A	N/A	6.9E-07	N/A	N/A	N/A	N/A	3.2E-02
Groundwater	Ingestion	N/A	1.0E-04^	4.4E-04^	N/A	N/A	7.3E-01^	4.2E+00@	N/A	N/A
	Dermal Contact	N/A	4.5E-08^	1.0E-06^	N/A	N/A	1.1E-02^	3.5E-02^	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	1.5E-06	N/A	N/A	N/A	N/A	1.5E-01
	Dermal Contact	N/A	N/A	N/A	3.6E-07	N/A	N/A	N/A	N/A	1.2E-01
TOTAL		4.0E-06	1.0E-04	4.6E-04	3.6E-06	2.9E-02	7.4E-01	4.5E+00	-	3.5E-01

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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TABLE 19-25a
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
	Dermal Contact	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/R	N/A	N/R	N/A	N/R	N/A	N/R	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	4.7E-06^	2.6E-05^	N/A	N/A	N/R	8.1E-01@	N/A	N/A
	Dermal Contact	N/A	2.9E-09^	5.7E-08^	N/A	N/A	N/R	8.2E-03^	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
TOTAL		-	4.7E-06	2.6E-05	-	-	-	8.2E-01	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendencies calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

the northeast, respectively. All of these sites are located in the Ware Creek watershed. The developed areas on and to the north and east of the site provide little or no ecological habitat, but the wetland and marsh areas adjacent to the site provide excellent habitat for terrestrial and aquatic receptors. The salt marsh is expected to attract most wetland species found in the Waterfront area, including semi-aquatic mammals and wading birds. No sensitive habitats, other than the wetlands and marsh, and no threatened or endangered species are known to occur on or near the site.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathway from the landfill is overland runoff. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and soils, particularly to surface water and sediments in the wetlands and marsh. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater, and groundwater from the site may eventually discharge to wetland and marsh surface water. However, the paved and developed nature of the site precludes infiltration on the majority of the site.

Exposure Routes

Terrestrial receptors at Site 17 may be exposed to surface soil contaminants via incidental ingestion of soil or by ingestion of contaminated food items. Terrestrial receptors may also come into contact with contaminants in Site 17 surface water by using it for drinking, although this pathway is generally insignificant, especially since the area is influenced by saltwater. Terrestrial vegetation may also be exposed to contaminants in soils at Site 17, mainly on the toe of the landfill. Aquatic and semi-aquatic organisms and terrestrial organisms that utilize the nearby wetlands and marsh may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water, although infiltration and leaching are impeded by paved areas.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were all contaminants detected in 1995 RI activities for this site. In particular, contaminants detected in Site 17 surface water, sediment, and surface soil were considered preliminary COPCs for quantitative assessment. Constituents in subsurface soil, sediment, and groundwater samples from the 1993 SI and groundwater samples from the 1995 RI were evaluated qualitatively.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

19.8.2 Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminated surface water, sediments, and surface soils. "Despite the tidal marsh adjacent to some Waterfront sites and potential saltwater influence, salinity measurements from 1995 RI surface water samples at the edge of the marsh for Site 17 were quite low. Hence, freshwater-based ETs were utilized. Surface water, sediment, surface soil, and terrestrial plant values are presented in Tables 2-28, 2-29, 2-30, and 2-31, respectively.

19.8.3 Preliminary Exposure Assessment

Contaminant concentrations in environmental media used for this initial screening were obtained from data generated during 1995 RI activities. Data collected during the summer and fall of 1995 for surface water, sediment, and surface soil were evaluated. The maximum detected contaminant concentrations in surface water, sediment, and surface soil were used as conservative representative exposure point concentrations. Subsurface soil, sediment, and groundwater samples from the 1993 SI and 1995 RI groundwater samples are discussed qualitatively in Section 19.8.5. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

19.8.4 Risk Characterization

Several inorganics in Site 17 surface water exceeded ET values and were retained as final COPCs (Table 19-26). These include aluminum, barium, cadmium, chromium, cobalt, copper, lead, manganese, selenium, thallium, vanadium, and zinc. No organics were detected in Site 17 surface waters. In Site 17 sediments, barium (HQ = 1.80) exceeded the only ET value available, and arsenic, cadmium, copper, lead, mercury, nickel and zinc exceeded the most conservative ET values available (Table 19-27). Several inorganics, including arsenic, cadmium, copper, lead, mercury, nickel, and zinc, exceeded the most

TABLE 19-26
SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (µg/L)	Maximum Concentration (µg/L)	Ecotox Threshold (µg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	3/3	409	9680	87	111.3	Retained-HQ > 1
Arsenic	3/3	ND	88.6	190	0.47	Eliminated-Does not exceed threshold
Barium	3/3	34	331	3.9	84.9	Retained-HQ > 1
Beryllium	1/3	0.33	1.3	5.1	0.25	Eliminated-Does not exceed threshold
Cadmium	1/3	0.18	3.2	1	3.2	Retained-HQ > 1
Chromium	2/3	2.6	20.4	10	2.04	Retained-HQ > 1
Cobalt	2/3	1.9	6.2	3	2.07	Retained-HQ > 1
Copper	3/3	9.8	65.1	11	5.92	Retained-HQ > 1
Lead	3/3	4.4	77.1	2.5	30.8	Retained-HQ > 1
Manganese	3/3	55.5	646	80	8.08	Retained-HQ > 1
Mercury	3/3	0.028	0.2	1.3	0.15	Eliminated-Does not exceed threshold
Nickel	3/3	7.1	11	160	0.07	Eliminated-Does not exceed threshold
Selenium	2/3	3.5	15.7	5	3.14	Retained-HQ > 1
Thallium	3/3	5.5	12.5	4	3.13	Retained-HQ > 1
Vanadium	3/3	0.9	73.6	19	3.87	Retained-HQ > 1
Zinc	3/3	29.4	290	100	2.90	Retained-HQ > 1

ND = None detected

TABLE 19-27
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold[1] (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	4/4	3940	19,300	NA		Retained-No suitable threshold available
Arsenic	4/4	6.2	36.3	8.2/70	4.4/0.52	Retained-HQ > 1
Barium	4/4	10.6	71.8	40	1.80	Retained-HQ > 1
Beryllium	3/4	0.57	1.2	NA		Retained-No suitable threshold available
Cadmium	2/4	ND	3.1	1.2/9.6	2.58/0.32	Retained-HQ > 1
Chromium	4/4	56	53.5	81	0.66	Eliminated-Does not exceed threshold
Cobalt	3/4	2.1	6.4	50	0.13	Eliminated-Does not exceed threshold
Copper	4/4	13	99.1	34/270	2.9/0.37	Retained-HQ > 1
Lead	4/4	34.3	126	47/218	2.68/0.58	Retained-HQ > 1
Manganese	4/4	9.2	74.8	460	0.16	Eliminated-Does not exceed threshold
Mercury	3/4	0.068	0.32	0.15/0.71	2.13/0.45	Retained-HQ > 1
Nickel	3/4	6	27.6	21/51.6	1.31/0.53	Retained-HQ > 1
Selenium	4/4	ND	7.4	NA		Retained-No suitable threshold available
Thallium	1/4	ND	1.5	NA		Retained-No suitable threshold available
Vanadium	4/4	42.7	101	NA		Retained-No suitable threshold available
Zinc	4/4	26.9	242	150/410	1.61/0.59	Retained-HQ > 1
Organics[3]						
2-Methylnapthalene	1/4	ND	170	330	0.52	Eliminated-Does not exceed threshold
4,4'-DDD	2/4	21	58	1.6/46	36.3/1.26	Retained-HQ > 1
4,4'-DDE	3/4	1.7	98	2.2/27	44.5/3.63	Retained-HQ > 1
4,4'-DDT	3/4	19	59	1.6/46	36.9/1.28	Retained-HQ > 1
4-Methylphenol	2/4	ND	820	NA		Retained-No suitable threshold available
Acenapthene	1/4	ND	340	620	0.55	Eliminated-Does not exceed threshold
Acenapthylene	1/4	ND	89	44/640	2.02/0.14	Retained-HQ > 1
Alpha Chlordane	2/4	ND	8.1	7	1.16	Retained-HQ > 1
Anthracene	1/4	ND	1000	330/1700	3.03/0.59	Retained-HQ > 1
Aroclor 1260	2/3	ND	80	22.7/180	3.52/0.44	Retained-HQ > 1
Benzo(a)anthracene	2/4	560	2600	330/1600	6.78/1.40	Retained-HQ > 1
Benzo(a)pyrene	3/4	590	2600	430/1600	6.05/1.63	Retained-HQ > 1
Benzo(b)fluoranthene	3/4	490	5000	330/1700	15.2/2.94	Retained-HQ > 1
Benzo(g,h,i)perylene	2/4	380	3100	330/1700	9.39/1.82	Retained-HQ > 1
Benzo(k)fluoranthene	2/4	470	1300	330/1700	3.94/0.76	Retained- HQ > 1
Bis(2-ethylhexyl)phthalate	2/4	ND	9400	8.90E+08	1.06E-05	Eliminated-Does not exceed threshold
Butylbenzylphthalate	1/4	ND	610	11000	0.06	Eliminated-Does not exceed threshold
Carbazole	1/4	ND	630	330/1700	1.91/0.37	Retained-HQ > 1
Chrysene	4/4	940	3100	330/2800	9.40/1.1	Retained-HQ > 1

TABLE 19-27
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold[1] (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Di-n-butylphthalate	1/4	ND	140	11,000	0.01	Eliminated-Does not exceed threshold
Dibenzo(a,h)anthracene	1/4	ND	820	330/5100	2.48/0.16	Retained-HQ > 1
Dibenzofuran	1/4	ND	220	2000	0.11	Eliminated-Does not exceed threshold
Diethylphthalate	2/4	44	100	630	0.16	Eliminated-Does not exceed threshold
Endosulfan II	1/4	ND	0.21	5.4	0.04	Eliminated-Does not exceed threshold
Fluoranthene	4/4	1800	4700	2900	1.62	Retained-HQ > 1
Fluorene	1/4	190	590	540	1.09	Retained-HQ > 1
Gamma-Chlordane	2/4	0.095	7.8	7	1.11	Retained-HQ > 1
Indeno(1,2,3-cd)pyrene	2/4	310	2200	330/1700	6.67/1.29	Retained-HQ > 1
Isophorone	1/4	ND	75	NA		Retained-No suitable threshold available
Methoxychlor	2/4	ND	3.9	19	0.21	Eliminated-Does not exceed threshold

TABLE 19-27
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 17
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold[1] (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Napthalene	1/4	ND	160	480	0.33	Eliminated-Does not exceed threshold
Phenanthrene	2/4	1900	4200	850/1500	4.94/2.8	Retained-HQ > 1
Pyrene	4/4	1900	7000	660/2600	10.61/2.69	Retained-HQ > 1
Toluene	1/4	480	4	670	0.01	Eliminated-Does not exceed threshold

ND = None detected
NA = No suitable threshold was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg.

conservative ET values available and were conservatively retained as final COPCs, but did not exceed less conservative values. Several organics exceeded ET values in Site 17 sediments and were retained as final COPCs. Of these, alpha-chlordane, fluoranthene, fluorene, and gamma-chlordane exceeded the only ET values available. Three pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT), and several PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(g,h,i)perylene, chrysene, indeno(1,2,3-cd)pyrene, phenanthrene, and pyrene) all exceeded most conservative and less conservative ET values and were retained as final COPCs in sediments. Acenapthylene, anthracene, Aroclor 1260, benzo(k)fluoranthene, carbazole, and dibenzo(a,h)anthracene exceeded most conservative values and were retained as final COPCs, but did not exceed less conservative values. Some inorganics, including aluminum, beryllium, selenium, thallium, and vanadium, and two organic constituents, 4-Methylphenol and isophorone, were conservatively retained as COPCs in Site 17 sediments since no suitable ET values were available.

In Site 17 surface soils, only chromium (HQ = 13.5) exceeded its ET value was retained as a final COPC (Table 19-28). For terrestrial plants, aluminum (HQ = 10.5), chromium (HQ = 5.4), and vanadium (HQ = 3.0) were retained as final COPCs (Table 19-29). No terrestrial plant ET value was available for 4,4'-DDT, the only organic detected in surface soil. Therefore, it was conservatively retained as a final COPC. The toxicological properties of all final COPCs in all media are summarized in Appendix M.

19.8.5 Summary and Conclusions

Most of the landfill is covered by pavement or gravel. Thus, it provides little or no ecological habitat. The toe of the landfill extends out into the wooded wetland and marsh areas and provides limited habitat. However, forested wetlands and an extensive salt marsh are adjacent to the landfill, and provide excellent habitat for terrestrial and wetland receptors. The primary release and migration pathway from the landfill is overland runoff, mainly from the toe of the landfill. Although the pavement prevents infiltration on most of the site, and hence, impedes contaminant infiltration to groundwater, leaching may still occur and groundwater to surface water discharge of contaminants is possible.

During the 1993 SI investigations, soil borings were taken on the landfill and were analyzed for TAL metals and cyanide. No elevated levels of contaminants were detected. Four sediment samples were also taken in the drainage at the toe of the landfill as part of the SI. Metals concentrations were relatively low and within the range of naturally occurring concentrations. Some organochlorine pesticides were detected in low concentrations, as were some VOCs and PAHs. Groundwater samples taken as part of the SI indicated the presence of low levels of some metals and low levels of methylene chloride. Groundwater samples were also taken as part of the 1995 RI. Metals in these samples were detected in concentrations

TABLE 19-28

SURFACE SOIL CONTAMINANTS OF POTENTIAL CONCERN - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	1/1	5310	525	600	0.88	Eliminated-Does not exceed threshold
Arsenic	1/1	14.4	2.3	60	0.04	Eliminated-Does not exceed threshold
Barium	1/1	31	3.2	3000	0.001	Eliminated-Does not exceed threshold
Beryllium	1/1	0.28	0.049	NA		Retained-No suitable threshold available
Cadmium	1/1	0.57	0.098	20	0.005	Eliminated-Does not exceed threshold
Chromium	1/1	59.5	5.4	0.4	13.5	Retained-HQ > 1
Cobalt	1/1	5	0.27	1000	2.7E-04	Eliminated-Does not exceed threshold
Copper	1/1	8.4	2.2	50	0.044	Eliminated-Does not exceed threshold
Lead	1/1	39.4	7.5	500	0.015	Eliminated-Does not exceed threshold
Manganese	1/1	214	9.9	100	0.099	Eliminated-Does not exceed threshold
Mercury	1/1	0.17	0.019	0.1	0.19	Eliminated-Does not exceed threshold
Nickel	1/1	7.2	1.3	200	0.006	Eliminated-Does not exceed threshold
Vanadium	1/1	64	6.0	20	0.3	Eliminated-Does not exceed threshold
Zinc	1/1	27.6	10.4	200	0.052	Eliminated-Does not exceed threshold
Organics						
4,4'-DDT	1/1	355.7	1.2	100	0.012	Eliminated-Does not exceed threshold

NA = No suitable threshold was available

* all organic values are in μg/kg

TABLE 19-29

TERRESTRIAL PLANT CONTAMINANTS OF POTENTIAL CONCERN - SITE 17

NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	1/1	5310	525	50	10.5	Retained-HQ > 1
Arsenic	1/1	14.4	2.3	10	0.23	Eliminated-Does not exceed threshold
Barium	1/1	31	3.2	500	0.006	Eliminated-Does not exceed threshold
Beryllium	1/1	0.28	0.049	10	0.005	Eliminated-Does not exceed threshold
Cadmium	1/1	0.57	0.098	3	0.03	Eliminated-Does not exceed threshold
Chromium	1/1	59.5	5.4	1	5.4	Retained-HQ > 1
Cobalt	1/1	5	0.27	20	0.01	Eliminated-Does not exceed threshold
Copper	1/1	8.4	2.2	100	0.02	Eliminated-Does not exceed threshold
Lead	1/1	39.4	7.5	50	0.15	Eliminated-Does not exceed threshold
Manganese	1/1	214	9.9	500	0.02	Eliminated-Does not exceed threshold
Mercury	1/1	0.17	0.019	0.3	0.06	Eliminated-Does not exceed threshold
Nickel	1/1	7.2	1.3	30	0.04	Eliminated-Does not exceed threshold
Vanadium	1/1	64	6.0	2	3.0	Retained-HQ > 1
Zinc	1/1	27.6	10.4	50	0.21	Eliminated-Does not exceed threshold
Organics						

* No suitable ETs were available for organics

similar to background, although a few elevated hits of some metals were present in one sample. No organics were detected in RI groundwater samples.

Surface water, sediment, and surface soil samples were taken at Site 17 as part of 1995 RI activities and were used for quantitative assessment. Most metals detected in surface water had HQs indicative of low potential risk, although aluminum, barium, and lead had HQs indicative of moderately high potential risk. No organics were detected in surface water. Most metals in sediments had HQs indicative of low potential risk. Aluminum, beryllium, selenium, thallium, and vanadium were conservatively retained as final COPCs since no suitable sediment ETs were available. Of these, aluminum, selenium, and vanadium were detected in concentrations significantly above background. Several pesticides and PAHs were detected in site sediments and many of these compounds had HQs indicative of moderate potential risk.

All surface soil HQs were indicative of negligible potential risk. Beryllium was conservatively retained as a final COPC since no suitable surface soil ET value was available, but was lower than background. In addition, terrestrial plant HQ values were low for inorganics. No suitable ETs were available for the only organic detected in surface soil, 4,4-DDT, but it was detected in a low concentration.

In summary, concentrations of several metals in surface water exceeded ET values, but most of these contaminants were not final COPCs in sediments. However, some metals in sediments, such as aluminum, were present in relatively high concentrations that may pose significant potential risk, and the presence of several metals in moderate concentrations in surface water and sediment may have a potential cumulative toxic effect on wetland receptors. Several PAHs and pesticides were detected in sediments adjacent to Site 17 in concentrations that pose moderate risk, and the presence of several organics also may cause a cumulative toxic effect in the environment. The pesticides present may not be from the landfill, however, since these compounds may have been used in the wetlands for pest control in the past. Also, runoff from the developed areas may contribute some PAHs to the forested wetland and marsh areas. Nonetheless, the relatively high concentrations of these compounds in sediments appears to stem, at least in part, from the landfill. Groundwater at the site flows towards the wetland areas, and since no organics were detected in 1995 RI groundwater samples and the concentrations of metals in these samples were relatively low, potential groundwater to surface water discharge of contaminants does not appear to be significant. Contaminant migration from runoff and erosion from the landfill toe may be occurring. Although concentrations in surface soils between the landfill and marsh were relatively low, as were related potential risks, only one sample was taken. Also, the area of contaminant impact in marsh sediments is not known. Although levels of contaminants in sediments were relatively high, the impacted area may be limited.

For these reasons, additional surface soil samples appear to be needed around the landfill perimeter to investigate potential runoff and erosion of contaminants from the landfill toe. Additional surface water and sediment samples taken further from the landfill also appear to be necessary to define the area of

influence of landfill-related contaminants and investigate whether contaminant concentrations in the marsh may also be the result of contaminant inputs from other sources. The other RI sites in the area, along with Site 17, may not pose significant risk by themselves, but may have an additive effect from combined contaminant contributions into the Ware Creek watershed.

19.9 EVALUATION AND RECOMMENDATIONS

19.9.1 Evaluation Summary

Groundwater at the site contains arsenic at concentrations above background resulting in non cancer HQs above one and calculated cancer risk above target acceptable cancer risk range. Groundwater also has concentrations of aluminum, beryllium, cadmium, iron , manganese and sodium above NJDEP GWQSs.

Surface water and sediments downgradient of Site 17 were found to contain metals and organic compounds at levels of ecological concern.

19.9.2 Recommendations

Additional investigation in the salt marsh appears necessary to gauge impacts of surface runoff, groundwater flow and soil erosion.

20.0 SITE 19: PAINT CHIP AND SLUDGE DISPOSAL AREA

20.1 SITE BACKGROUND AND PHYSICAL SETTING

Site 19 is an ordnance maintenance area where paint chips and paint sludge were discharged to a topographic depression near Building S-34. The site was in operation from the early 1940s until the early 1960s. Paint slurries and solvent residues were discharged into the open drainage swale. During construction at the site, a significant portion of the contaminated material may have been removed. The site is a 300-foot circular area that is surrounded by woodlands. Half the site, from Building S-34 south to the site perimeter, is paved. The remainder has a gravel surface. The depression that received the sludge discharge is approximately 50 feet in diameter and 5 to 10 feet deep and is located in the center of the site south of a barricade. A small drainage ditch runs from the depression to the west, toward a wetlands area. General groundwater flow direction is toward the west. Figure 20-1 is a map of the site.

20.2 PREVIOUS INVESTIGATIONS

20.2.1 Summary of Activities and Results

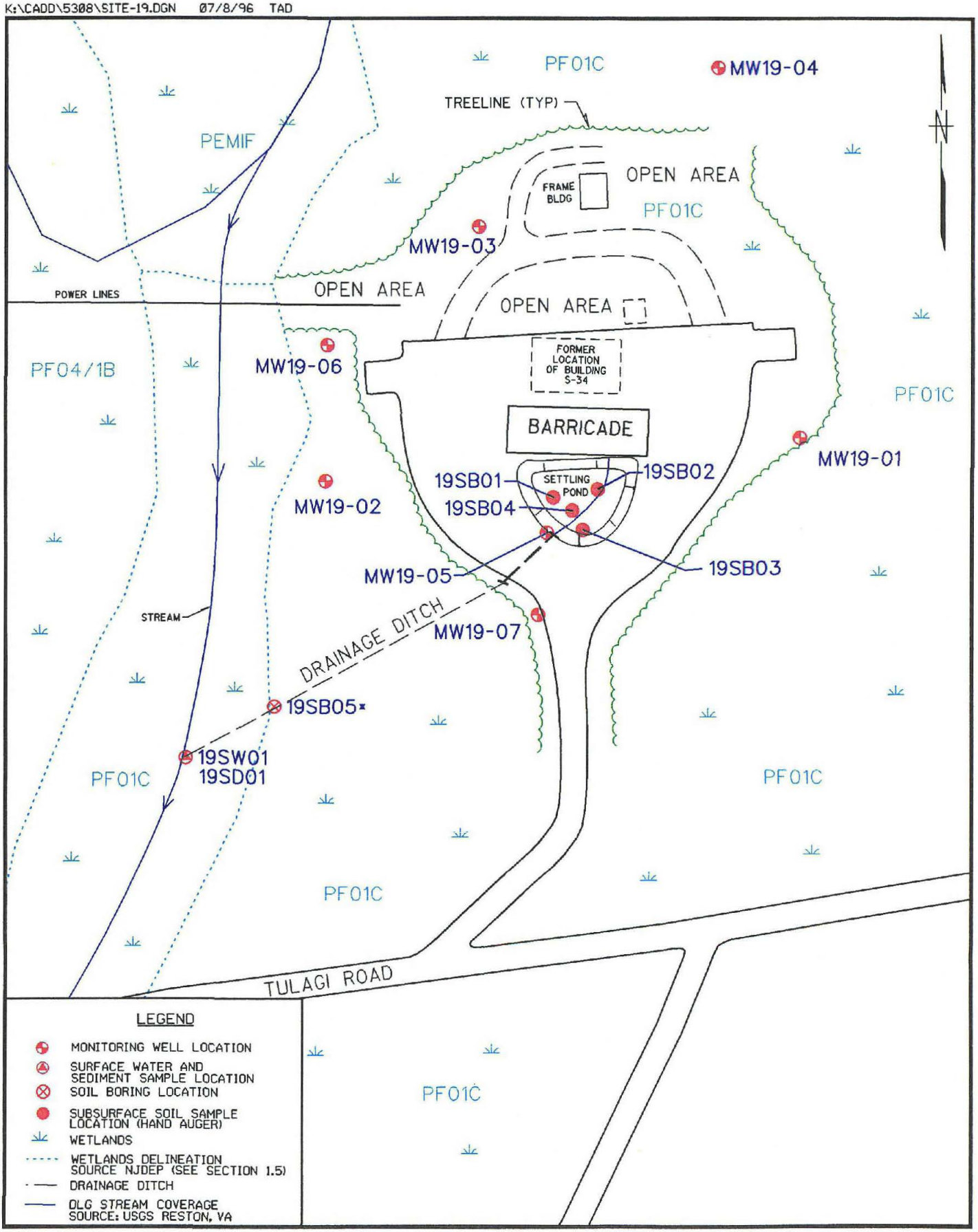
The 1983 IAS consisting of interviews and observations, concluded significant paint disposal to surface soil occurred over approximately ten years. The site was not recommended for confirmation study because it was believed that impacted soils were removed for construction of new barricade facilities in the early 1970's.

During the 1993 SI, three monitoring wells were installed, and soil, sediment, surface water, and groundwater samples were analyzed. Cadmium, lead, and zinc were detected at elevated concentrations in soil. The upgradient well (MW19-1) contained a detectable level of cadmium.

During the RI/FS, 24 surface soil samples were collected. Four surface soil samples were analyzed for TAL inorganics, and 20 were analyzed for cadmium and lead. Four shallow soil boring samples were collected from the drainageway exiting site and were analyzed for VOCs and TPH. Thirteen sediment samples were collected from the depression and adjoining drainage swale and analyzed for TAL inorganics. Low levels of volatiles and metals were detected in surface soil samples and elevated levels of metals were detected in sediments, most notably from samples taken within the depression and drainage swale.

During the RI/FS, three additional monitoring wells were installed to further characterize groundwater conditions. Groundwater samples were collected from all six monitoring wells and analyzed for TCL organics, TAL inorganics, VOCs, and drinking water metals. MW19-02 and MW19-06 were analyzed for explosives. Two volatile compounds, methylene chloride and acetone, were detected in almost all samples and in blanks. These detections are likely due to laboratory/field contamination. DDE and DDT were

K:\CADD\5308\SITE-19.DGN 07/8/96 TAD



SAMPLE LOCATIONS

FIGURE 20-1

SITE 19 - PAINT CHIP AND SLUDGE DISPOSAL AREA

0 100 200

SCALE IN FEET

Brown & Root Environmental

detected in MW19-02 from one sampling round (of three). These compounds were undetected in later rounds. Elevated levels of metals were detected at all monitoring wells.

20.2.2 Summary of Conclusions

Elevated levels of chromium and lead at concentrations above regulatory guideline limits were found in drainage depression and swale soils. Elevated levels of lead and chromium were also found in groundwater samples.

20.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations, follow-up remedial investigation activities were developed to meet the following objectives:

- Determine vertical extent of soil contamination in the swale.
- Determine whether surface water or wetland has been impacted by past practices.
- Compare metals data to background levels and risk based criteria.
- Determine impact of turbidity on metals results by using the low-flow sampling technique.

20.3 RI FIELD INVESTIGATIONS

Between June and October 1995, B&R Environmental conducted the following field investigation activities at Site 19:

- Sampling and analysis of surface water (Section 20.3.1).
- Sampling and analysis of sediment (Section 20.3.2).
- Sampling and analysis of surface and subsurface soil samples (Section 20.3.3).
- Drilling and installation of one shallow permanent monitoring well (Section 20.3.4).
- Sampling and analysis of groundwater from the newly installed well and existing wells (Section 20.3.4).
- Measurement of static-water levels in the wells (Section 20.3.4).

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the surface water and sediment sample locations, surface and subsurface soil samples, and the newly installed and selected existing monitoring wells. Surveying notes are proved in Appendix F.

20.3.1 Surface Water Sampling

One surface water sample (19 SW 01) was collected in June 1995 from the confluence of a drainage ditch and a branch of Mingamahone Brook to determine if compounds related to the historical use of the site are leaving the disposal area. NORTHDIV moved the planned sample location, shown in the RI work plan, due to dry conditions. Figure 20-1 shows sample locations. B&R Environmental collected the surface water sample by dipping the sample bottle directly into the water. Field measurements collected during sampling included pH, specific conductance, temperature, turbidity, dissolved oxygen, and salinity. The surface water sample was submitted to Lancaster Laboratories for TCL VOCs, TCL SVOC, TCL pesticides/PCBs, and TAL metals analyses. Sample log sheets are presented in Appendix D.

20.3.2 Sediment Sampling

One sediment sample (19 SD 01) was collected in June 1995 from the confluence of a drainage ditch and a branch of Mingamahone Brook to determine if contaminants are leaving the disposal area (Figure 20-1).

The sediment material consisted of dark brown silt with some organic matter. The sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, and TAL metals, moisture, and pH analyses. Sample log sheets are presented in Appendix D. The team collected the sediment sample using a stainless-steel trowel from 0 to 6 inches below the sediment/water interface. The sediment material was placed directly into the appropriate bottleware via the stainless-steel trowel.

20.3.3 Surface and Subsurface Soil Sampling

Surface Soil Sampling

Five surface soil samples including one field duplicate (19 SB 01-01, 19 SB 02-00, 19 SB 03-00, DUP-06, and 19 SB 04-00) were collected in June 1995 to investigate the impact of site activities on surficial soils (Figure 20-1). 19 SB 02 and 19 SB 03 were collected in the vicinity of previous sampling locations, which showed high metals concentrations. Each surface soil sample was collected from 0 to 2 feet bgs except for 19 SB 01-01, which was collected from 1 to 3 feet bgs. Samples were submitted to Lancaster Laboratories for analysis. Sample information is summarized in Table 20-1. Sample log sheets are presented in Appendix D.

Table 20-1
Surface and SubSurface Soil Sampling Summary
NWS Earle, Colts Neck, New Jersey

Sample Number	Sample Depth Interval[1] (feet)	Analytical Parameters	Soil Description
19 SB 01-01	1 to 3	TCL VOC and TAL metals	Brown silty sand
19 SB 02-00	0 to 2	TCL VOC, TAL metals, chromium (hexavalent), and moisture	Tan to gray silty sand with trace amounts of gravel
19 SB 03-00	0 to 2	TCL VOC, TAL metals, chromium (hexavalent), and moisture	Tan/gray sand and gravel (some paint chips)
19 SB 04-00	0 to 2	TCL VOC and TAL metals	Brown/tan silty sand with trace amounts of roots and gravel
19 SB 01-03	3 to 5	TCL VOC and TAL metals	Brown silty sand with trace amounts of gravel
19 SB 02-03	3 to 5	TCL VOC, TAL metals, chromium (hexavalent), and moisture	Dark brown silty sand with trace amounts of gravel
19 SB 03-03	3 to 5	TCL VOC, TAL metals, chromium (hexavalent), and moisture	Light brown silty sand with trace amounts of clay
19 SB 04-03	3 to 5	TCL VOC and TAL metals	Brown silty sand - some gravel
19 SB 05-02	2 to 3	TAL metals	Brown/tan silty sand

(1) In feet below grade

Subsurface Soil Sampling

Five subsurface soil samples (19 SB 01-03, 19 SB 02-03, 19 SB 03-03, 19 SB 04-03, and 19 SB 05-02) were collected in June 1995 (Figure 20-1). 19 SB 02 and 19 SB 03 were collected in the vicinity of previous sampling locations, which had shown high metals concentrations. Four of the subsurface soil samples were collected from 3 to 5 feet bgs to determine if metals have migrated downward from the surface and to provide data on the depth and extent of soil impacts. 19 SB 05 was collected from along the culvert, southwest of the depression, from a depth of 2 to 3 feet to gauge the vertical extent of impacts near the culvert. All the samples were submitted to Lancaster Laboratories for analysis. Sample information is summarized in Table 20-1. Sample log sheets are presented in Appendix D.

The field team used a hand auger to auger down to the desired depth and placed the soil sample directly into the appropriate bottleware. The auger holes were backfilled with the unused removed cuttings. The hand auger was cleaned between sample locations.

20.3.4 Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

One shallow permanent monitoring well (MW19-07) was added to the site in June 1995 to investigate groundwater quality southwest of the site (Figure 20-1). The boring had a total depth of 20 feet and water was encountered at approximately 11 feet below grade during drilling. The boring was drilled to approximately 8 feet below the water table and completed as a cased well, screened across the water table. Monitoring well characteristics are summarized in Table 20-2.

Subsurface soil samples were collected continuously to the water table by driving 2-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. HNu readings were 0 ppm throughout the MW19-07 boring with no stains or odors observed. A soil boring log sheet was prepared for the boring to evaluate subsurface lithologies (see Appendix C).

The well was constructed with 2-inch I.D., flush jointed and threaded, Schedule 40 PVC well casing and 2-inch I.D., Schedule 40, 0.10-foot slotted PVC well screen fitted with a PVC bottom cap. A 10-foot screen was installed in the well. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 3 feet above the top of the screen. An approximately 2-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height approximately 1 foot below the ground surface.

Table 20-2
Site 19 - Monitoring Well Characteristics Summary
NWS Earle Colts Neck, New Jersey

Monitoring Well Number	Total Depth[1] (feet)	Ground Surface Elevation[2]			Diameter (inches)	Screened Interval Depth[1] (feet)	Filter Pack Interval Depth[1] (feet)	Date Installed
		Top of Concrete Pad	Top of PVC Riser	Top of Standpipe				
MW19-01	25	NS	116.62	NS	4	10 - 25	8 - 25	1/20/86
MW19-02	24	NS	109.38	NS	4	9 - 24	7 - 24	1/20/86
MW19-03	24	NS	111.34	NS	4	9 - 24	7 - 24	1/20/86
MW19-04	16	111.93	113.44	NS	4	4 - 16	2.5 - 16.5[3]	1/15/91
MW19-05	20	112.59	114.08	114.21	4	5 - 20	3 - 20.5[3]	1/16/91
MW19-06	16	106.95	109.32	NS	4	2.5 - 16	1.5 - 16.5[3]	2/15/91
MW19-07	20	111.68	113.78	114.35	2	10 - 20	7 - 20	6/27/95

Note: All wells were constructed with Schedule 40 polyvinyl chloride (PVC) well casing.

(1) In feet below grade. Reading obtained during monitoring well installation. See Table 20-3 for more accurate measurements.
(2) In feet above mean sea level.
(3) Filter pack extends beneath screened interval.
NS Not surveyed.

The well was completed with a 2-foot-high standpipe. A 4- by 4-foot concrete pad was keyed into the well annulus and poured around the well standpipe. Monitoring well construction sheets are in Appendix C.

The well was developed 48 hours after installation. Groundwater temperatures, pH, conductivity, turbidity, dissolved oxygen, and water level were monitored during development. The well was developed until removed water was visibly clear of suspended solids. A total of 45 gallons of water were removed from MW19-07.

Static-Water-Level Measurements

In order to define groundwater flow directions and horizontal and vertical groundwater gradients, two rounds of static-water-level measurements were collected. The first round of water-level measurements was collected on August 7, 1995, the second on October 17, 1995. Static-water levels were measured from the top of PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation ranged from approximately 96.44 to 101.13 feet above MSL during the first round of measurements and from approximately 95.92 to 100.67 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 20-3.

Groundwater Sampling

Groundwater samples were obtained from five of the six existing monitoring wells (MW19-01, MW19-02, MW19-03, MW19-05, and MW19-06) and the newly installed well (MW19-07) to determine groundwater quality and to provide data for use in the risk assessment. The five existing monitoring wells were sampled in July 1995. MW19-04 was dry and therefore was not sampled. MW19-07 was sampled in August 1995. Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity. Prior to sampling, B&R Environmental purged the wells using the micro-purge protocol to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure that little or no drawdown in water levels occurred throughout the purge and sample process.

A total of six groundwater samples (19 GW 01, 19 GW 02, 19 GW 03, 19 GW 05, 19 GW 06, and 19 GW 07) were collected and submitted to Lancaster Laboratories for TCL VOC and TAL metals analyses. 19 GW 06 was also sampled for chromium (hexavalent); however, the holding time was missed for the original sample, collected in July 1995, and the sample was collected again in August 1995, solely for chromium (hexavalent) analysis. Sample log sheets are presented in Appendix D.

TABLE 20-3
SITE 19 STATIC WATER-LEVEL MEASUREMENT SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY

Monitoring Well Number	August 7, 1995			October 17, 1995		
	Depth to Water Table(1) (feet)	Top of PVC Riser(2) (feet)	Elevation of Water Table(2) (feet)	Depth to Water Table(1) (feet)	Top of PVC Riser(2) (feet)	Elevation of Water Table(2) (feet)
MW19-01	15.49	116.62	101.13	15.95	116.62	100.67
MW19-02	12.94	109.38	96.44	13.43	109.38	95.95
MW19-03	14.52	111.34	96.82	14.99	111.34	96.35
MW19-04	Dry	113.44	-	Dry	113.44	-
MW19-05	17.41	114.08	96.67	17.93	114.08	96.15
MW19-06	11.98	109.32	97.34	12.42	109.32	96.90
MW19-07	17.21	113.78	96.57	17.86	113.78	95.92

(1) In feet below top of riser
(2) In feet above mean sea level

20.4 SITE CHARACTERISTICS

20.4.1 Geology

Regional mapping places Site 19 within the outcrop area of the Kirkwood Formation. The Kirkwood Formation ranges between 60 and 100 feet in thickness and the soil borings are no more than 25 feet deep. The lithology of the sediments encountered in the on-site soil borings generally agrees with the published descriptions of the Kirkwood and Vincentown Formations. Assuming a portion of the Kirkwood Formation was removed by erosion, it is possible that the soil borings penetrated the underlying Vincentown Formation. In general, the borings encountered brown and yellowish-brown, fine- to medium-grained sand, silty sand, sandy silt, and silt (probably representative of the Kirkwood Formation) and glauconitic, fine- to medium-grained sand (probably representative of the Vincentown Formation). Mainside is located above the up dip limit of the Piney Point, Shark River, and Manasquan Formations; therefore, the glauconitic sand is interpreted to be part of the Vincentown Formation.

Based upon the boring log descriptions, the wells penetrated the Kirkwood and Vincentown Formations.

20.4.2 Hydrogeology

Groundwater in the Kirkwood and Vincentown aquifer beneath the site occurs under unconfined conditions and the formations are interpreted to be hydraulically interconnected. Static-water-level measurements and water-table elevations are summarized in Table 20-3. Groundwater elevations for August 1995 and October 1995 are contoured on Figures 20-2 and 20-3, respectively. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October groundwater contour maps, is toward the west. There does not appear to be significant seasonal variation in groundwater flow direction.

Based on boring log descriptions, the wells are screened across the contact between the Kirkwood and Vincentown Formations. The hydraulic conductivities calculated for MW19-04 and MW19-05 are 6.91 x 10^{-4} cm/sec (1.96 ft/day) and 1.06 x 10^{-3} cm/sec (3.00 ft/day), respectively.

20.5 NATURE AND EXTENT OF CONTAMINATION

20.5.1 Subsurface Soils

Nine site-related subsurface soil samples (19 SB 01-00 through 19 SB 04-00, 19 SB 01-03 through 19 SB 04-03, and 19 SB 05-02) were collected at Site 19 (Figure 20-1). Tables 20-4 and 20-5 present the occurrence and distribution of inorganic and organic chemicals detected in site-related subsurface soil samples and compares them to background as presented in Section 30.1. Table 20-4a presents a

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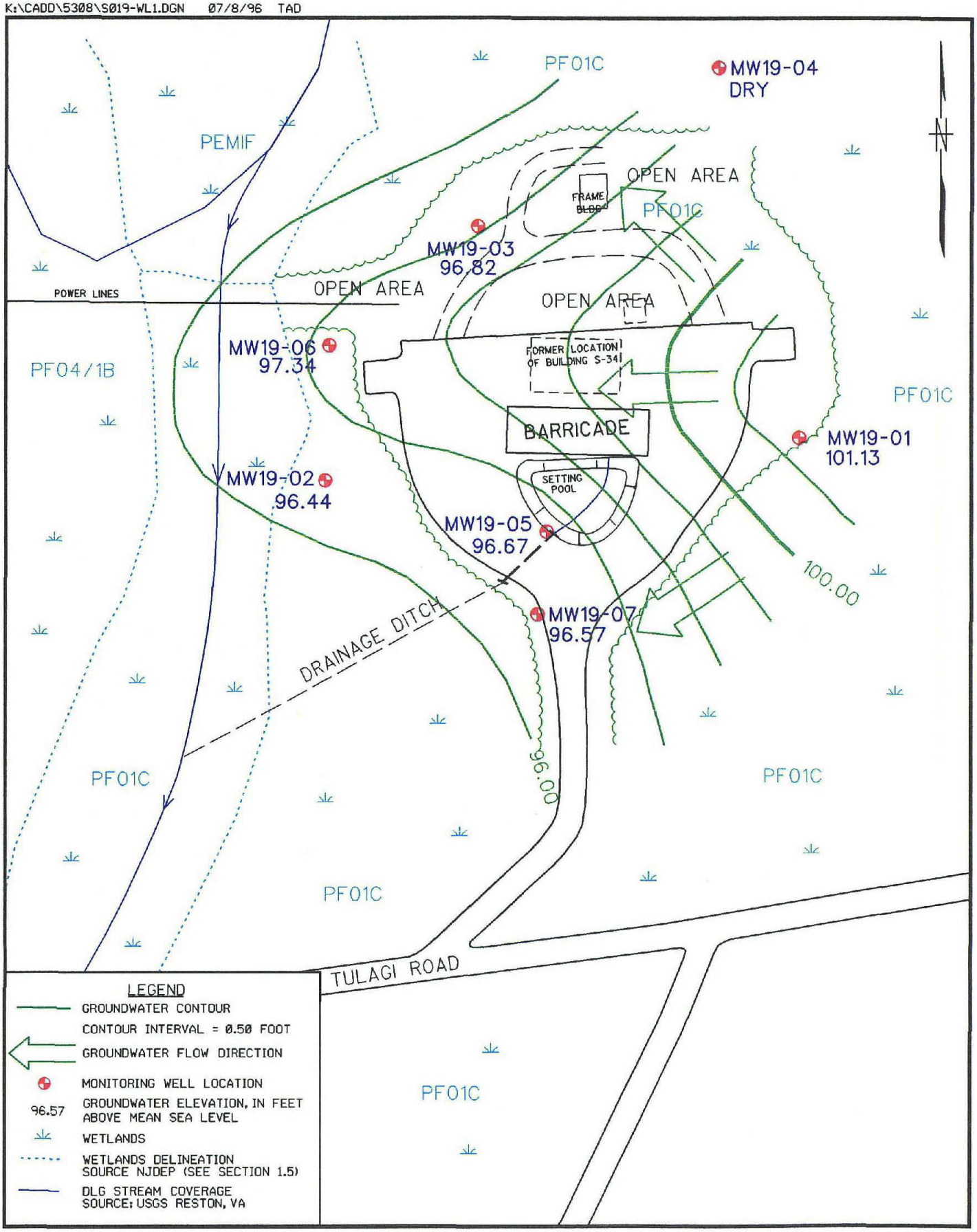


GROUNDWATER CONTOUR MAP AUGUST 7, 1995

SITE 19 - PAINT CHIP AND SLUDGE DISPOSAL AREA

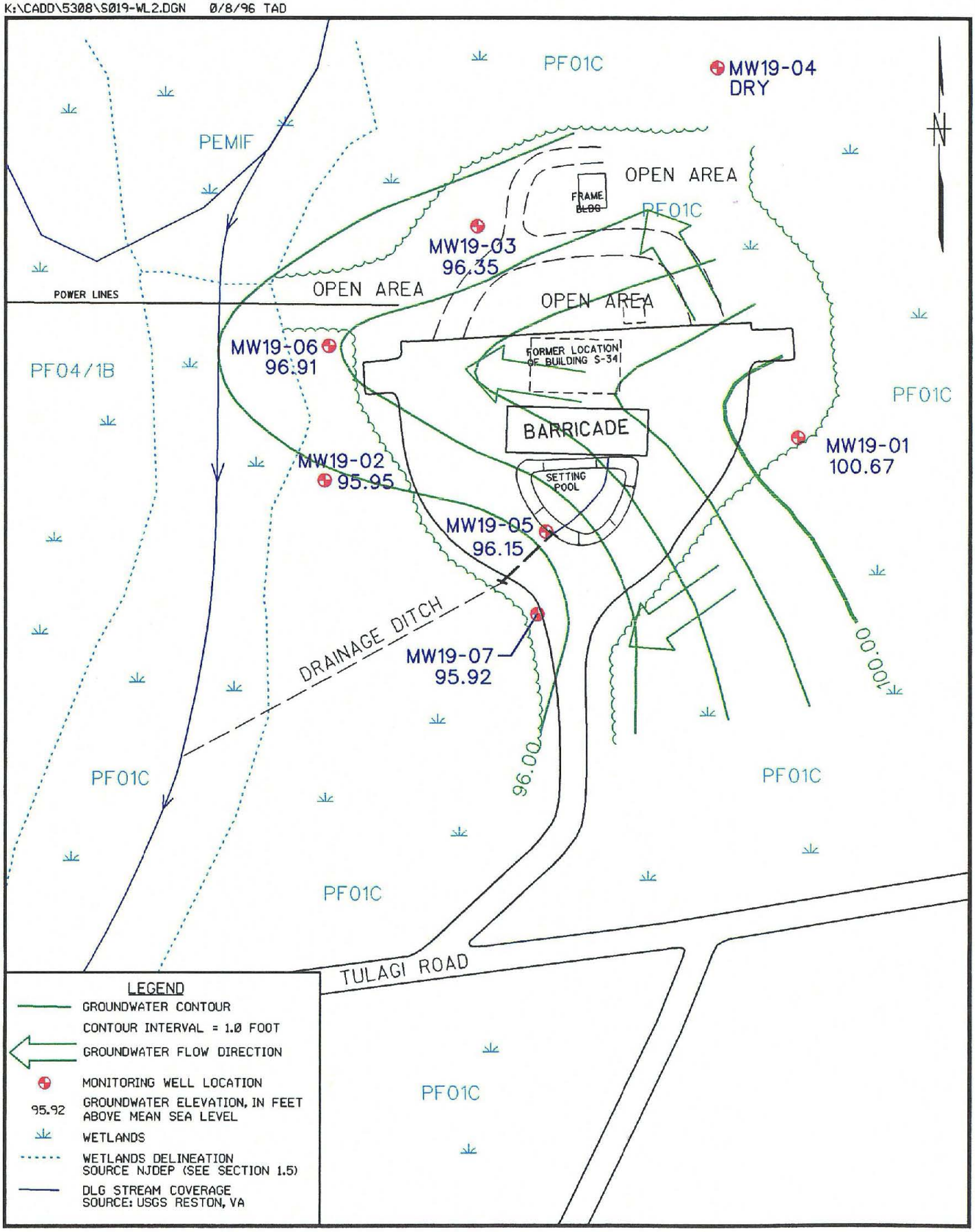
FIGURE 20-2

0 100 200

SCALE IN FEET

Brown & Root Environmental

K:\CADD\5308\S019-WL2.DGN 0/8/96 TAD



GROUNDWATER CONTOUR MAP OCTOBER 17, 1995

FIGURE 20-3

SITE 19 - PAINT CHIP AND SLUDGE DISPOSAL AREA

0 100 200

SCALE IN FEET

Brown & Root Environmental

TABLE 20-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOILS AT SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5370.00	9 / 9	562 - 3610	1551.89	NO	2496.73
ANTIMONY	NOT DETECTED	-	-	2 / 9	0.7 - 32.15	3.87	YES	10.44
ARSENIC	8 / 8	1.35 - 14.4	13.29	7 / 9	0.66 - 5.05	1.49	NO	2.43
BARIUM	8 / 8	0.92 - 31	17.92	9 / 9	3.3 - 303	122.39	YES	303
BERYLLIUM*	2 / 8	0.12 - 0.28	0.28	9 / 9	0.12 - 0.245	0.16	NO	0.19
CADMIUM	1 / 8	0.57	0.58	9 / 9	0.052 - 5.9	0.73	YES	1.93
CALCIUM	8 / 8	28.6 - 799	577.55	9 / 9	68.6 - 532	330.07	NO	532
CHROMIUM	8 / 8	4.7 - 59.5	54.73	9 / 9	6.4 - 528	73.29	YES	179.33
COBALT*	4 / 8	0.75 - 5	2.77	5 / 9	0.15 - 6.2	0.79	NO	2.05
COPPER*	8 / 8	0.97 - 8.6	8.66	9 / 9	1.2 - 14.75	4.84	NO	7.32
IRON	8 / 8	3745 - 62500	40871.25	9 / 9	874 - 4605	2423.22	NO	3657.94
LEAD	8 / 8	1.4 - 39.4	24.33	9 / 9	2.7 - 1345	156.07	YES	432.47
MAGNESIUM	8 / 8	18.5 - 619	504.05	9 / 9	61.3 - 436	177.37	NO	245.09
MANGANESE	8 / 8	2.6 - 214	92.51	5 / 9	1.4 - 2.9	2.66	NO	2.9
MERCURY*	8 / 8	0.03 - 0.17	0.13	7 / 9	0.014 - 0.19	0.04	NO	0.07
NICKEL	4 / 8	1.8 - 7.2	4.75	9 / 9	0.32 - 1.95	0.69	NO	0.99
POTASSIUM	7 / 8	95 - 792	793.35	9 / 9	58 - 495	222.79	NO	416.26
SELENIUM	2 / 8	0.57 - 0.93	0.79	1 / 9	0.71	0.33	NO	0.42
SILVER	2 / 8	0.37 - 0.67	0.51	2 / 9	0.14 - 0.23	0.10	NO	0.13
SODIUM	8 / 8	17.5 - 94.8	79.35	9 / 9	66.3 - 192.5	145.31	YES	181.54
THALLIUM	4 / 8	0.7 - 1.9	1.38	3 / 9	0.77 - 1.1	0.52	NO	0.70
VANADIUM	8 / 8	11.05 - 64	64.71	9 / 9	3.9 - 11.15	6.38	NO	8.22
ZINC	6 / 8	1.1 - 50.7	31.35	9 / 9	2.2 - 7760	930.48	YES	2518.16

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 20-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
TETRACHLOROETHENE	NOT DETECTED	-	-	4 / 8	4 - 4	4

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TABLE 20-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 19

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19SB01-01	19SB01-03	19SB02-00	19SB02-03	19SB03-00	19SB03-00-DUP	ARARS & TBCs		
LOCATION:	19SB01	19SB01	19SB02	19SB02	19SB03	19SB03	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	1430	980	562	790	3000	1430	-	-	-
antimony	0.57 U	0.57 U	0.54 U	0.56 U	21.5 E	42.8 E	14.0	340	-
arsenic	1.1 J	0.57 UJ	0.66 J	0.56 UJ	4.9 J	5.2 J	20.0	20.0	-
barium	151 J	104 J	157 J	129 J	283 J	323 J	700	47000	-
beryllium	0.14	0.16	0.13	0.12	0.29	0.20	1.00	1.00	-
cadmium	0.069	0.063	0.12	0.090	5.0 E	6.8 E	1.00	100	-
calcium	385	178	453	321	412	652	-	-	-
chromium, hexavalent	n/a	n/a	10.0 J	0.90 J	320 E J	530 E J	-	10.0	-
chromium, total	7.4	8.6	45.3	9.4	460	596 E	-	500	-
cobalt	0.14 U	0.14 U	0.18	0.14 U	5.6	6.8	-	-	-
copper	4.7	4.8	5.6 J	2.4	11.1 J	18.4 J	600	600	-
iron	2500 J	3110 J	1450 J	874 J	6090 J	3120 J	-	-	-
lead	3.1 J	2.7 J	7.4 J	3.4 J	1220 E J	1470 E J	400	600	-
magnesium	222	107	147	95.0	387	485	-	-	-
manganese	3.7 R	1.7 J	2.9 J	1.4 J	16.5 R	19.8 R	-	-	-
mercury	0.015 J	0.0073 U	0.018 J	0.0073 U	0.20 J	0.18 J	14.0	270	-
nickel	0.56	0.36	0.64	0.32	1.7	2.2	250	2400	-
potassium	147	194	58.0	174	377	302	-	-	-
selenium	0.57 UJ	0.57 UJ	0.54 UJ	0.56 UJ	0.71 J	0.56 UJ	63.0	3100	-
silver	0.14 U	0.14 U	0.14 U	0.14 U	0.17	0.29	110	4100	-
sodium	153	66.3	145	153	192	193	-	-	-
thallium	0.69 U	0.68 U	0.65 U	0.68 U	1.1 J	0.67 U	2.00	2.00	-
vanadium	6.2	6.1	3.9	4.2	12.0	10.3	370	7100	-
zinc	101 J	83.2 J	138 J	76.9 J	6730 E J	8790 E J	1500	1500	-
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
tetrachloroethene	4.0 J	11.0 U	4.0 J	11.0 U	4.0 J	11.0 U	4000	6000	1000

TABLE 20-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 19

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19SB03-03		19SB04-00		19SB04-03		19SB05-02		---		---		ARARS & TBCs		
LOCATION:	19SB03		19SB04		19SB04		19SB05		---		---		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI								
INORGANICS	**mg/kg**		**mg/kg**		**mg/kg**		**mg/kg**						**mg/kg**	**mg/kg**	**mg/kg**
aluminum	3610		1470		1690		1220						-	-	-
antimony	0.59	U	0.54	U	0.54	U	0.70						14.0	340	-
arsenic	2.8	J	1.1	J	1.0	J	1.1	J					20.0	20.0	-
barium	8.2	J	5.0	J	241	J	3.3	J					700	47000	-
beryllium	0.19		0.12		0.15		0.17						1.00	1.00	-
cadmium	0.11		0.052		0.074		0.10						1.00	100	-
calcium	129		524		380		68.6						-	-	-
chromium, hexavalent	7.0	J	n/a		n/a		n/a						-	10.0	-
chromium, total	34.0		6.8		6.4		13.7						-	500	-
cobalt	0.16		0.15		0.17		0.14	U					-	-	-
copper	4.6		1.8		3.7		1.2						600	600	-
iron	2900	J	2750	J	1730	J	1890	J					-	-	-
lead	27.4	J	6.9	J	5.8	J	2.9	J					400	600	-
magnesium	158		186		184		61.3						-	-	-
manganese	1.6	J	3.7	R	3.4	R	2.7	J					-	-	-
mercury	0.049	J	0.023	J	0.027	J	0.014	J					14.0	270	-
nickel	0.58		0.68		0.69		0.42						250	2400	-
potassium	495		98.6		320		179						-	-	-
selenium	0.59	UJ	0.54	UJ	0.54	UJ	0.58	UJ					63.0	3100	-
silver	0.15	U	0.14	U	0.14		0.15	U					110	4100	-
sodium	162		154		144		138						-	-	-
thallium	0.80	J	0.64	U	0.77	J	0.70	U					2.00	2.00	-
vanadium	8.2		6.1		7.2		4.4						370	7100	-
zinc	89.1	J	2.2	J	100	J	24.4	J					1500	1500	-
VOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
tetrachloroethene	12.0	U	4.0	J	11.0	U	n/a						4000	6000	1000

TABLE 20-4a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to *soil criteria:*

- No standard is available for this chemical in this classification.

TABLE 20-4b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 19

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19SB02-00	19SB02-03	19SB03-00	19SB03-00-DUP	19SB03-03	---	ARARS & TBCs		
LOCATION:	19SB02	19SB02	19SB03	19SB03	19SB03	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI				
MISCELLANEOUS	%	%	%	%	%		%	%	%
moisture	8.1	11.5	13.5	11.1	14.7		-	-	-

TABLE 20-4b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

comparison of detected compounds to ARARs and TBCs. Figure 20-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

20.5.1.1 Inorganics

Concentrations of antimony, cadmium, chromium, lead, and zinc in sample 19 SB 03-00 were greater than the range associated with background subsurface soil samples. In addition, zinc was detected at levels slightly greater than background in sample 19 SB 02-00 and barium was present at levels greater than background in samples 19 SB 01-01, 19 SB 01-03, 19 SB 02-00, 19 SB 02-03, 19 SB 03-00, and 19 SB 04-03.

Sample 19 SB 03-00 revealed an elevated level of total chromium (528 mg/kg); hexavalent chromium analysis indicated that 70 to 90 percent of the chromium present is attributable to hexavalent chromium. Two other samples (19 SB 02-00 and 19 SB 03-03) revealed slightly elevated total chromium readings (from 34 to 45.3 mg/kg); hexavalent chromium analysis indicated that approximately 20 percent of the chromium present in these two samples is in the form of hexavalent chromium.

20.5.1.2 Organics

PCE was detected only in the four subsurface soil samples collected at the shallow depth interval (near surface). The PCE concentrations were 4 ug/kg in each sample. PCE was not detected in background subsurface soil samples.

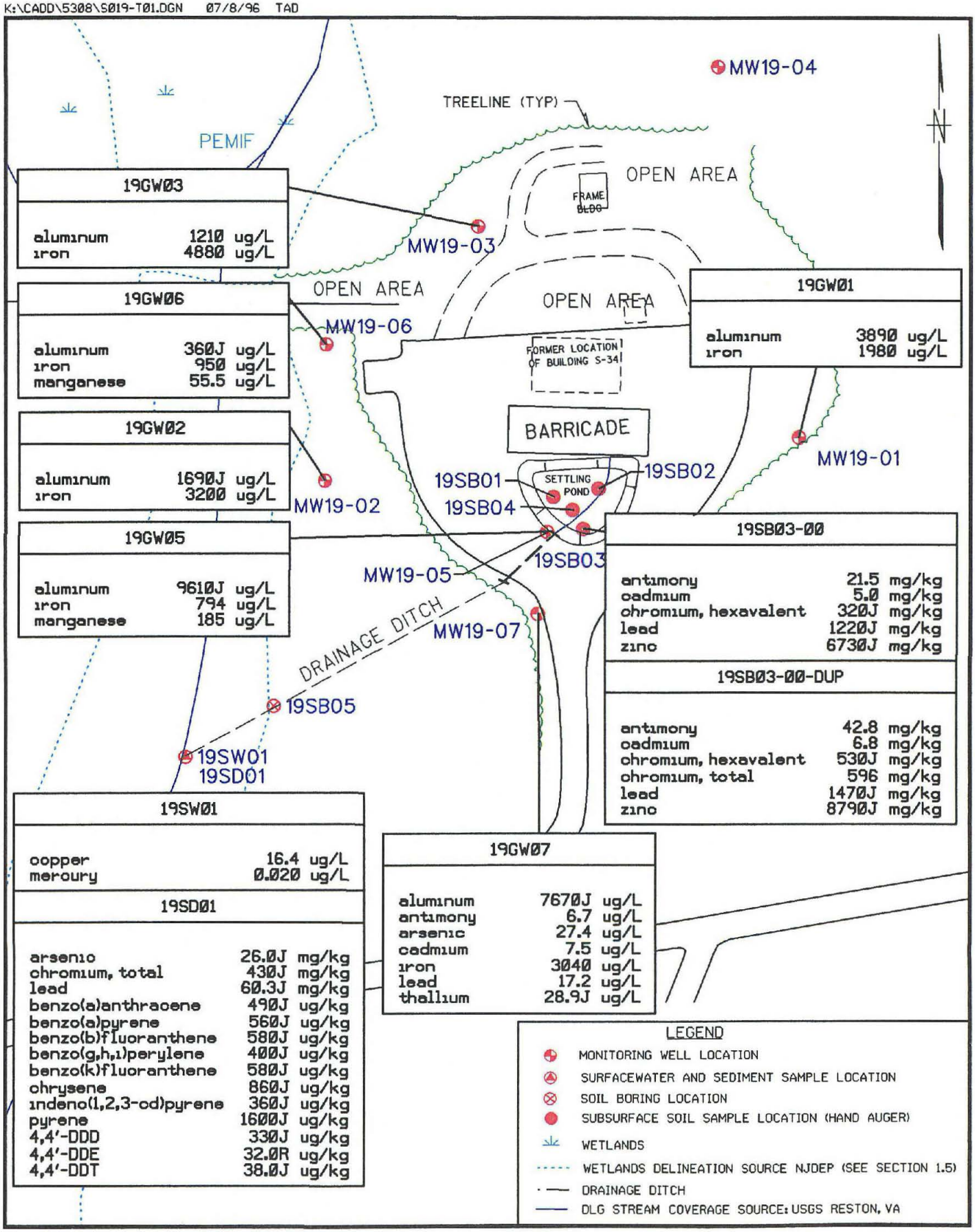
20.5.1.3 Miscellaneous Parameters

Four of the subsurface samples collected at Site 19 were analyzed for hexavalent chromium. The impact of the hexavalent chromium results has been addressed under the inorganic section. Miscellaneous parameter results are presented in Appendix A.

20.5.2 Sediment

One site-related sediment sample (19 SD 01) was collected at Site 19 (Figure 20-1). Tables 20-6 and 20-7 presents the occurrence and distribution of inorganic and organic chemicals detected in site-related sediment samples and compares them to background. TableS 20-6a and 20-6b present a comparison of detected compounds to ARARs and TBCs. Figure 20-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

K:\CADD\5308\S019-T01.DGN 07/8/96 TAD



CONCENTRATIONS ABOVE SCREENING LEVELS

SITE 19 - PAINT CHIP AND SLUDGE DISPOSAL AREA

FIGURE 20-4

0 100 200

SCALE IN FEET

Brown & Root Environmental

TABLE 20-6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	5492.67	1 / 1	12600	12600	YES	12600
ARSENIC	2 / 3	2.4 - 6.2	5.95	1 / 1	26	26	YES	26
BARIUM	3 / 3	3.9 - 10.6	14.07	1 / 1	11.9	11.9	NO	11.9
BERYLLIUM	1 / 3	0.57	0.67	1 / 1	1.3	1.3	YES	1.3
CALCIUM	3 / 3	179 - 518	685.33	1 / 1	427	427	NO	427
CHROMIUM	3 / 3	4.3 - 56	43.13	1 / 1	430	430	YES	430
COPPER	3 / 3	1.5 - 13	12.47	1 / 1	14.2	14.2	YES	14.2
IRON	3 / 3	228 - 7650	6578.67	1 / 1	45200	45200	YES	45200
LEAD	3 / 3	4.6 - 34.3	30.60	1 / 1	60.3	60.3	YES	60.3
MAGNESIUM	3 / 3	60.7 - 256	306.47	1 / 1	1820	1820	YES	1820
MANGANESE	3 / 3	4.6 - 9.2	13.80	1 / 1	54.2	54.2	YES	54.2
MERCURY	1 / 3	0.068	0.05	1 / 1	0.076	0.076	YES	0.076
POTASSIUM	2 / 3	86.1 - 681	589.40	1 / 1	5500	5500	YES	5500
SODIUM	3 / 3	26.6 - 116	115.27	1 / 1	109	109	NO	109
VANADIUM	3 / 3	5.9 - 42.7	36.93	1 / 1	210	210	YES	210
ZINC	3 / 3	14.2 - 26.9	37.33	1 / 1	36.9	36.9	NO	36.9

Note: Selected COPCs are indicated in boldface type.

TABLE 20-7
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	2 / 3	4.9 - 21	21	2 / 2	5.5 - 330	330
4,4'-DDE	1 / 3	1.7	1.7	1 / 2	18	18
4,4'-DDT	1 / 3	19	19	2 / 2	35 - 38	38
ALPHA-CHLORDANE	NOT DETECTED	-	-	1 / 2	1.2	1.2
BENZO(A)ANTHRACENE	2 / 3	140 - 560	560	1 / 1	490	490
BENZO(A)PYRENE	2 / 3	160 - 590	590	1 / 1	560	560
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	1 / 1	580	580
BENZO(G,H,I)PERYLENE	2 / 3	130 - 380	380	1 / 1	400	400
BENZO(K)FLUORANTHENE	2 / 3	150 - 470	470	1 / 1	580	580
CHRYSENE	2 / 3	250 - 940	940	1 / 1	860	860
FLUORANTHENE	2 / 3	300 - 1800	1800	1 / 1	2000	2000
GAMMA-CHLORDANE	1 / 3	0.095	0.095	2 / 2	1 - 1.4	1.4
HEPTACHLOR EPOXIDE	NOT DETECTED	-	-	1 / 2	0.57	0.57
INDENO(1,2,3-CD)PYRENE	2 / 3	110 - 310	310	1 / 1	360	360
PHENANTHRENE	2 / 3	200 - 1900	1900	1 / 1	730	730
PYRENE	2 / 3	350 - 1900	1900	1 / 1	1600	1600
TOLUENE	1 / 3	480	480	1 / 1	17	17

TABLE 20-6a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 19

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19SD01	---	---	---	---	---	---	ARARS & TBCs
LOCATION:	19SD01	---	---	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI							
INORGANICS	**mg/kg**							**mg/kg**
aluminum	12600 J							-
arsenic	26.0 E J							8.20 L
barium	11.9 J							40.0 B
beryllium	1.3 J							-
calcium	427 J							-
chromium, total	430 E J							81.0 L
copper	14.2 J							34.0 L
iron	45200 J							-
lead	60.3 E J							47.0 L
magnesium	1820 J							-
manganese	54.2 J							460 O
mercury	0.076 J							0.150 L
potassium	5500 J							-
sodium	109 J							-
vanadium	210 J							-
zinc	36.9 J							150 L
SEMIVOLATILES	**ug/kg**							**ug/kg**
benzo(a)anthracene	490 E J							330 F
benzo(a)pyrene	560 E J							430 L
benzo(b)fluoranthene	580 E J							330 F
benzo(g,h,i)perylene	400 E J							330 F
benzo(k)fluoranthene	580 E J							330 F
chrysene	860 E J							330 F
fluoranthene	2000 J							2900 Q
indeno(1,2,3-cd)pyrene	360 E J							330 F
phenanthrene	730 J							850 Q
pyrene	1600 E J							660 L

TABLE 20-6a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 19

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19SD01	---	---	---	---	---	---	ARARS & TBCs
LOCATION:	19SD01	---	---	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI							
VOLATILES	**ug/kg**							**ug/kg**
toluene	17.0 J							-
PESTICIDES	**ug/kg**							**ug/kg**
4,4'-DDD	330 E J							1.60 L
4,4'-DDE	32.0 E R							2.20 L
4,4'-DDT	38.0 E J							1.60 L
alpha-chlordane	2.6 R							-
endosulfan II	0.79 R							-
endrin ketone	1.2 R							-
gamma-chlordane	1.4 J							1.70 F
heptachlor epoxide	0.92 R							-

TABLE 20-6a
COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCS - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - *Constituent was not analyzed for in this sample.*

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - *Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.*

TABLE 20-6b

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 19

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19SD01	---	---	---	---	---	---	ARARS & TBCs
LOCATION:	19SD01	---	---	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI							
MISCELLANEOUS								
moisture %	86.9							-
pH	6.5 J							-

TABLE 20-6b
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

20.5.2.1 Inorganics

The one site-related sediment sample exhibited total chromium at a level seven times the upper range of background samples. Aluminum, iron, manganese, and vanadium were detected at levels slightly greater than background.

20.5.2.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, and fluoranthene were detected in background sediment samples at a range from 140 ug/kg to 1,800 ug/kg. Similar PAHs were detected in the sediment sample collected at Site 19 at concentrations one to four times higher. 4,4'-DDT (19 ug/kg), 4,4'-DDD (4.9 ug/kg to 21 ug/kg), and gamma chlordane (0.095 ug/kg) were detected in background sediment samples. These pesticides were detected in the site-related sediment sample at levels of 38 ug/kg (4,4'-DDT), 330 ug/kg (4,4'-DDD), and 1.4 ug/kg (gamma chlordane). Toluene was detected in the site-related sample at 5.8 ug/kg and in a background sediment sample at 480 ug/kg.

20.5.2.3 Miscellaneous Parameters

Only one sediment sample collected at Site 19 was analyzed for miscellaneous parameters. The analyses were pH and moisture. Results are presented in Appendix A.

20.5.3 Groundwater

Six groundwater samples were collected at Site 19, 19 GW 01 through 19 GW 03 and 19 GW 05 through 19 GW 07 (Figure 20-1). Table 20-8 presents the occurrence and distribution of inorganic chemicals in Site 19 site-related groundwater samples and compares them to background. No organics were detected in Site 19 groundwater samples. Table 20-8a presents a comparison of detected compounds to ARARs and TBCs. Figure 20-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

20.5.3.1 Inorganics

Antimony, arsenic, cadmium, thallium, and zinc were detected at levels greater than background in one monitoring well, MW19-07, which is located adjacent to the drainage ditch approximately 60 feet south-southwest of the former disposal area. Barium and zinc were detected at levels greater than background in monitoring well MW19-03.

TABLE 20-8
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM*	11 / 11	287 - 7870	5097.82	6 / 6	360 - 9610	4071.67	NO	9610.00
ANTIMONY	NOT DETECTED	-	-	1 / 6	6.7	2.24	YES	5.31
ARSENIC	1 / 11	5.8 - 5.8	4.05	2 / 6	3.5 - 27.4	6.25	YES	14.80
BARIUM*	11 / 11	2.6 - 518	229.60	6 / 6	16.7 - 753	159.92	NO	399.78
BERYLLIUM*	4 / 11	0.21 - 1.6	0.49	2 / 6	0.75 - 1	0.33	NO	1.00
CADMIUM	5 / 11	0.6 - 1.9	1.21	6 / 6	0.73 - 7.5	2.54	YES	4.61
CALCIUM	11 / 11	506 - 17200	8306.55	6 / 6	1330 - 17200	7795.00	NO	17200.00
CHROMIUM	NOT DETECTED	-	-	6 / 6	3.9 - 43.1	22.32	YES	43.10
COBALT*	6 / 11	0.7 - 10.1	4.06	6 / 6	0.95 - 15.6	3.89	NO	8.62
COPPER*	9 / 11	0.79 - 13.5	6.53	3 / 6	4.8 - 17.5	4.84	NO	10.30
IRON*	11 / 11	153 - 7690	4197.09	6 / 6	794 - 4880	2474.00	NO	4880.00
LEAD	3 / 11	2.1 - 3	2.44	5 / 6	1.6 - 17.2	4.78	YES	9.93
MAGNESIUM	11 / 11	273 - 27400	8449.64	6 / 6	921 - 27400	6351.50	NO	14940.75
MANGANESE	11 / 11	3.3 - 65	46.18	6 / 6	8.1 - 185	54.43	YES	109.27
MERCURY*	11 / 11	0.005 - 0.12	0.12	6 / 6	0.007 - 0.12	0.06	NO	0.12
NICKEL*	10 / 11	0.81 - 25.5	11.98	6 / 6	4.8 - 25.4	9.42	NO	15.96
POTASSIUM	11 / 11	350 - 3245	2810.55	6 / 6	831 - 1540	1104.50	NO	1395.95
SELENIUM	1 / 11	5.3 - 5.3	4.96	1 / 6	27.2	6.37	YES	27.20
SILVER	NOT DETECTED	-	-	1 / 6	1	0.56	YES	0.76
SODIUM	11 / 11	1850 - 11650	8449.09	6 / 6	3640 - 48100	11976.67	YES	26563.35
THALLIUM	3 / 11	4 - 5.1	5.15	1 / 6	28.9	6.32	YES	28.90
VANADIUM	10 / 11	0.69 - 42.25	16.48	5 / 6	2.3 - 15.6	6.38	NO	15.60
ZINC	6 / 9	3.7 - 348	178.61	4 / 6	7.6 - 694	204.52	YES	452.49

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based upon amended risk assessment.

TABLE 20-8a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 19

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19GW01	19GW02	19GW03	19GW05	19GW06	19GW07	ARARS & TBCs		
LOCATION:	19GW01	19GW02	19GW03	19GW05	19GW06	19GW07	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	3890 E	1690 E J	1210 E	9610 E J	360 E J	7670 E J	-	-	200
antimony	2.7 U	2.7 U	2.7 U	2.7 U	2.7 U	6.7 E	6.00	3.00 a	20.0
arsenic	3.3 U	3.3 U	3.5	3.3 U	3.3 U	27.4 E	50.0	-	8.00
barium	16.7	29.3	753	50.2	25.2	85.1	2000	2000 a	2000
beryllium	0.11 U	0.11 U	0.11 U	0.75	0.11 U	1.0	4.00	4000 e	20.0
cadmium	0.73	1.1	2.0	1.3	2.6	7.5 E	5.00	5.00 e	4.00
calcium	17200 J	1330	2770	8620	3250	13600	-	-	-
chromium, total	20.2	16.2	14.4	43.1	3.9	36.1	100 *	100 a	100
cobalt	2.0	1.3	1.6	1.9	1.0	15.6	-	-	-
copper	4.8	0.77 U	17.5	0.77 U	0.77 U	5.6	1300	-	1000
iron	1980 E	3200 E	4880 E	794 E	950 E	3040 E	-	-	300
lead	1.5 UJ	1.6	1.9 J	5.1	2.1	17.2 E	15.0	-	10.0
magnesium	27400	1080	921	2570	958	5180	-	-	-
manganese	20.2	12.4	8.1	185 E	55.5 E	45.4	-	-	50.0
mercury	0.12 J	0.0070	0.10 J	0.031	0.029	0.054	2.00	2.00 b	2.00
nickel	6.3	8.9	5.3	4.8	5.8	25.4	100	100 a	100
potassium	1020	831	1020	1340	876	1540	-	-	-
selenium	4.4 UJ	4.4 UJ	4.4 UJ	4.4 UJ	4.4 UJ	27.2	50.0	-	50.0
silver	0.94 U	0.94 U	0.94 U	0.94 U	0.94 U	1.0	-	100 a	-
sodium	4050	6690	3640	5270	4110	48100	-	-	50000
thallium	3.6 U	3.6 U	3.6 U	3.6 U	3.6 U	28.9 E J	2.00	0.400 a	10.0
vanadium	5.5	7.4	7.2	0.61 U	2.3	15.6	-	-	-
zinc	5.8 R	51.8	470 J	1.6 U	7.6	694	-	2000 a	5000

TABLE 20-8a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

• - Criteria are for total chromium.

•* - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

20.5.4 Surface Water

One surface water sample was collected at Site 19, 19 SW 01 (Figure 20-1). Tables 20-9 and 20-10 present the occurrence and distribution of inorganic and organic chemicals in site-related surface water samples and compare them to background. Table 20-9a presents a comparison of detected compounds to ARARs and TBCs. Figure 20-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

20.5.4.1 Inorganics

Concentrations of metals in the site-related surface water sample were similar to the range of background samples.

20.5.4.2 Organics

Beta-BHC (0.0068 ug/L) and endosulfan I (0.001 ug/L) were each detected in one site-related surface water sample, 19 SW 01, which was located in the surface water discharge pathway approximately 300 feet southwest of the disposal area. These pesticides were not detected in background surface water samples.

20.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 19 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 20.6.1. Persistence of detected chemicals in the environment is discussed in Section 20.6.2. Section 20.6.3 presents a brief discussion of contaminant trends.

20.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 19 indicate elevated levels of hexavalent chromium, antimony, cadmium, and lead in one out of nine subsurface soil samples, zinc in two subsurface soil samples, trace levels of PCE in several subsurface soil samples, elevated levels of total chromium in a sediment sample, low levels of PAHs and toluene in a sediment sample, and notable levels of antimony, arsenic, cadmium, thallium, and zinc in one groundwater sample. Surface water did not reveal significant contamination other than traces of two pesticides. The physical transport data for the detected contaminants are presented in Table 2-10. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

TABLE 20-9
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	265 - 409	705.33	1 / 1	229	229	NO	229
BARIUM	3 / 3	16.3 - 34	53.73	1 / 1	24.9	24.9	NO	24.9
BERYLLIUM	2 / 3	0.22 - 0.33	0.41	1 / 1	0.15	0.15	NO	0.15
CALCIUM	3 / 3	462 - 10100	9128.00	1 / 1	5470	5470	NO	5470
COPPER	2 / 3	1.1 - 9.8	7.40	1 / 1	16.4	16.4	YES	16.4
IRON	3 / 3	160 - 702	1040.00	1 / 1	1140	1140	YES	1140
LEAD	1 / 3	4.4	3.43	1 / 1	3.1	3.1	NO	3.1
MAGNESIUM	3 / 3	369 - 2770	2525.33	1 / 1	1490	1490	NO	1490
MANGANESE	3 / 3	14 - 55.5	59.93	1 / 1	11.9	11.9	NO	11.9
MERCURY	2 / 3	0.023 - 0.028	0.04	1 / 1	0.02	0.02	NO	0.02
NICKEL	3 / 3	2.1 - 7.1	8.60	1 / 1	1.2	1.2	NO	1.2
POTASSIUM	2 / 3	251 - 1850	1482.33	1 / 1	499	499	NO	499
ZINC	3 / 3	7.6 - 29.4	32.67	1 / 1	22	22	NO	22

Note: Selected COPCs are indicated in boldface type.

TABLE 20-10
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE WATER AT SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
BETA-BHC	NOT DETECTED	-	-	1 / 1	0.0068	0.0068
ENDOSULFAN I	NOT DETECTED	-	-	1 / 1	0.001	0.001

TABLE 20-9a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 19

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	19SW01	---	---	---	ARARS & TBCs				
LOCATION:	19SW01	---	---	---					
DATA SOURCE:	1995 RI				AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
INORGANICS	**ug/L**				**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	229 J				-	-	-	-	-
barium	24.9				-	-	-	-	2000
beryllium	0.15				-	-	-	-	-
calcium	5470				-	-	-	-	-
copper	16.4 E				11.0 +	-	-	-	-
iron	1140				-	-	-	-	-
lead	3.1				3.20 +	-	-	-	5.00
magnesium	1490				-	-	-	-	-
manganese	11.9				-	-	-	-	-
mercury	0.020 E				0.0120	0.140	0.150	-	-
nickel	1.2				160 +	610	4600	-	516
potassium	499				-	-	-	-	-
sodium	12700 R				-	-	-	-	-
zinc	22.0 J				101 +	-	-	-	-
PESTICIDES	**ug/L**				**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
beta-BHC	0.0068 J				-	0.0140	0.0460	-	0.137
endosulfan I	0.0010 J				0.0560	0.930	2.00	0.0560	0.932

TABLE 20-9a
COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

- - No standard is available for this chemical in this classification.

+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L.

Elevated levels of metals were detected only in two of the four subsurface soil samples collected at the shallow depth interval (near-surface). Many metals are adsorbed onto soil and sediment easily but may also exist in dissolved or suspended forms. The primary migration route for metals present in near-surface soils is considered to be erosional transport through the drainage ditch towards the wetlands. Previous investigations have revealed elevated levels of lead in surface soil samples collected along the drainage pathway that leads southwest.

Hexavalent chromium comprised the majority of the total chromium detected in the near-surface soil 19 SB 03-00. The hexavalent form is considered rather soluble and quite mobile in groundwater and is not sorbed to any significant degree by clays or hydrous metal oxides (Clement Associates, 1985). Hexavalent chromium can be removed by organic carbon from water and may have some affinity for organic materials in natural water. Trivalent chromium tends to be adsorbed strongly onto clay particles and organic matter but can be solubilized if it is complexed with organic molecules. It should be noted that total chromium levels in groundwater were similar to the range of background samples, which does not suggest that groundwater impacts have occurred for this metal.

The levels of antimony, arsenic, cadmium, thallium, and zinc detected in groundwater reflect metals present in solution, given the low turbidity readings observed. This indicates the potential for groundwater transport for these metals.

Of the inorganic compounds detected in the sediment sample collected in the drainage ditch, aluminum, arsenic, chromium, iron, manganese, lead, and vanadium were present at elevated levels. No metals appeared at levels greater than background in the surface water.

PCE was detected only in the four subsurface soil samples collected at the shallow depth interval (near surface) and was not detected in groundwater. VOCs are typically considered highly mobile due to their solubility and volatility; however, the low levels of PCE detected and the absence of deeper subsurface soil contamination or groundwater contamination suggest that significant groundwater contamination has not occurred.

Two pesticides, beta-BHC and endosulfan I, were detected in the surface water, and PAHs and pesticides were detected in the sediment. PAHs and pesticides are typically strongly bound to organic matter in sediment and are not expected to migrate significantly except in conjunction with surface water erosional patterns.

20.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

Hexavalent and trivalent chromium are readily interconvertible in nature depending on microenvironmental conditions such as pH, hardness, and the types of other compounds present. Hexavalent chromium is a moderately strong oxidizing agent that reacts with reducing materials to form trivalent chromium. Trivalent chromium in the aquatic environment is hydrolyzed and precipitates as the insoluble hydroxide.

Hexavalent chromium is quickly reduced to trivalent chromium in poorly drained soils that have a high content of organic matter.

20.6.3 Observed Chemical Contaminant Trends

Chromium was detected at elevated levels as the hexavalent form in one subsurface soil and as total chromium in one sediment sample. In accordance with the RI work plan, only two subsurface soil samples were tested for hexavalent chromium. Surface water transport of chromium may have occurred either as soluble (hexavalent) chromium migration or as suspended (trivalent) chromium erosional dispersion. Either process could be responsible for the elevated levels observed in sediment. Although hexavalent chromium is considered relatively soluble and mobile in groundwater, groundwater levels of chromium were similar to the range of background groundwater samples.

Lead was found at elevated levels in one near-surface soil sample and zinc was detected at elevated levels in two near-surface soil samples. A previous investigation (1993) revealed lead and zinc present at elevated levels in surface soils in this source area and along the drainage pathway, which indicates that

contaminant migration has occurred. However, in the current investigation, elevated levels of lead and zinc were not found in the subsurface soil collected at the 2-foot depth in the drainage ditch, or in a wetland sediment sample from the toe of the drainage ditch. Therefore, impacts of lead and zinc migration appear limited to surficial drainage ditch sediments.

Antimony and cadmium were detected in one site-related near-surface soil sample at levels greater than background. Of these metals, only cadmium was detected at elevated levels in surface soils or sediments collected during a previous investigation, and neither was present at elevated levels in sediment or downstream subsurface soil sampled during the current investigation.

Antimony, arsenic, cadmium, thallium, and zinc were detected at levels greater than background in newly installed monitoring well, MW19-07, which is located near the drainage source. Previous investigations showed elevated levels of antimony, arsenic, cadmium, chromium, lead, and zinc in other monitoring wells. Historical data did not utilize low-flow purge methods and revealed even greater aluminum levels in those samples containing elevated metals. In the current investigation, samples collected from other media did not reveal elevated levels of the same inorganic contaminants that were found in groundwater, with the exception of zinc in one sediment sample. Based upon current and historical data, there do not appear to be trends establishing migration of lead from soil or sediment to groundwater at this site, despite the existence of considerable data that indicate that this constituent is the primary metal of concern in soil at the site.

PCE, which is considered mobile in groundwater, was detected in all four near-surface soil samples at trace levels but was not detected in the groundwater or sediment samples. The several PAHs and pesticides were detected at low levels in sediment but were not found in groundwater or subsurface soil samples.

The latter classes of organic compounds are typically strongly sorbed to organic matter in soils and sediment and are not considered mobile in groundwater.

20.6.4 Conclusions

Hexavalent chromium was found at an elevated level in one near-surface soil sample at Site 19 and may have the potential to impact groundwater. Levels of chromium in groundwater observed in the current investigation were similar to background. Historical groundwater data, while indicating substantially greater chromium levels at one location, are not viewed as representing only dissolved metals and are suspected to reflect a high level of suspended solids. In the current investigation, chromium was detected at elevated

levels in sediment from the toe of the drainage pathway, which suggests that migration of chromium has occurred through the surface water drainage pathway.

Certain metals (notably lead and zinc) were detected at elevated levels in one subsurface soil but were not found at elevated levels in subsurface soil collected in the drainage ditch, or in a wetland sediment. Therefore, impacts of lead and zinc migration appear limited to surficial drainage ditch sediments. Again, historical data indicate that these metals were detected at elevated levels in groundwater, but the ratio of suspended versus dissolved metal concentrations is suspected to be high.
In the current investigation, one monitoring well exhibited levels of antimony, arsenic, cadmium, lead, thallium, and zinc greater than background. Of these metals, only zinc was found at elevated levels in samples from other media collected at the site. Based upon current and historical data, these trends do not demonstrate significant evidence for consistently elevated levels of metals in groundwater.

Trace levels of PCE were detected only in several subsurface soils collected at the shallow depth. This compound is considered highly mobile but was not detected in groundwater. The low levels detected may suggest that the source areas for this compound have since been depleted or were not included in the sampled locations in this investigation.

Less mobile contaminant species (PAHs and pesticides) were found only in sediment and not groundwater. These compounds exhibit a high affinity for soils/sediments and are not expected to migrate significantly except through erosional dispersion. These substances were not detected at elevated levels in the subsurface soils associated with the source area.

20.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 19. The risk assessment was performed using the approach outlined in Section 2.4. Tables 20-11 through 20-14 provide the selected COPCs and representative concentrations of inorganics and organics in site-related subsurface soil, sediment, groundwater (inorganics only), and surface water, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The purpose of this RI was to determine impacts to groundwater and the extent of migration of known heavy metals contamination identified from earlier investigations. As a result, sampling was biased toward confirmation of ambiguous previous results or toward filling data gaps. The risk assessment performed assumes that the source contamination of heavy metals (principally lead and chromium) in sediments/surface soil in the drainage depression and drainage swale found previously is removed.

TABLE 20-11
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ANTIMONY	10.44	NORMAL
ARSENIC	2.43	NORMAL
BARIUM	303	LOGNORMAL
BERYLLIUM	0.19	NONPARAMETRIC
CADMIUM	1.93	NORMAL
CHROMIUM VI	59.54	NORMAL
CHROMIUM III	119.79	NORMAL
COBALT	2.05	NORMAL
COPPER	7.32	NORMAL
LEAD	432.47	NORMAL
MERCURY	0.07	NORMAL
ZINC	2518.16	NORMAL
TETRACHLOROETHENE*	4	LOGNORMAL

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 20-12
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COCS
SEDIMENT - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ALUMINUM	12600	NONPARAMETRIC
ARSENIC	26	NONPARAMETRIC
BARIUM	11.9	NONPARAMETRIC
BERYLLIUM	1.3	NONPARAMETRIC
CHROMIUM	430	NONPARAMETRIC
COPPER	14.2	NONPARAMETRIC
IRON	45200	NONPARAMETRIC
LEAD	60.3	NONPARAMETRIC
MANGANESE	54.2	NONPARAMETRIC
MERCURY	0.076	NONPARAMETRIC
VANADIUM	210	NONPARAMETRIC
ZINC	36.9	NONPARAMETRIC
4,4'-DDD*	330	NONPARAMETRIC
4,4'-DDE*	18	NONPARAMETRIC
4,4'-DDT*	38	NONPARAMETRIC
ALPHA-CHLORDANE	1.2	NONPARAMETRIC
BENZO(A)ANTHRACENE*	490	NONPARAMETRIC
BENZO(A)PYRENE*	560	NONPARAMETRIC
BENZO(B)FLUORANTHENE*	580	NONPARAMETRIC
BENZO(G,H,I)PERYLENE*	400	NONPARAMETRIC
BENZO(K)FLUORANTHENE*	580	NONPARAMETRIC
CHRYSENE*	860	NONPARAMETRIC
FLUORANTHENE*	1200	NONPARAMETRIC
GAMMA-CHLORDANE*	1.4	NONPARAMETRIC
HEPTACHLOR EPOXIDE*	0.57	NONPARAMETRIC
INDENO(1,2,3-CD)PYRENE*	360	NONPARAMETRIC
PHENANTHRENE*	730	NONPARAMETRIC
PYRENE*	1600	NONPARAMETRIC
TOLUENE*	17	NONPARAMETRIC

* UNITS FOR ORGANICS ARE IN ug/kg

TABLE 20-13
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
GROUNDWATER - SITE 19 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	9610	NONPARAMETRIC
ANTIMONY	5.31	LOGNORMAL
ARSENIC	14.80	NORMAL
BARIUM	399.78	NORMAL
BERYLLIUM	1	LOGNORMAL
CADMIUM	4.61	NORMAL
CHROMIUM VI	43.1	NONPARAMETRIC
COBALT	8.62	NORMAL
COPPER	10.30	NORMAL
IRON	4880	NONPARAMETRIC
LEAD	9.93	NORMAL
MERCURY	0.12	NONPARAMETRIC
NICKEL	15.96	NORMAL
SELENIUM	27.2	LOGNORMAL
SILVER	0.76	LOGNORMAL
THALLIUM	28.9	LOGNORMAL
ZINC	452.49	NORMAL

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TABLE 20-14
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SURFACE WATER - SITE 19 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
BERYLLIUM	0.15	NONPARAMETRIC
COPPER	16.4	NONPARAMETRIC
IRON	1140	NONPARAMETRIC
LEAD	3.1	NONPARAMETRIC
BETA-BHC	0.0068	NONPARAMETRIC
ENDOSULFAN I	0.001	NONPARAMETRIC

The result of the conservative baseline risk assessment was greater than a value of 1.0 for non-cancer risk and greater than 1E-04 for cancer risk; therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. Section 20.7.1.5 discusses the modifications made to the conservative preliminary baseline risk assessment.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation alternatives are identified for a site.

20.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential, recreational, and industrial receptors).

20.7.1.1 Future Industrial Employee

The estimated total RME cancer risks for the future industrial employee for exposure to COPCs in groundwater at Site 19 are within the mid-range of the 1E-04 to 1E-06 target acceptable risk range. (Ingestion exposures contributed the significant portion of risks.)

The conservative preliminary baseline risk assessment yielded an estimated noncarcinogenic HI with a value greater than 1.0 for the future industrial employee assuming exposure to COPCs in groundwater at Site 19. (Ingestion exposures contributed the significant portion of risk.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for industrial exposure to groundwater are discussed in Section 20.7.1.5 and presented in Tables 20-17, 20-18, and 20-18a, respectively.

The estimated total RME cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 19 are 1.3E-05 (ingestion), 1.3E-05 (dermal contact), and 3.9E-08 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate ARARs. The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 98 percent of the cancer risk for this pathway; and dermal contact, 32 percent of the cancer risk for this pathway) and beryllium (dermal contact, 68 percent of the cancer risk for this pathway).

The estimated RME noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becoming future surface soils) at Site 16 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic health effects are not expected because the sum of these HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soils at Site 19 in Tables 20-15 and 20-16, respectively.

20.7.1.2 Future Residential Receptor

For the future residential receptor, the conservative preliminary baseline risk assessment yielded estimated total cancer risks greater than 1E-04 (groundwater) and approximately 1E-04 (subsurface soil). For the future residential child, HIs were greater than 1.0 (subsurface soil and groundwater). Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. The amended carcinogenic and noncarcinogenic risks for residential receptors are discussed in Section 20.7.1.5 and presented for subsurface soil in Tables 20-19 and 20-20, respectively. Estimated carcinogenic risks and noncarcinogenic HQs for future residential receptors exposed to groundwater are presented in Tables 20-21, 20-21a, 20-22, and 20-22a, respectively.

20.7.1.3 Future Recreational Receptor

The estimated total RME cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 19 are 5.5E-07 (ingestion) and 2.6E-07 (dermal contact). This sediment cancer risk is below the 1E-04 to 1E-06 target acceptable risk range. The RME cancer risks for exposure to COPCs in surface water during wading at Site 19 are 7.2E-09 (ingestion) and 3.3E-08 (dermal contact). The surface water cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The RME HIs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 19 are less than 1.0 for ingestion and dermal contact exposure pathways. The RME HIs for the future recreational child assuming exposure to COPCs in surface water during wading at Site 19 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of the HIs is below 1.0.

TABLE 20-15
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 19
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
TETRACHLOROETHENE	7.3E-11	2.3E-10	1.4E-14
ANTIMONY	N/A	N/A	N/A
ARSENIC	1.3E-05	4.2E-06	2.8E-09
BARIUM	N/A	N/A	N/A
BERYLLIUM	2.8E-07	8.7E-06	5.2E-11
CADMIUM	N/A	N/A	1.6E-10
CHROMIUM VI	N/A	N/A	3.2E-08
CHROMIUM III	N/A	N/A	N/A
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
MERCURY	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	1.3E-05	1.3E-05	3.5E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 20-16
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 19
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
TETRACHLOROETHENE	3.9E-07	1.2E-06	7.2E-11
ANTIMONY	2.6E-02	1.6E-01	4.7E-06
ARSENIC	7.9E-03	2.6E-03	1.5E-06
BARIUM	4.2E-03	3.3E-02	7.8E-05
BERYLLIUM	3.6E-05	1.1E-03	6.7E-09
CADMIUM	3.8E-03	2.4E-02	1.9E-06
CHROMIUM VI	1.2E-02	1.8E-01	2.2E-06
CHROMIUM III	1.2E-04	1.8E-03	7.6E-03
COBALT	3.3E-05	2.1E-04	6.2E-09
COPPER	1.8E-04	9.3E-05	3.3E-08
LEAD	N/A	N/A	N/A
MERCURY	2.4E-04	1.1E-03	7.6E-08
ZINC	8.2E-03	1.0E-02	1.5E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-17
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
ANTIMONY	N/A	N/A
ARSENIC	7.8E-05	3.3E-08
CADMIUM	N/A	N/A
CHROMIUM VI	N/A	N/A
LEAD	N/A	N/A
SELENIUM	N/A	N/A
SILVER	N/A	N/A
THALLIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	7.8E-05	3.3E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMCIAL

TABLE 20-18
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	CENTRAL NERVOUS SYSTEM	GROUNDWATER DERMAL CONTACT
ANTIMONY	1.3E-01	1.3E-01					1.1E-03
ARSENIC	4.8E-01		4.8E-01				2.1E-04
CADMIUM	9.0E-02			9.0E-02			3.7E-04
CHROMIUM VI	8.4E-02			8.4E-02			1.7E-03
LEAD	N/A	N/A				N/A	N/A
SELENIUM	5.3E-02		5.3E-02				2.7E-05
SILVER	1.5E-03		1.5E-03				3.1E-06
THALLIUM	3.5E+00		3.5E+00	3.5E+00	3.5E+00	3.5E+00	2.9E-02
ZINC	1.5E-02	1.5E-02					2.4E-05
	HI BY TARGET ORGAN	1.4E-01	4.1E+00	3.7E+00	3.5E+00	3.5E+00	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-18a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	CENTRAL NERVOUS SYSTEM	GROUNDWATER DERMAL CONTACT
ANTIMONY	8.0E-02	8.0E-02					9.3E-04
ARSENIC	3.0E-01		3.0E-01				1.8E-04
CADMIUM	5.5E-02			5.5E-02			3.2E-04
CHROMIUM VI	2.7E-02			2.7E-02			7.8E-04
LEAD	N/A	N/A				N/A	N/A
SELENIUM	7.6E-03		7.6E-03				5.6E-06
SILVER	9.1E-04		9.1E-04				2.7E-06
THALLIUM	4.7E-01		4.7E-01	4.7E-01	4.7E-01	4.7E-01	5.5E-03
ZINC	9.0E-03	9.0E-03					2.1E-05
	HI BY TARGET ORGAN	8.9E-02	7.8E-01	5.6E-01	4.7E-01	4.7E-01	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-19
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 19
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
TETRACHLOROETHENE	3.3E-10	N/A	8.3E-15
ANTIMONY	N/A	N/A	N/A
ARSENIC	5.7E-05	4.2E-05	1.7E-09
BARIUM	N/A	N/A	N/A
CADMIUM	N/A	N/A	9.7E-11
CHROMIUM VI	N/A	N/A	2.0E-08
CHROMIUM III	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	5.7E-05	4.2E-05	2.2E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
• CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 20-20
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 19
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
TETRACHLOROETHENE	5.1E-06	N/A	7.7E-11
ANTIMONY	3.3E-01	N/A	5.0E-06
ARSENIC	1.0E-01	6.4E-02	1.6E-06
BARIUM	5.5E-02	N/A	8.2E-05
CADMIUM	4.9E-02	9.7E-03	2.0E-06
CHROMIUM VI	1.5E-01	N/A	2.3E-06
CHROMIUM III	1.5E-03	N/A	8.0E-03
LEAD	N/A	N/A	N/A
ZINC	1.1E-01	N/A	1.6E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-21
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ANTIMONY	N/A	N/A	N/A
ARSENIC	3.3E-04	7.8E-07	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM VI	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SELENIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
THALLIUM	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	3.3E-04	7.8E-07	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMCIAL

TABLE 20-21a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
ANTIMONY	N/A	N/A	N/A
ARSENIC	4.7E-05	1.0E-07	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM VI	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SELENIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
THALLIUM	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	4.7E-05	1.0E-07	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMCIAL

TABLE 20-22
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN				
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	CENTRAL NERVOUS SYSTEM
ANTIMONY	8.5E-01	8.5E-01				
ARSENIC	3.2E+00		3.2E+00			
CADMIUM	5.9E-01			5.9E-01		
CHROMIUM VI	5.5E-01			5.5E-01		
LEAD	N/A	N/A				N/A
SELENIUM	3.5E-01		3.5E-01			
SILVER	9.7E-03		9.7E-03			
THALLIUM	2.3E+01		2.3E+01	2.3E+01	2.3E+01	2.3E+01
ZINC	9.6E-02	9.6E-02				
	HI BY TARGET ORGAN	9.5E-01	2.7E+01	2.4E+01	2.3E+01	2.3E+01

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-22
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW DERMAL CONTACT BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER DERMAL CONTACT - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	CENTRAL NERVOUS SYSTEM	INHALATION OF VOAS IN GW - ADULT
ANTIMONY	3.3E-02	3.3E-02	3.3E-02				N/A
ARSENIC	6.5E-03		6.5E-03				N/A
CADMIUM	1.2E-02			1.2E-02			N/A
CHROMIUM	5.4E-02		5.4E-02	5.4E-02			N/A
LEAD	N/A	N/A				N/A	N/A
SELENIUM	8.5E-04		8.5E-04				N/A
SILVER	9.5E-05		9.5E-05				N/A
THALLIUM	9.0E-01		9.0E-01	9.0E-01	9.0E-01	9.0E-01	N/A
ZINC	7.5E-04	7.5E-04					N/A
	HI BY TARGET ORGAN	3.4E-02	1.0E+00	9.7E-01	9.0E-01	9.0E-01	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-22a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN				
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	CENTRAL NERVOUS SYSTEM
ANTIMONY	4.0E-01	4.0E-01				
ARSENIC	1.5E+00		1.5E+00			
CADMIUM	2.8E-01			2.8E-01		
CHROMIUM VI	1.3E-01			1.3E-01		
LEAD	N/A	N/A				N/A
SELENIUM	3.8E-02		3.8E-02			
SILVER	4.6E-03		4.6E-03			
THALLIUM	2.4E+00		2.4E+00	2.4E+00	2.4E+00	2.4E+00
ZINC	4.5E-02	4.5E-02				
	HI BY TARGET ORGAN	4.4E-01	3.9E+00	2.8E+00	2.4E+00	2.4E+00

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-22a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 19
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW DERMAL CONTACT BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER DERMAL CONTACT - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	CENTRAL NERVOUS SYSTEM	INHALATION OF VOAS IN GW - ADULT
ANTIMONY	2.2E-02	2.2E-02	2.2E-02				N/A
ARSENIC	4.3E-03		4.3E-03				N/A
CADMIUM	7.7E-03			7.7E-03			N/A
CHROMIUM	1.9E-02		1.9E-02	1.9E-02			N/A
LEAD	N/A	N/A				N/A	N/A
SELENIUM	1.3E-04		1.3E-04				N/A
SILVER	6.3E-05		6.3E-05				N/A
THALLIUM	1.3E-01		1.3E-01	1.3E-01	1.3E-01	1.3E-01	N/A
ZINC	5.0E-04	5.0E-04					N/A
	HI BY TARGET ORGAN	2.3E-02	1.8E-01	1.6E-01	1.3E-01	1.3E-01	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 19 in Tables 20-23 and 20-24, respectively. Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to surface water at Site 19 in Tables 20-25 and 20-26, respectively.

20.7.1.4 Lead Results

Lead was found at concentrations exceeding the EPA action level (15 ug/L) in groundwater samples taken in previous investigations, and in groundwater samples collected using low-flow techniques during the 1995 RI. Lead was found at levels exceeding 400 mg/kg in surface soil/sediment samples taken during past investigations and from samples taken during the 1995 RI. Figure 20-5 is a schematic representation map of lead distribution in samples from the 1993 RI/FS.

The IEUBK Lead Model (v. 0.99) was used to characterize risks from lead in soil, dust, and water for future residential children (ages 0 through 6), who are considered to be the most sensitive receptor group at Site 19. The simulated range of blood-lead values that might occur in a population as a result of exposures to lead was compared to a guideline level of 10 ug/dL. Based on model results, 15.5 percent of residential children exposed under similar conditions might have blood-lead levels above 10 ug/dL. This exceeds a protective guideline of 5 percent for the maximum proportion of individuals with blood levels above 10 ug/dL (EPA, 1994). The model inputs assumed were default parameter values, 432 mg/kg lead in site-related soils, and 9.9 ug/L lead in unfiltered groundwater. The IEUBK population histograms for default and Site 19 exposures are presented in Appendix I.

20.7.1.5 Amended Risk Assessment

The amended risk assessment recalculated the cancer and non-cancer risks at Site 19 for future residential and future industrial receptors assuming exposure to COPCs in groundwater and for future residential receptors assuming exposure to COPCs in subsurface soil.

<u>Comparison to Background: Groundwater</u>

Aluminum, barium, beryllium, cobalt, copper, iron, mercury, and nickel were eliminated from consideration as groundwater COPCs based on a comparison of average levels to twice the background level. Table 20-8 presents the comparison of COPCs to background concentrations. No other metals were able to be eliminated based on comparison to background upper 95 percent UTLs.

Comparison to Background: Subsurface Soil

Beryllium, cobalt, copper, and mercury were eliminated from consideration as subsurface soil COPCs based on a comparison of average levels to twice the background level. However, since arsenic is a class A carcinogen, it could not be eliminated from consideration. Table 20-4 presents the comparison of COPCs to background concentrations. No other metals could be eliminated based on comparison to background upper 95 percent UTLs.

Consideration of Modified Dermal Absorption and Target Organ Grouping: Groundwater

As discussed in Section 2.4.6.2, groundwater cancer and non-cancer risks were recalculated using a modified gastrointestinal absorption factor for one chemical. After these steps, the final RME cancer risks are still above the 1E-04 to 1E-06 target acceptable range for the future residential receptor (3.3E-04, via groundwater ingestion). The cancer risk associated with the future industrial (groundwater) exposure scenario is within the mid-range of the target acceptable risk range. Arsenic is the principal COPC contributing to the groundwater RME cancer risks.

The revised HIs are greater than 1.0 for exposure to groundwater by future residential and future industrial receptors; therefore, these risks were grouped according to target organ. The resulting final RME HIs are greater than 1.0 in several cases. For groundwater ingestion by the future residential child, thallium was responsible for HIs in the range of 23 to 27 for the target organs kidney, liver, central nervous system, and skin (arsenic also influenced the latter HI group). For groundwater ingestion by the future employee, thallium was responsible for HIs (for the same target organs) between 3.5 and 4.1. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial employees exposed to groundwater in Tables 20-17 and 20-18, respectively. Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater in Tables 20-21 and 20-22, respectively.

Consideration of Modified Dermal Absorption and Target Organ Grouping: Subsurface Soil

Subsurface soil cancer and non-cancer risks were recalculated using modified soil-to-skin absorption factors for three chemicals and excluding dermal effects for other COPCs. After these steps, total RME cancer risks (from soil ingestion, dermal contact, and inhalation of dust) are in the upper end of the 1E-04 to 1E-06 target acceptable range. Arsenic (via soil ingestion and dermal contact) is the principal COPC that contributed to these risks. The resulting final RME HIs are less than 1.0 for each affected organ for

TABLE 20-23
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 19
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	8.7E-10	2.1E-10
4,4'-DDE	6.7E-11	1.7E-11
4,4'-DDT	1.4E-10	3.5E-11
ALPHA-CHLORDANE	1.7E-11	4.2E-12
BENZO(A)ANTHRACENE	3.9E-09	1.6E-09
BENZO(A)PYRENE	4.5E-08	5.9E-08
BENZO(B)FLUORANTHENE	4.6E-09	1.8E-09
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	4.6E-10	1.8E-10
CHRYSENE	6.9E-11	2.7E-11
FLUORANTHENE	N/A	N/A
GAMMA-CHLORDANE	2.0E-11	4.9E-12
HEPTACHLOR EPOXIDE	5.7E-11	2.8E-11
INDENO(1,2,3-CD)PYRENE	2.9E-09	1.1E-09
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
TOLUENE	N/A	N/A
ALUMINUM	N/A	N/A
ARSENIC	4.3E-07	1.8E-08
BARIUM	N/A	N/A
BERYLLIUM	6.1E-08	2.4E-07
CHROMIUM	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
MERCURY	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	5.5E-07	3.2E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 20-24
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 19
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	NA	NA
4,4'-DDE	NA	NA
4,4'-DDT	9.7E-06	2.4E-06
ALPHA-CHLORDANE	2.6E-06	6.3E-07
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
CHRYSENE	NA	NA
FLUORANTHENE	6.4E-06	2.5E-06
GAMMA-CHLORDANE	3.0E-06	7.4E-07
HEPTACHLOR EPOXIDE	5.6E-06	2.8E-06
INDENO(1,2,3-CD)PYRENE	NA	NA
PHENANTHRENE	NA	NA
PYRENE	6.8E-06	2.1E-06
TOLUENE	1.1E-08	2.2E-09
ALUMINUM	1.6E-03	1.3E-03
ARSENIC	1.1E-02	4.6E-04
BARIUM	2.2E-05	2.2E-05
BERYLLIUM	3.3E-05	1.3E-04
CHROMIUM	1.1E-02	2.2E-02
COPPER	4.5E-05	3.0E-06
IRON	1.9E-02	1.5E-02
LEAD	NA	NA
MANGANESE	1.4E-03	1.8E-03
MERCURY	3.2E-05	1.8E-05
VANADIUM	3.8E-03	1.5E-02
ZINC	1.6E-05	2.5E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-25
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 19
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
BETA-BHC	1.3E-10	3.4E-10
ENDOSULFAN I	N/A	N/A
BERYLLIUM	7.1E-09	3.3E-08
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
TOTAL RISK	7.2E-09	3.3E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 20-26
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 19
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
BETA-BHC	N/A	N/A
ENDOSULFAN I	2.1E-08	9.0E-08
BERYLLIUM	3.8E-06	1.8E-05
COPPER	5.2E-05	4.1E-06
IRON	4.9E-04	4.5E-04
LEAD	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

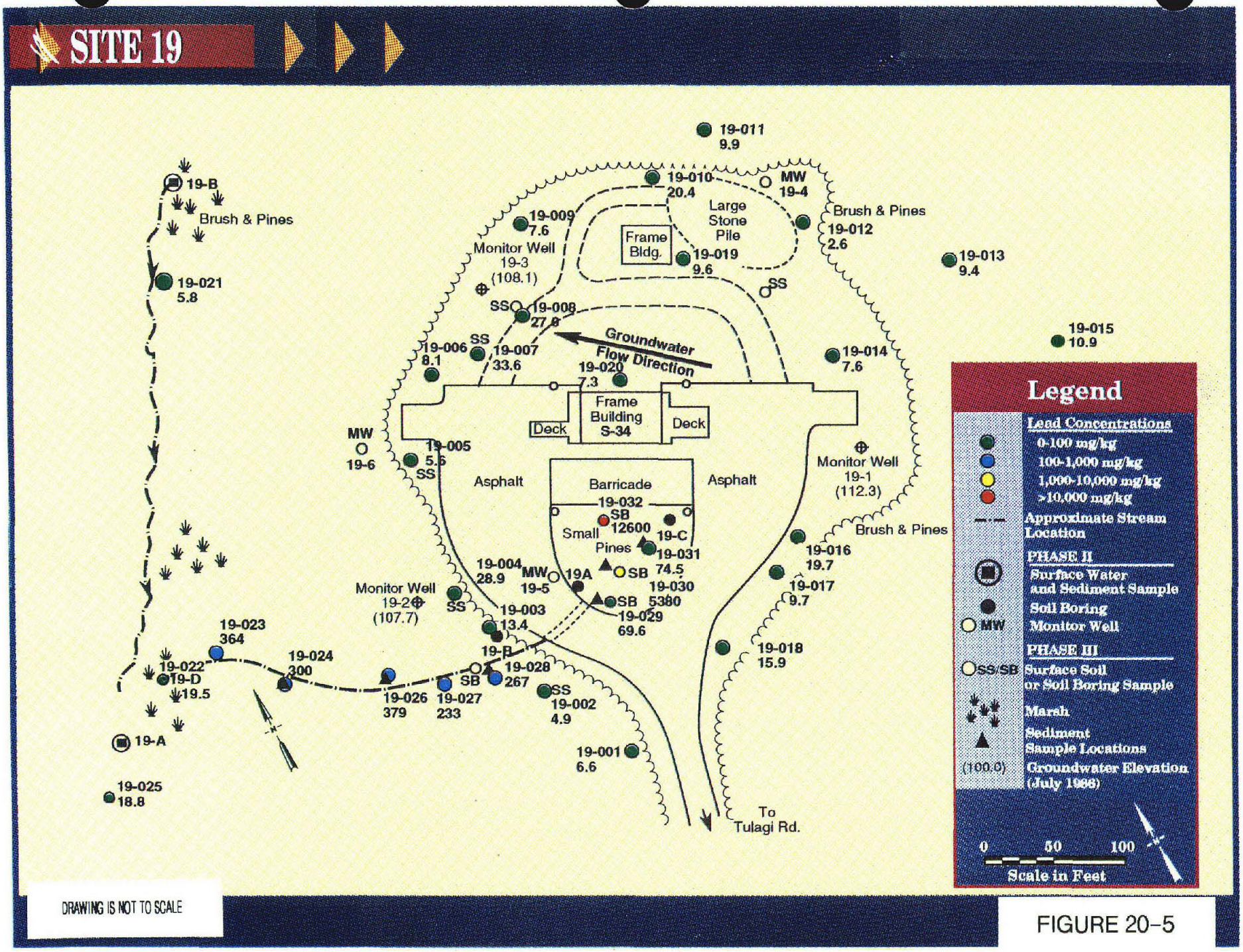

FIGURE 20-5

SCHEMATIC MAP OF LEAD DISTRIBUTION IN SITE 19 SOILS, NWS EARLE

the future residential child. Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soil in Tables 20-19 and 20-20, respectively.

Application of Central Tendencies Guidance

Central tendency assumptions were applied to calculate groundwater cancer and non-cancer risks for future residential receptors and non-cancer risks for the future industrial employee. Central tendency generates a lower risk estimate than RME because it assumes typical rather than upper range receptor behavior patterns related to the ingested dose. Based on this evaluation, the estimated total central tendency cancer risks are within the mid-range of the target acceptable risk range. However, for groundwater ingestion by the future residential child, thallium contributed to several central tendency HIs with values above 1.0 (ranging from 2.4 to 3.9 for the target organs skin, liver, kidney, and central nervous system).

Estimated central tendency noncarcinogenic HQs for future industrial employees exposed to groundwater are presented in Table 20-18. Estimated central tendency carcinogenic risks and noncarcinogenic HQs for future residential receptors exposed to groundwater are presented in Tables 20-21a and 20-22a, respectively.

20.7.2 Conclusions

Subsurface soil, sediment, groundwater, and surface water were sampled at Site 19. The potential receptors for this site were future industrial, residential, and recreational receptors.

The RME cancer risks associated with future residential (subsurface soil and groundwater) exposure scenarios exceeded 1E-04, the upper end of the target risk range. Arsenic (via ingestion of groundwater) was the major COPC that contributed to the cancer risks for these exposure scenarios. However, these RME estimates are probably overconservative because a central tendency calculation shows that cancer risks are more likely to be within the mid-range of the target acceptable risk range.

RME estimates for noncarcinogenic HIs associated with future industrial (groundwater) and future residential (groundwater) exposure scenarios exceeded 1.0; the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Thallium and arsenic (both via ingestion of groundwater) were the COPCs that exceeded 1.0 or contributed to the HI exceeding 1.0 for these exposure scenarios. The RME estimates of non-cancer risk from exposure to groundwater for the future industrial receptor are probably overconservative because associated central tendency non-cancer HIs are less than 1.0. However, central tendency risk estimates for residential exposure to groundwater yielded

HIs greater than 1.0 for the target organs liver, kidney, skin, and central nervous system (thallium and arsenic were the principal COPCs).

Lead was detected in subsurface soil and groundwater at the site at levels greater than the EPA screening guidelines. Based on the results of the IEUBK Lead Model (v. 0.99), the maximum detected soil concentration and the representative groundwater concentration might be expected to be associated with significant increases in blood-lead levels (i.e., above 10 ug/dL) in 16 percent of children from a population exposed under similar conditions.

Because sampling was biased to fill in data gaps, etc. remaining after earlier studies, the conclusions of this risk assessment conditionally assume that other areas (i.e., surface soils/sediments in the drainage depression) are remediated.

The amended risk assessment procedure did not result in the elimination of all non-cancer risks above guideline limits.

Risk characterization results (total RME cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 19 in Table 20-27 for subsurface soil, sediment, groundwater, and surface water. Table 20-27a presents the relevant central tendency risk estimates associated with potential receptors for groundwater.

20.8 ECOLOGICAL RISK ASSESSMENT

20.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

The area from the former location of Building S-34 south to the site perimeter, which contains the sludge discharge depression, is paved, and the remainder of the site is covered with gravel. A few pines are present in the depression directly behind the barricade. Upland areas surround the site, and are dominated by white oak, pitch pine, and sassafras, with a dense understory of blueberry. A small drainage ditch runs from the depression to a stream approximately 500 feet to the southwest. The site is at a higher elevation than the stream. The stream is a tributary of Mingamahone Brook, and as a result, the site is located within the Mingamahone Brook watershed. Water is present in the drainage depression only after periods of heavy rainfall. The stream southwest of the site is surrounded by wetlands. The wetlands, including the stream, drains to the south. The stream is dammed near the power lines west of the site, which has created a small pond north of the dam. The wetland areas are dominated by rushes (*Juncus*

TABLE 20-27
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.3E-05	5.7E-05^	N/A	N/A	6.2E-02	8.0E-01^	N/A	N/A
	Dermal Contact	N/A	1.3E-05	4.2E-05^	N/A	N/A	4.2E-01	7.4E-02^	N/A	N/A
	Inhalation of Fugitive Dust	N/A	3.5E-08	2.2E-08^	N/A	N/A	7.7E-03	8.1E-03^	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	5.5E-07	N/A	N/A	N/A	N/A	4.8E-02
	Dermal Contact	N/A	N/A	N/A	3.2E-07	N/A	N/A	N/A	N/A	5.6E-02
Groundwater	Ingestion	N/A	7.8E-05^	3.3E-04^	N/A	N/A	4.1E+00@	2.7E+01@	N/A	N/A
	Dermal Contact	N/A	3.3E-08^	7.8E-07^	N/A	N/A	3.2E-02^	1.0E+00@	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	7.2E-09	N/A	N/A	N/A	N/A	5.4E-04
	Dermal Contact	N/A	N/A	N/A	3.3E-08	N/A	N/A	N/A	N/A	4.7E-04
TOTAL		-	1.0E-04	4.3E-04	9.1E-07	-	4.6E+00	2.9E+01	-	1.1E-01

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from nended risk assessment.

TABLE 20-27a
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	N/R	N/A	N/A	N/R	N/R	N/A	N/A
	Dermal Contact	N/A	N/R	N/R	N/A	N/A	N/R	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/R	N/R	N/A	N/A	N/R	N/R	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	N/R	4.7E-05^	N/A	N/A	7.8E-01@	3.9E+00@	N/A	N/A
	Dermal Contact	N/A	N/R	1.0E-07^	N/A	N/A	7.7E-03^	1.8E-01@	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
TOTAL		-	-	4.7E-05	-	-	7.9E-01	4.1E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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sp.) and red maple. No other RI site are situated near Site 19. The RI site closest to Site 19 is Site 27, located approximately one mile to the east.

Site 19 is paved or graveled and provides little ecological habitat. The adjacent upland and wetland areas provide excellent habitat. Most receptors species found in the Mainside area, such as white-tailed deer, red fox, gray fox, and several species of small mammals, probably use the wooded upland areas. The wetland areas are probably utilized by most wetland receptors found in the Mainside area, including wading birds, small fish, and several species of amphibians. No sensitive habitats, other than the wetlands, and no threatened or endangered species are known to occur on or around the site.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major release pathway from the depression behind the barricade is overland runoff. Precipitation runoff may carry constituents to nearby surface waters, sediments, and soils, mainly to the wetlands southwest of the site via the drainage ditch. In addition, infiltrating precipitation may cause the contamination of subsurface soil and groundwater at the site. Upon infiltrating the soil column and reaching the water table, a contaminant may be carried with the flow of groundwater to downgradient locations. Groundwater from the site may eventually discharge to surface water in the wetlands to the west; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms.

Exposure Routes

Terrestrial receptors associated with Site 19 may be exposed to soil contaminants via incidental ingestion of soil or ingestion of contaminated food items, although the small size of the site and extensive paved and graveled areas limit exposure of terrestrial receptors, both plants and animals, to site contaminants. Terrestrial receptors may also come into contact with contaminants present in Site 19 surface water by drinking the water, but this represents an insignificant pathway. The area of greatest ecological concern is the wetlands to the west and southwest. Therefore, wetland organisms were the focus of the ERA at Site 19. Aquatic and terrestrial organisms inhabiting the wetlands may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Wetland organisms may also be exposed to constituents from contaminated groundwater flowing into surface water.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

All contaminants detected in 1993 RI/FS sediment samples were considered preliminary contaminants of potential concern (COPCs) for quantitative assessment. Contaminants detected in 1986 Phase II surface water and sediment samples, 1993 RI/FS groundwater and subsurface soil samples, and 1995 RI subsurface soil and groundwater samples were evaluated qualitatively.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

20.8.2 Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminated sediments. Sediment ET values are presented in Table 2-27.

20.8.3 Preliminary Exposure Assessment

Representative exposure point contaminant concentrations used for this screening were obtained from 1993 RI/FS sediment samples. Thirteen samples were collected throughout the site, but eight samples taken in the drainage depression and wetlands were used for this assessment. These samples were analyzed for full or selected TAL inorganics. The maximum values for contaminants detected in those samples were used as conservative exposure point contaminant concentrations. Data from Phase II SI sediment investigations, 1993 RI/FS subsurface soil and groundwater investigations, and 1995 RI subsurface soil, surface water, and sediment samples are discussed qualitatively in Section 20.8.3. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

20.8.4 Risk Characterization

In drainage ditch and wetland sediments, barium (HQ = 2.1) exceeded the only ET available and was retained as a final COPC (Table 20-28). Cadmium exceeded the most conservative ET value available and was retained as a final COPC, but did not exceed a less conservative value. Chromium, lead, and zinc exceeded both most and less conservative ET values. Aluminum and beryllium were conservatively retained as final COPCs since no suitable ETs were available. The toxicological properties of final COPCs in sediments are summarized in Appendix M.

20.8.5 Summary and Conclusions

Most of Site 19 is paved or graveled, affording little ecological habitat. Forested upland areas surround most of the site and provide excellent terrestrial habitat. A tributary of Mingamahone Brook is located about 500 feet west of the site, and is surrounded by wetlands. The upland and wetland areas are expected to be utilized by a wide variety of ecological receptors. The major contaminant release pathway from the depression behind the barricade is overland runoff, primarily to the wetlands via a drainage depression. Groundwater-to-surface water contaminant migration is possible, but the high levels of metals in the drainage depression indicate that runoff is much more significant.

Phase II SI investigations at the site indicated that levels of several metals, including cadmium, lead, and zinc were elevated in site sediments and soils. Soil samples collected as part of 1993 RI/FS activities at the site contained elevated levels of several metals, mainly lead, and low levels of some VOCs in the depression behind the barricade and in the drainage ditch southwest of the site.

In RI/FS groundwater samples, low levels of some VOCs and pesticides were detected, and elevated levels of metals were detected. Groundwater samples were also collected during 1995 RI sampling activities at Site 19. Several metals concentrations were elevated in sample MW10-07, located approximately 60 feet south-southwest of the site. Slightly elevated levels of barium and zinc were detected in well MW19-03, located in the open area northwest of the site. In 1995 RI subsurface soil samples taken in the barricade depression and drainage depression, antimony, chromium, cadmium, lead, and zinc were elevated. A low level of PCE was also detected. Also as part of 1995 RI activities, a surface water and sediment sample was taken where the drainage ditch meets the stream to confirm results from the 1993 RI/FS. Concentrations of metals were similar to background in the surface water sample, and low levels of two pesticides were detected. In the sediment sample, a high concentration of chromium was detected, along with slightly elevated concentrations of aluminum, iron, manganese, and vanadium. Low levels of some organics, including some PAHs and pesticides, were also detected.

TABLE 20-28
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 19
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold[1] (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	2/2	3940	3110	NA		Retained-No suitable threshold available
Arsenic	2/2	6.2	2.0	8.2	0.24	Eliminated-Does not exceed threshold
Barium	2/2	10.6	84.2	40	2.11	Retained-HQ > 1
Beryllium	1/2	0.57	0.25	NA		Retained-No suitable threshold available
Cadmium	3/9	ND	1.9	1.2/9.6	1.58/0.20	Retained-HQ > 1
Chromium	2/2	56	464	81/370	5.72/1.25	Retained-HQ > 1
Cobalt	2/2	2.1	3.1	50	0.06	Eliminated-Does not exceed threshold
Copper	2/2	13	27.9	34	0.82	Eliminated-Does not exceed threshold
Lead	9/9	34.3	379	47/218	8.06/1.74	Retained-HQ > 1
Manganese	2/2	9.2	43.7	460	0.095	Eliminated-Does not exceed threshold
Mercury	1/2	0.068	0.13	0.15	0.87	Eliminated-Does not exceed threshold
Vanadium	2/2	42.7	14.6	NA		Retained-No suitable threshold available
Zinc	2/2	26.9	1050	150/410	7.0/2.56	Retained-HQ > 1

ND = None detected
NA = No suitable threshold was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.

Several sediment samples were taken in the drainage depression and ditch as part of 1993 RI/FS activities and were used for quantitative assessment. HQs for most inorganics were indicative of low potential risk. However, HQs for chromium, lead, and zinc were indicative of moderate potential risk; each of these inorganics exceeded both most and less conservative ET values. Aluminum and vanadium were conservatively retained as final COPCs since no suitable ET values were available, but were detected in concentrations similar to background.

The results of 1993 RI/FS sediment samples, along with subsurface soil and sediment samples from other studies at Site 19, indicate that contaminants, primarily inorganics, have migrated from the site to the drainage ditch that leads to the stream and wetlands. Results of groundwater sampling indicate that contaminant impacts to groundwater, mainly inorganics, has occurred. Although no extensive groundwater contaminant migration has been documented, groundwater at the site flows towards the wetlands. A sediment sample was taken upstream west-northwest of the site in the stream the stream in the wetlands as part of 1993 RI/FS sampling, which would indicate groundwater to surface water migration upstream of the drainage depression confluence with the stream. Concentrations of metals analyzed for in that sample were low, suggesting limited groundwater to surface water migration. Future groundwater to surface water migration is possible, but available data indicate that overland runoff via the drainage ditch poses a much greater potential risk to the stream and wetlands. Additional sediment samples could be taken both upstream and downstream of the drainage ditch confluence with the stream to investigate potential groundwater-to-surface water migration and downstream migration into the Mingamahone Brook watershed. However, the sediment samples taken in the drainage ditch indicate that contaminant concentrations decrease as the drainage ditch gets closer to the stream, and only an elevated detection of chromium was present at the confluence.

Additional sediment samples may help further define the extent of contamination in the wetlands. Removal of sediments in the drainage depression and depression behind the barricade would eliminate the source and prevent future overland contaminant migration.

20.9 EVALUATION AND RECOMMENDATIONS

20.9.1 Evaluation Summary

Metals in groundwater at levels above regulatory guidelines included aluminum, antimony, arsenic, cadmium, iron, manganese, lead, and thallium. In general, the highest concentrations of metals were found in MW 19-07 which was newly installed in 1995 downgradient of the drainage depression. These results generally confirm earlier results.

No organic compounds were found at concentrations above regulatory guidelines in groundwater. This confirms earlier findings.

Sampling confirmed past findings of elevated lead and chromium in the surface soil/sediments of the drainage depression and swale. The additional data collected can be used in a subsequent FS.

Results of human health risk assessment concluded that non-cancer risks were above guideline limits for future resident scenario due to thallium in groundwater.

Ecological risk assessment concluded that sediment samples taken in the drainage ditch indicate that contaminant concentrations decrease in the drainage ditch closer to the stream, and only an elevated detection of chromium was present at the confluence. This is an indication that wetlands impacts may be limited.

20.9.2 Recommendations

Additional sediment sampling should be considered in the wetlands to further investigate potential contaminant migration to those areas and define the extent of contamination in the wetlands.

The FS for this site should consider removal of soils in the drainage depression and the drainage swale.

21.0 SITE 20: GRIT BLASTING AREA AT BUILDING 544

21.1 SITE BACKGROUND AND PHYSICAL SETTING

The grit blasting area at Building 544 is a small area behind Building 544 that houses grit blasting operations for the removal of paint from ordnance. A leaching field is reported to be present behind this building. Past disposal activities at this leaching field are unknown. Activities at the site included the disposal of paint chips and spent grit from site operations. Spent grit from mine refurbishing grit blasting operations would typically contain lead and zinc from the coatings removed during blasting. An estimated yearly volume of 53 gallons of paint chips was disposed (IAS, 1983). The spent grit was dumped in an open pile southwest of Building 544. The pile was approximately 10 feet in diameter and 1 foot high. Grit blast media from the pile and trailing along a drainage depression was excavated and temporarily staged southwest of Building 544 in November and December 1994. Approximately 300 cubic yards of spent grit, along with impacted soils and sediments, was stockpiled on thick plastic and analyzed for off-site disposal (Navy Interim Remedial Action Report for Site 20, 1995). The site is bordered on the northeast by a marsh and wetlands. A gravel road accesses the site from Midway Road. A shallow drainage depression, which is approximately 300 feet in length and 1 foot deep, runs along the eastern and southeastern boundaries of the site and discharges to the northeast toward the marsh. Surface water flows toward this marshy area. Figure 21-1 is a map of the site.

21.2 PREVIOUS INVESTIGATIONS AND REMOVAL ACTION

21.2.1 Summary of Activities and Results

The 1983 IAS, consisting of interviews and site observations, concluded minimal probable impact based on the presumption that metals in paint chips would not leach to the environment. The site was not recommended for a confirmation study.

A site investigation (Confirmation Study) in 1986 consisted of four soil samples obtained from areas of grit deposition. Soil samples were analyzed for metals (EPTOX) and petroleum hydrocarbons. Analytical results from the 1986 SI indicated that no metals above EPTOX limits, and a maximum TPH of 65.7 mg/kg was found in site soil samples taken.

During the 1993 RI/FS, five sediment (surface soil) samples were collected, one in the grit pile and four spaced along the drainage ditch which discharges to the northeast. The soil samples were analyzed for TAL inorganics and cyanide. Two samples were also analyzed for pesticides/PCBs and SVOCs, and one sample was analyzed for VOCs. Elevated levels of semivolatile compounds and metals were detected

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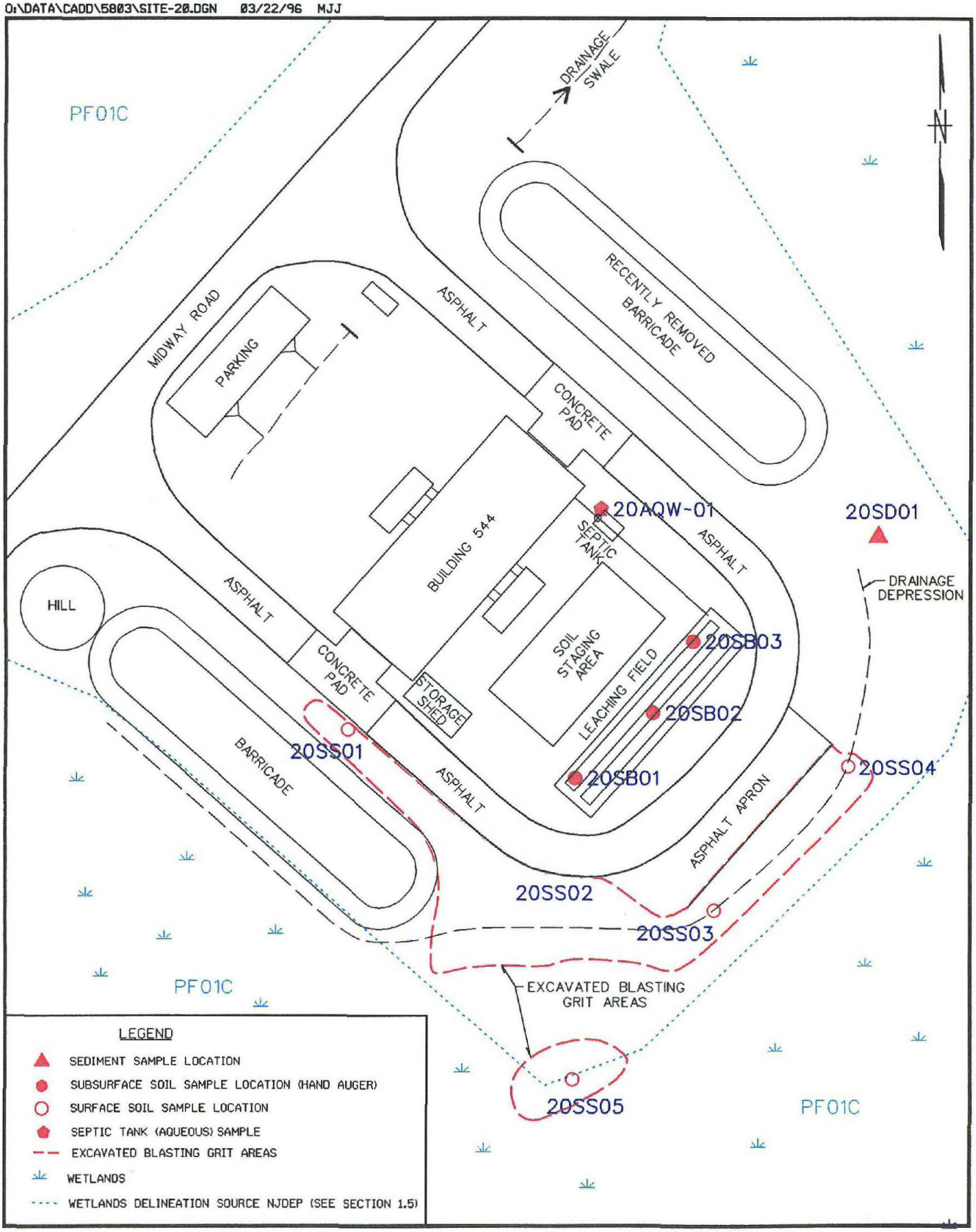

SAMPLE LOCATION

SITE 20 - GRIT BLASTING AREA AT BLDG 544

FIGURE 21-1

0 50 100

SCALE IN FEET

Brown & Root Environmental

from samples along the drainage. Only very low levels of volatiles (possible laboratory artifacts) were detected in surface soil samples.

A removal action was performed to remediate the site by removal and disposal of contaminated grit and related site media. Removal was executed in two stages. Stage one removal, in December 1994, consisted of excavation of approximately 300 cubic yards of grit tainted soils, which were stockpiled for sampling and off-site disposal. Figure 21-1 shows the approximate limits of excavation. Post stage one excavation sampling consisted of 12 surface soil samples and duplicates analyzed for TCL metals and TCL semivolatile compounds. Sample analysis indicated metals residues remained at concentrations above NJDEP residential surface soil cleanup standards. Stage two excavation, consisting of additional removal at locations found with metals above NJDEP cleanup criteria, was carried out in March 1995. Stage two excavation was followed closely by the 1995 RI sampling to verify site cleanup results.

21.2.2 Summary of Conclusions

Elevated levels of metals were found throughout the ditch, with the highest concentrations found in obvious source areas (grit piles). A removal action was initiated in 1994 and completed in the Spring of 1995.

A review of site drawings prior to the removal action identified a leach field which served Building 544.

21.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations and removal actions, follow-up remedial investigation activities were developed to meet the following objectives:

- Determine the effectiveness of the removal action.
- Perform risk analysis to determine if further action is required.
- Determine if downgradient wetlands have been impacted.
- Evaluate potential impact from the leach field.

21.3 RI FIELD INVESTIGATIONS

Between June and August 1995, B&R Environmental conducted the following field investigation activities at Site 20:

- Sampling and analysis of subsurface soil (Section 21.3.1)
- Sampling and analysis of surface soil (Section 21.3.2)
- Sampling and analysis of sediment (Section 21.3.3)

- Sampling and analysis of an aqueous septic tank sample (Section 21.3.4)

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the surface and subsurface soil samples, the sediment sample, and the aqueous septic tank sample. Surveying notes are provided in Appendix F.

21.3.1 Subsurface Soil Sampling

Three subsurface soil samples (20 SB 01-03, 20 SB 02-03, and 20 SB 03-03) were collected in June 1995 from a leaching field to determine the effect of the leaching field on soils. Figure 21-2 shows sample locations. The samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, and TAL metals analyses. 20 SB 01-03 and 20 SB 03-03 consisted of dark gray silty clay with trace amounts of gravel and roots. 20 SB 02-03 consisted of dark gray silty clay. Extra volume was collected from 20 SB 03-03 for the matrix spike/matrix spike duplicate sample. Sample log sheets are presented in Appendix D.

The subsurface soil samples were collected from 3 to 5 feet bgs. The team used a hand auger to bore down to the desired depth and placed the soil sample directly into the appropriate bottleware. The auger holes were backfilled with the removed cuttings. The auger was cleaned between sampling events.

21.3.2 Surface Soil Sampling

Six surface soil samples, including one field duplicate (20 SS 01, 20 SS 02, Dup-22, 20 SS 03, 20 SS 04, and 20 SS 05), were collected in August 1995 from areas of soil removal to determine the effectiveness of the grit removal (Figure 21-2). 20 SS 01 through 20 SS 04 were collected from the excavated area south and southwest of the site. 20 SS 05 was collected from the former location of a smaller pile of grit southwest of the other samples. The samples were collected from 0 to 6 inches bgs using a stainless-steel trowel and placed directly into the appropriate bottleware. The surface vegetation was removed before sampling. The surface soil samples were submitted to Lancaster Laboratories for analyses. See Table 21-1 for a surface soil sampling summary. Sample log sheets are presented in Appendix D.

21.3.3 Sediment Sampling

Due to dry conditions during the summer, surface water was not observed at the site and only one sediment sample was collected. 20 SD 01 was collected in August 1995 from the wetlands area located on the eastern side of the site to determine if past activities have affected the wetlands (Figure 21-1). The sediment sample location was chosen because it is the historical location of site drainage in the migration pathway from the (removed) grit pits and it is beyond the area of site excavation/removal. The sediment

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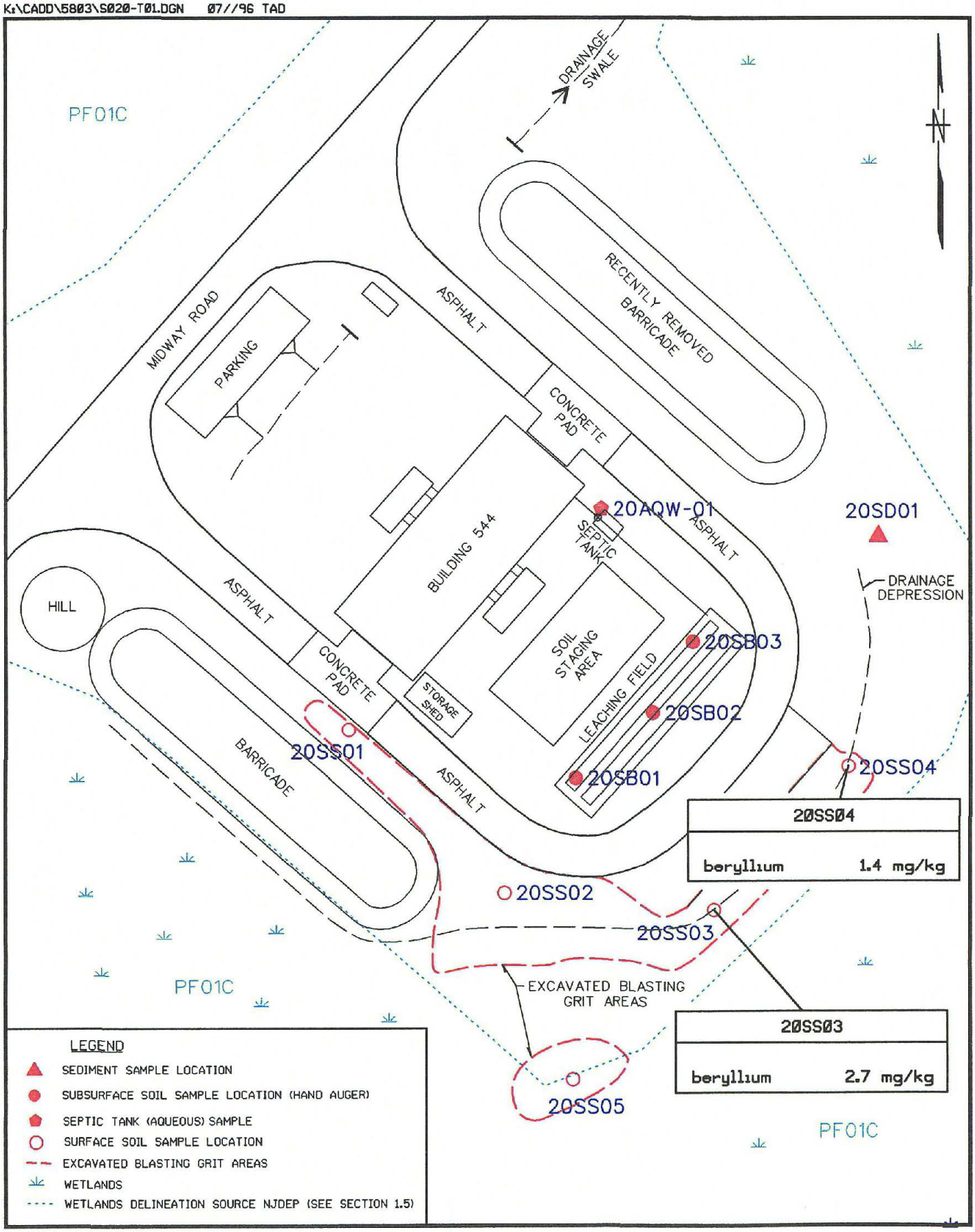

CONCENTRATIONS ABOVE SCREENING LEVELS

SITE 20 - GRIT BLASTING AREA AT BLDG 544

FIGURE 21-2

0 50 100

SCALE IN FEET

Brown & Root Environmental

Table 21-1
Surface Soil Sampling Summary
NWS Earle Colts Neck, New Jersey

Sample Number	Sample Depth (feet)	Analytical Parameters	Soil Description
20 SS 01	0 to 0.5	TCL VOC, TCL SVOC, and TAL metals	Brown sandy silt and gravel
20 SS 02	0 to 0.5	TCL VOC, TCL SVOC, and TAL metals	Light brown silty sand
20 SS 03	0 to 0.5	TCL VOC, TCL SVOC, TAL metals, TOC, and grain size	Light brown silt and gravel
20 SS 04	0 to 0.5	TCL VOC, TCL SVOC, TAL metals, TOC, and grain size	Yellowish-brown silty sand
20 SS 05	0 to 0.5	TCL VOC , TCL SVOC, and TAL metals	Light tan/white fine-grained sand

sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TAL metals, TOC, and grain-size analysis. The sediment material consisted of brown silty sand with trace amounts of gravel. Sample log sheets are presented in Appendix D.

The sediment sample was collected using a stainless-steel trowel from 0 to 6 inches bgs. The sediment material was placed directly into the required bottleware via the stainless-steel trowel.

21.3.4 Septic Tank Sample

One aqueous and one sludge sample were proposed to be collected from the active septic tank located on site. However, no sludge was observed during the time of sampling, and only an aqueous sample was collected. 20 AQW-01 was collected in August 1995 from the septic tank located southeast of Building 544 to determine if the septic tank is a potential source of contamination (Figure 21-2). The sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, and TAL metals analyses. Sample log sheets are presented in Appendix D.

The total depth of the septic tank was 8 feet, and water was encountered at 5 feet bgs. The aqueous sample was collected by lowering a disposable polyethylene bailer by rope to the aqueous zone and filling the appropriate bottleware via the bailer. Field measurements were not collected during sampling.

21.4 SITE CHARACTERISTICS

21.4.1 Geology

Regional mapping places Site 20 within the outcrop area of the Kirkwood Formation. The Kirkwood Formation ranges between 60 to 100 feet in thickness and consists of gray and tan, very fine- to medium-grained quartz sand and dark-colored, micaceous diatomaceous clay. The presence of the Kirkwood Formation beneath the site cannot be confirmed because no soil borings were drilled at the site. However, the lithology of the sediments encountered in borings at Site 10 generally agrees with the published descriptions of the Kirkwood and Vincentown Formations. Site 10 is located about 1,000 feet north-northeast of Site 20. In general, the borings at Site 10 encountered gray pebbly sand (probably representative of the upper colluvium), brownish-yellow, fine- to medium-grained sand (probably representative of the Kirkwood Formation), and olive and dark greenish-gray, glauconitic, fine- to medium-grained sand (probably representative of the Vincentown Formation). The upper colluvium is absent at site 20.

21.4.2 Hydrogeology

Groundwater conditions beneath the site cannot be confirmed because no wells were installed at the site. However, groundwater in the Kirkwood and Vincentown aquifer beneath Site 10, and presumably Site 20, occurs under unconfined conditions. The direction of shallow groundwater flow in the aquifer beneath Site 10, as indicated by both the August and October groundwater contour maps for Site 10, is toward the northwest, north, and north-northeast.

21.5 NATURE AND EXTENT OF CONTAMINATION

21.5.1 Surface Soils

Five site-related surface soil samples (20 SS 01 through 20 SS 05) were collected at Site 20 (Figure 21-1). Tables 21-2 and 21-3 present the occurrence and distribution of inorganic chemicals detected in 20 site-related surface soil samples and compare them to background as presented in Section 31. Tables 21-2a and 21-2b present a comparison of detected compounds to ARARs and TBCs. Figure 21-2 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

21.5.1.1 Inorganics

Concentrations of most metals in site-related surface soil samples were similar to the ranges of background. Antimony, beryllium, copper, lead, selenium, and zinc were detected at levels greater than background in one surface soil sample (20 SS 03), which exhibited the highest concentrations of these metals at Site 20.

21.5.1.2 Organics

Fluoranthene (40 ug/kg to 84 ug/kg), pyrene (46 ug/kg), and butylbenzyl phthalate (220 ug/kg) were detected in background surface soil samples. PAHs including benz(a)anthracene (41 ug/kg to 500 ug/kg), benzo(a)pyrene (315 ug/kg), benzo(b)fluoranthene (80 ug/kg to 500 ug/kg), benzo(k)fluoranthene (205 ug/kg), carbazole (54 ug/kg), chrysene (57 ug/kg to 490 ug/kg), dibenzofuran (45 ug/kg), indeno(1,2,3-cd)pyrene (245 ug/kg), fluoranthene (78 ug/kg to 750 ug/kg), phenanthrene (39 ug/kg to 520 ug/kg), and pyrene (96 ug/kg to 810 ug/kg) were detected in site-related surface soil samples. One sample (20 SS 02) exhibited PAHs at levels slightly greater than background for most compounds (in the range of 300 ug/kg to 1,000 ug/kg).

TABLE 21-2
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOILS AT SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	4 / 4	1710 - 5310	6152.50	5 / 5	904 - 3670	2586.80	NO	3670
ANTIMONY	NOT DETECTED	-	-	2 / 5	1 - 2.4	0.85	YES	2.4
ARSENIC	4 / 4	1.35 - 14.4	13.43	5 / 5	1.3 - 5.4	2.55	NO	5.4
BARIUM	4 / 4	1.85 - 31	22.53	5 / 5	5.1 - 58	25.02	YES	58
BERYLLIUM	1 / 4	0.28	0.39	5 / 5	0.072 - 2.7	0.90	YES	2.7
CADMIUM*	1 / 4	0.57	0.67	4 / 5	0.11 - 0.26	0.14	NO	0.26
CALCIUM	4 / 4	40.1 - 519	551.80	5 / 5	118 - 2320	1091.40	YES	2320
CHROMIUM*	4 / 4	7.8 - 59.5	69.05	5 / 5	4.2 - 97.1	33.29	NO	97.1
COBALT	2 / 4	0.75 - 5	3.15	5 / 5	0.47 - 18.4	5.76	YES	18.40
COPPER	4 / 4	0.97 - 8.4	10.06	5 / 5	8.2 - 447	121.05	YES	300.24
IRON*	4 / 4	3745 - 62500	52402.50	5 / 5	1740 - 16500	7941.00	NO	16500
LEAD	4 / 4	1.8 - 39.4	37.30	5 / 5	3.6 - 252	86.42	YES	252
MAGNESIUM	4 / 4	71.7 - 619	578.85	5 / 5	53.5 - 1185	551.30	NO	1185
MANGANESE	4 / 4	3.45 - 214	128.33	5 / 5	6.4 - 126	51.90	NO	126
MERCURY	4 / 4	0.035 - 0.17	0.18	5 / 5	0.025 - 0.0455	0.03	NO	0.0427
NICKEL*	2 / 4	1.8 - 7.2	5.18	3 / 5	4.3 - 7.4	24.94	YES	7.4
POTASSIUM	4 / 4	95 - 792	912.50	5 / 5	72.2 - 410	249.84	NO	410
SELENIUM*	2 / 4	0.57 - 0.93	1.03	2 / 5	1.2 - 1.4	0.79	NO	1.4
SILVER*	2 / 4	0.37 - 0.67	0.69	1 / 5	0.83	0.24	NO	0.83
SODIUM	4 / 4	17.5 - 86.2	78.30	5 / 5	19.1 - 206	125.98	YES	206
THALLIUM	2 / 4	0.7 - 1.9	1.64	2 / 5	0.75 - 1	0.58	NO	1
VANADIUM	4 / 4	11.05 - 64	70.13	5 / 5	5.4 - 23.8	13.63	NO	23.8
ZINC	3 / 4	1.1 - 27.6	22.80	5 / 5	4.2 - 972	294.13	YES	972

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 21-3
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
ANTHRACENE	NOT DETECTED	-	-	1 / 5	63.5	63.5
BENZO(A)ANTHRACENE	NOT DETECTED	-	-	3 / 5	41 - 500	500
BENZO(A)PYRENE	NOT DETECTED	-	-	1 / 5	315	261.42
BENZO(B)FLUORANTHENE	NOT DETECTED	-	-	2 / 5	80 - 500	374.14
BENZO(G,H,I)PERYLENE	NOT DETECTED	-	-	1 / 5	235	211.47
BENZO(K)FLUORANTHENE	NOT DETECTED	-	-	1 / 5	205	193.86
BUTYLBENZYLPHTHALATE	1 / 4	220	220	1 / 5	66	66
CARBAZOLE	NOT DETECTED	-	-	1 / 5	54	54
CHRYSENE	NOT DETECTED	-	-	3 / 5	57 - 490	490
DIBENZOFURAN	NOT DETECTED	-	-	1 / 5	45	45
FLUORANTHENE	2 / 4	40 - 84	-	3 / 5	78 - 750	525.57
INDENO(1,2,3-CD)PYRENE	NOT DETECTED	-	-	1 / 5	245	217.69
PHENANTHRENE	NOT DETECTED	-	-	3 / 5	39 - 520	520
PYRENE	1 / 4	46	46	3 / 5	96 - 810	562.13

TABLE 21-2a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 20

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	20SS01	20SS02	20SS02-DUP	20SS03	20SS04	20SS05	ARARS & TBCs		
LOCATION:	20SS01	20SS02	20SS02	20SS03	20SS04	20SS05	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	2000	3520	3720	3670	2740	904	-	-	-
antimony	0.57 U	0.55 U	0.55 U	2.4	1.0	0.58 U	14.0	340	-
arsenic	1.5	2.5	2.8	5.4	1.9	1.3	20.0	20.0	-
barium	5.1	14.1	15.3	58.0	39.4	7.9	700	47000	-
beryllium	0.072	0.21	0.23	2.7 E	1.4 E	0.085	1.00	1.00	-
cadmium	0.081 U	0.11	0.11	0.26	0.19	0.11	1.00	100	-
calcium	209	2400	2240	1690	1120	118	-	-	-
chromium, total	7.6 J	13.0 J	13.9 J	97.1 J	44.1 J	4.2 J	-	500	-
cobalt	0.47	2.3	2.5	18.4	6.9	0.63	-	-	-
copper	8.2	20.9	20.4	447	119	10.4	600	600	-
iron	4850	7480	7990	16500	8880	1740	-	-	-
lead	3.6	16.1	16.9	252	115	45.0	400	600	-
magnesium	188	1200	1170	806	524	53.5	-	-	-
manganese	6.4	57.4	58.4	126	57.9	11.3	-	-	-
mercury	0.025	0.044	0.047	0.030	0.025	0.034	14.0	270	-
nickel	4.3	7.4	8.2 R	162 R	54.8 R	4.6	250	2400	-
potassium	163	225	253	410	365	72.2	-	-	-
selenium	1.2 J	0.89 UJ	0.89 UJ	1.4 J	0.89 UJ	0.94 UJ	63.0	3100	-
silver	0.20 U	0.19 U	0.19 U	0.83	0.19 U	0.20 U	110	4100	-
sodium	75.8	206	206	206	123	19.1	-	-	-
thallium	0.76 U	0.75	0.73 U	1.0	0.73 U	0.77 U	2.00	2.00	-
vanadium	8.5	15.2	16.3	23.8	14.7	5.4	370	7100	-
zinc	4.2	42.0 J	52.9 J	972 J	402 J	45.0 J	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
anthracene	350 U	47.0 J	80.0 J	340 U	330 U	350 U	10000000	10000000	100000
benzo(a)anthracene	350 U	320 J	500	55.0 J	41.0 J	350 U	900	4000	500000
benzo(a)pyrene	350 U	240 J	390 J	340 U	330 U	350 U	660	660	100000
benzo(b)fluoranthene	350 U	500	780 J	340 U	80.0 J	350 U	900	4000	50000

TABLE 21-2a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 20

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	20SS01		20SS02		20SS02-DUP		20SS03		20SS04		20SS05		ARARS & TBCs		
LOCATION:	20SS01		20SS02		20SS02		20SS03		20SS04		20SS05		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SEMIVOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	ug/kg	ug/kg
benzo(g,h,i)perylene	350	U	170	J	300	J	340	UJ	330	U	350	U	-	-	-
benzo(k)fluoranthene	350	U	160	J	250	J	340	U	330	U	350	U	900	4000	500000
butylbenzylphthalate	350	U	330	U	340	U	340	U	66.0	J	350	U	1100000	10000000	100000
carbazole	350	U	330	U	54.0	J	340	U	330	U	350	U	-	-	-
chrysene	350	U	380		600		71.0	J	57.0	J	350	U	9000	40000	500000
dibenzofuran	350	U	330	U	45.0	J	340	U	330	U	350	U	-	-	-
fluoranthene	350	U	670		830		140	J	78.0	J	350	U	2300000	10000000	100000
indeno(1,2,3-cd)pyrene	350	U	190	J	300	J	340	U	330	U	350	U	900	4000	500000
phenanthrene	350	U	380		660		100	J	39.0	J	350	U	-	-	-
pyrene	350	U	620		1000		120	J	96.0	J	350	U	1700000	10000000	100000

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

. - No standard is available for this chemical in this classification.

TABLE 21-2b

COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 20

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	20SS03	20SS04	---	---	---	---	ARARS & TBCs		
LOCATION:	20SS03	20SS04	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI							
MISCELLANEOUS	**mg/kg**	**mg/kg**					**mg/kg**	**mg/kg**	**mg/kg**
total organic carbon	2100	1900					-	-	-

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

. - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

21.5.1.3 Miscellaneous Parameters

Two surface soils (20 SS 03 and 20 SS 04) collected at Site 20 were analyzed for the miscellaneous parameter TOC. Maximum background TOC levels were not exceeded in either sample.

21.5.2 Subsurface Soils

Three site-related subsurface soil samples (20 SB 01-03 through 20 SB 03-03) were collected (Figure 21-1). Tables 21-4 and 21-5 presents the occurrence and distribution of inorganic and organic chemicals detected in Site 20 background and site-related subsurface soil samples and compares them to background. Table 21-4a presents a comparison of detected compounds to ARARs and TBCs. Figure 21-2 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

21.5.2.1 Inorganics

Concentrations of metals in site-related subsurface soil samples were generally within the same range as background samples.

21.5.2.2 Organics

Toluene (1 ug/kg to 13 ug/kg) was detected in all three subsurface soil samples collected within the region of the leach field at Site 20. 1,2-DCE (8 ug/kg to 15 ug/kg) and 2-butanone (38 ug/kg to 71 ug/kg) were detected in two subsurface soil samples, 20 SB 02-03 and 20 SB 03-03, which were collected in the eastern half of the leach field. 4-Methylphenol (72 ug/kg) and ethylbenzene (5 ug/kg) were each detected in one subsurface soil sample (20 SB 02-03) located in the center of the leach field area.

21.5.3 Sediment

One site-related sediment sample (20 SD 01) was collected at Site 20 (Figure 21-2). Table 21-6 presents the occurrence and distribution of inorganic chemicals detected in Site 20 background and site-related sediment samples. Table 21-7 presents the occurrence and distribution of organic chemicals detected in Site 20 background and site-related sediment samples. Tables 21-6a and 21-6b present a comparison of detected compounds to ARARs and TBCs. Figure 21-2 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

TABLE 21-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOILS AT SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5370.00	3 / 3	1730 - 4560	3023.33	NO	4560
ARSENIC	8 / 8	1.35 - 14.4	13.29	2 / 3	2.9 - 5.1	2.77	NO	5.1
BARIUM	8 / 8	0.92 - 31	17.92	3 / 3	9.2 - 47.5	24.83	YES	47.5
CALCIUM	8 / 8	28.6 - 799	577.55	3 / 3	84.8 - 810	391.27	NO	810
CHROMIUM	8 / 8	4.7 - 59.5	54.73	3 / 3	3.7 - 11.1	8.23	NO	11.1
COBALT	4 / 8	0.75 - 5	2.77	1 / 3	1	0.56	NO	1
COPPER	8 / 8	0.97 - 8.6	8.66	3 / 3	1.7 - 8.1	5.43	NO	8.1
IRON	8 / 8	3745 - 62500	40871.25	3 / 3	1690 - 10500	6820.00	NO	10500
LEAD	8 / 8	1.4 - 39.4	24.33	3 / 3	4.4 - 14	9.50	NO	14
MAGNESIUM	8 / 8	18.5 - 619	504.05	3 / 3	55.1 - 287	154.37	NO	287
MANGANESE	8 / 8	2.6 - 214	92.51	3 / 3	9.2 - 16.2	12.53	NO	16.2
MERCURY	8 / 8	0.03 - 0.17	0.13	3 / 3	0.052 - 0.14	0.10	NO	0.14
NICKEL	4 / 8	1.8 - 7.2	4.75	2 / 3	1.7 - 2.6	1.68	NO	2.6
POTASSIUM	7 / 8	95 - 792	793.35	3 / 3	136 - 391	249.67	NO	391
SELENIUM	2 / 8	0.57 - 0.93	0.79	2 / 3	1.3 - 1.4	1.00	YES	1.4
SODIUM	8 / 8	17.5 - 94.8	79.35	3 / 3	40.7 - 127	76.40	NO	127
VANADIUM	8 / 8	11.05 - 64	64.71	3 / 3	3.7 - 13.5	9.27	NO	13.5
ZINC	6 / 8	1.1 - 50.7	31.35	3 / 3	1.3 - 4.1	2.23	NO	4.1

Note: Selected COPCs are indicated in boldface type.

TABLE 21-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,2-DICHLOROETHENE (TOTAL)	NOT DETECTED	-	-	2 / 3	8 - 15	15
2-BUTANONE	NOT DETECTED	-	-	2 / 3	38 - 71	71
4-METHYLPHENOL	NOT DETECTED	-	-	1 / 3	72	72
ETHYLBENZENE	NOT DETECTED	-	-	1 / 3	5	5
TOLUENE	NOT DETECTED	-	-	3 / 3	1 - 13	13

TABLE 21-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 20

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	20SB01-03	20SB02-03	20SB03-03	---	---	---	ARARS & TBCs		
LOCATION:	20SB01	20SB02	20SB03	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI						
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**				**mg/kg**	**mg/kg**	**mg/kg**
aluminum	1730	4560	2780				-	-	-
arsenic	0.59 U	5.1	2.9				20.0	20.0	-
barium	9.2	47.5	17.8				700	47000	-
calcium	84.8	810	279				-	-	-
chromium, total	3.7	11.1	9.9				-	500	-
cobalt	0.64 U	1.0	0.71 U				-	-	-
copper	1.7	8.1	6.5				600	600	-
iron	1690	10500	8270				-	-	-
lead	4.4	14.0	10.1				400	600	-
magnesium	55.1	287	121				-	-	-
manganese	9.2 J	16.2 J	12.2 J				-	-	-
mercury	0.052 J	0.14 J	0.10 J				14.0	270	-
nickel	1.5 U	2.6	1.7				250	2400	-
potassium	136	391	222				-	-	-
selenium	0.59 U	1.4 J	1.3 J				63.0	3100	-
sodium	61.5	127	40.7				-	-	-
vanadium	3.7	13.5	10.6				370	7100	-
zinc	1.3 J	4.1 J	1.3 J				1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**	**ug/kg**	**ug/kg**
4-methylphenol	390 U	72.0 J	430 U				2800000	10000000	-
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	12.0 U	15.0 J	8.0 J				79000	1000000	1000
2-butanone	12.0 U	71.0	38.0				1000000	1000000	50000
ethylbenzene	12.0 U	5.0 J	13.0 U				1000000	1000000	100000
toluene	1.0 J	13.0 J	6.0 J				1000000	1000000	500000

TABLE 21-4a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- No standard is available for this chemical in this classification.

TABLE 21-6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND				SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	5492.67	3940	1 / 1	1720	1720	NO	1720
ARSENIC	2 / 3	2.4 - 6.2	5.95	6.2	1 / 1	2.6	2.6	NO	2.6
BARIUM	3 / 3	3.9 - 10.6	14.07	10.6	1 / 1	12.3	12.3	NO	12.3
BERYLLIUM	1 / 3	0.57	0.67	0.57	1 / 1	0.1	0.1	NO	0.1
CADMIUM	NOT DETECTED	-	-	-	1 / 1	0.14	0.14	YES	0.14
CALCIUM	3 / 3	179 - 518	685.33	518	1 / 1	878	878	YES	878
CHROMIUM	3 / 3	4.3 - 56	43.13	56	1 / 1	6.1	6.1	NO	6.1
COBALT	1 / 3	2.1	3.30	2.1	1 / 1	0.26	0.26	NO	0.26
COPPER	3 / 3	1.5 - 13	12.47	13	1 / 1	5	5	NO	5
IRON	3 / 3	228 - 7650	6578.67	7650	1 / 1	2960	2960	NO	2960
LEAD	3 / 3	4.6 - 34.3	30.60	34.3	1 / 1	9.2	9.2	NO	9.2
MAGNESIUM	3 / 3	60.7 - 256	306.47	256	1 / 1	227	227	NO	227
MANGANESE	3 / 3	4.6 - 9.2	13.80	9.2	1 / 1	9.9	9.9	NO	9.9
MERCURY	1 / 3	0.068	0.05	0.068	1 / 1	0.046	0.046	NO	0.046
NICKEL	2 / 3	2.1 - 6	7.93	6	1 / 1	2.2	2.2	NO	2.2
POTASSIUM	2 / 3	86.1 - 681	589.40	681	1 / 1	155	155	NO	155
SODIUM	3 / 3	26.6 - 116	115.27	116	1 / 1	35.5	35.5	NO	35.5
VANADIUM	3 / 3	5.9 - 42.7	36.93	42.7	1 / 1	7.2	7.2	NO	7.2
ZINC	3 / 3	14.2 - 26.9	37.33	26.9	1 / 1	11.7	11.7	NO	11.7

Note: Selected COPCs are indicated in boldface type.

TABLE 21-7
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
BENZO(A)ANTHRACENE	2 / 3	140 - 560	560	1 / 1	90	90
BENZO(A)PYRENE	2 / 3	160 - 590	590	1 / 1	100	100
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	1 / 1	160	160
BENZO(G,H,I)PERYLENE	2 / 3	130 - 380	380	1 / 1	54	54
BENZO(K)FLUORANTHENE	2 / 3	150 - 470	470	1 / 1	50	50
CHRYSENE	2 / 3	250 - 940	940	1 / 1	130	130
FLUORANTHENE	2 / 3	300 - 1800	1800	1 / 1	150	150
PHENANTHRENE	2 / 3	200 - 1900	1900	1 / 1	120	120
PYRENE	2 / 3	350 - 1900	1900	1 / 1	230	230

TABLE 21-6a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 20

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	20SD01		---	---	---	---	---	---	ARARS & TBCs	
LOCATION:	20SD01		---	---	---	---	---	---	Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI									
INORGANICS	**mg/kg**								**mg/kg**	
aluminum	1720								-	
arsenic	2.6								8.20	L
barium	12.3								40.0	B
beryllium	0.10								-	
cadmium	0.14								1.20	L
calcium	878								-	
chromium, total	6.1	J							81.0	L
cobalt	0.26								50.0	T
copper	5.0								34.0	L
iron	2960								-	
lead	9.2								47.0	L
magnesium	227								-	
manganese	9.9								460	O
mercury	0.046								0.150	L
nickel	2.2								21.0	L
potassium	155								-	
sodium	35.5								-	
vanadium	7.2								-	
zinc	11.7	J							150	L
SEMIVOLATILES	**ug/kg**								**ug/kg**	
benzo(a)anthracene	90.0	J							330	F
benzo(a)pyrene	100	J							430	L
benzo(b)fluoranthene	160	J							330	F
benzo(g,h,i)perylene	54.0	J							330	F
benzo(k)fluoranthene	50.0	J							330	F
chrysene	130	J							330	F
fluoranthene	150	J							2900	Q
phenanthrene	120	J							850	Q

TABLE 21-6a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 20

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	20SD01	---	---	---	---	---	---	ARARS & TBCs
LOCATION:	20SD01	---	---	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI							
SEMIVOLATILES	**ug/kg**							**ug/kg**
pyrene	230 J							660 L

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 21-6b

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 20

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	20SD01	---	---	---	---	---	---	ARARS & TBCs
LOCATION:	20SD01	---	---	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI							
MISCELLANEOUS	**mg/kg**							**mg/kg**
total organic carbon	5200							-

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

21.5.3.1 Inorganics

Concentrations of metals in the site-related sediment samples were similar to background.

21.5.3.2 Organics

PAHs including benz(a)anthracene (90 ug/kg), benzo(a)pyrene (100 ug/kg), benzo(b)fluoranthene (160 ug/kg), benzo(k)fluoranthene (50 ug/kg), chrysene (130 ug/kg), fluoranthene (150 ug/kg), phenanthrene (120 ug/kg), and pyrene (230 ug/kg) were detected in one site sediment sample. These data indicate that concentrations of PAHs in on-site sediment is similar to background.

21.5.3.3 Miscellaneous Parameters

One sediment sample collected at Site 20 was analyzed for TOC. The TOC level (5,200 mg/kg) detected in the sample did not exceed the background levels.

21.5.4 Aqueous Waste

One aqueous waste sample from the septic tank was collected at Site 20 to investigate if the compounds found in other site samplings are related to the septic tank as a possible source (Figure 21-2). Results are presented in Appendix A.

21.5.4.1 Inorganics

The site-related sample exhibited the following concentrations of metals: aluminum, 119 ug/L; barium, 17.1 ug/L; cadmium, 0.94 ug/L; chromium, 0.99 ug/L; copper, 20.2 ug/L; manganese, 43.2 ug/L; mercury, 0.025 ug/L; and nickel, 3.3 ug/L.

21.5.4.2 Organics

1,4-Dichlorobenzene (1,4-DCB; 140 ug/L), 2,4-dichlorophenol (6 ug/L), 2-methylphenol (2 ug/L), 4-methylphenol (160 ug/L), carbon disulfide (2 ug/L), chlorobenzene (1 ug/L), chloroform (5 ug/L), phenol (75 ug/L), and toluene (38 ug/L) were each detected in the aqueous waste sample from Site 20.

21.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 20 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 21.6.1. Persistence of detected chemicals in the environment is discussed in Section 21.6.2. Section 21.6.3 presents a brief discussion of contaminant trends.

21.6.1 Detected Chemicals and Transport Potential

Volatile and semivolatile organic compounds in subsurface soil, low levels of PAHs and metals in surface soil, and several volatile and semivolatile compounds in the aqueous waste sample were found at Site 20. The physical transport data for the detected contaminants are presented in Table 2-10. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

Substances detected at concentrations greater than background in surface soil include certain metals and low levels of PAHs. Antimony, copper, lead, thallium, and zinc, which were present at concentrations greater than background in one surface soil sample. These metals are absorbed onto soil and sediment easily but may also exist in dissolved or suspended forms. Many metal oxides such as those found in paint pigments are considered insoluble and, like the detected PAHs, would not be expected to migrate significantly except through erosional runoff. However, vegetation coupled with the relatively flat topography that dominates most of the site, will considerably limit the amount of transport of these constituents through erosion or airborne dusting.

No evidence of elevated levels of metals was noted in subsurface soils or sediment samples. Subsurface soils from the leach field revealed VOCs and phenols, which are soluble and have the potential to migrate in groundwater. The septic tank, which drains to the leach field, yielded an aqueous waste sample that was found to contain low levels of several volatiles and semivolatiles, all of which exhibit high solubility and are potentially mobile in groundwater.

21.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

PAHs can be biodegraded but the rate of degradation is slower for the higher molecular weight compounds. PAHs tend to strongly adsorb onto soil and exhibit low water solubility. The solubility and vapor pressure of the detected volatile compounds make them characteristically mobile in the environment. In addition, phenols, toluene, ethylbenzene, and 2-butanone are considered to have low persistence due to their solubility and susceptibility to biodegradation. 1,2-DCE is associated with degradation of PCE and TCE (Cline and Viste, 1983) and may further degrade to vinyl chloride.

21.6.3 Observed Chemical Contaminant Trends

Most of the surface soil samples, which were collected in areas of recent excavation, exhibited concentrations of detected substances in similar ranges to background samples. One sample (20 SS 03) revealed levels of antimony, copper, lead, thallium, and zinc somewhat greater than background. Nickel was also detected at elevated levels in this sample but results were qualified (R), rejected, during data validation and cannot be used for risk assessment. However, elevated levels are believed to be present in 20 SS 03. Of these metals, copper, lead, nickel, and zinc were identified as contaminants present at elevated levels in a waste pile of grit material sampled during a previous 1993 investigation. Therefore, the distribution of elevated metals in 20 SS 03 also suggests the presence of residual grit material at this location.

Another surface soil, 20 SS 02, revealed PAHs at low levels slightly greater than background. The slightly elevated levels of PAHs may or may not be related to previous disposal activities associated with spent blasting grit or paint chips from ordnance paint removal. Elevated levels of metals were not observed in any other media at this site.

The aqueous waste sample collected from the septic tank revealed low levels of 1,4-DCB, 2,4-dichlorophenol, 2-methylphenol, 4-methylphenol, carbon disulfide, chlorobenzene, chloroform, phenol, and toluene. 1,4-DCB (and possibly the other chlorinated aromatics) may be related to use of common disinfectants in lavatories. Carbon disulfide is a common component of sewage. Potential sources of chloroform, toluene, and phenols in this waste are not known.

All three subsurface soil samples collected within the leach field area at Site 20 revealed trace levels of toluene, and two of the three samples exhibited low levels of 1,2-DCE and 2-butanone. 4-Methylphenol and ethylbenzene were each detected in one subsurface soil sample collected from the leach field area. These data suggest limited impacts from the leach field on subsurface soils, since toluene and 4-methylphenol were also detected in the aqueous waste sample. Although 1,2-DCE is a degradation product of TCE and PCE, neither of the parent compounds were detected in any media sampled at Site 20. 1,2-DCE may have originated from source areas that have since been depleted (for example, past septic tank cleaning) or from source locations that were not sampled during this investigation.

21.6.4 Conclusions

Substances detected at concentrations greater than background in surface soil include certain metals and low levels of PAHs. Several of the metals detected at elevated levels in surface soil are the same as inorganic contaminants previously detected in waste material from a grit pile sampled during a 1993 investigation. Because surface soils from the current investigation were collected in areas where blasting grit was previously located, this indicates the presence of residual contamination. Antimony, copper, lead, thallium, and zinc, which were present at concentrations greater than background in one surface soil, are absorbed onto soil and sediment easily but may also exist in dissolved or suspended forms. However, many metal oxides such as those found in paint pigments are considered insoluble and, like the detected PAHs, would not be expected to migrate significantly except through erosional runoff. No evidence of elevated levels of metals was noted in subsurface soils or sediment samples.

The aqueous waste sample collected from the septic tank revealed low levels of 1,4-DCB, 2,4-dichlorophenol, 2-methylphenol, 4-methylphenol, carbon disulfide, chlorobenzene, chloroform, phenol, and toluene. It is believed that the septic tank and leachfield are still in operation, although the septic tank is apparently pumped out on a regular basis. Since the septic system is still operational, continued disposal is expected. Limited impacts from the leach field on subsurface soils are indicated by the detection of compounds in subsurface soil that were also found in the septic tank (toluene and 4-methylphenol). 1,2-DCE, a degradation product of TCE and PCE, and 2-butanone were also detected in subsurface soil at low levels. All the organic compounds detected in subsurface soil are considered soluble and potentially mobile in groundwater. The source of the trace level of 1,2-DCE could be related to past leaching from the septic tank or from source locations that were not identified during this investigation. The impact of these compounds on groundwater at the site is not known at this time.

21.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 20. The risk assessment was performed using the approach outlined in Section 2.4. Tables 21-8 through 21-10 provide the selected COPCs and representative concentrations of inorganics and organics in site-related surface soil, subsurface soil, and sediment, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The result of the conservative baseline risk assessment was greater than a value of 1.0 for non-cancer risk; therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. Section 21.7.1.6 discusses the modifications made to the conservative preliminary baseline risk assessment.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

21.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of current land use (industrial employee) and hypothetical future land use (residential, recreational, and industrial receptors).

21.7.1.1 Current Industrial Employee

The estimated total cancer risks for the current industrial employee for exposure to COPCs in surface soil at Site 20 are within the mid-range of the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate standards and criteria (ARARs). The principal COPC contributing to the surface soil cancer risk is arsenic (via ingestion and dermal contact).

The conservative preliminary baseline risk assessment yielded an estimated noncarcinogenic HI with a value greater than 1.0 for the current industrial employee assuming exposure to COPCs in surface soil at Site 20. (Dermal contact exposures contributed the significant portion of risk.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended

TABLE 21-8
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SURFACE SOIL - SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ARSENIC	5.4	NONPARAMETRIC
BARIUM	58	NONPARAMETRIC
BERYLLIUM	2.7	NONPARAMETRIC
CADMIUM	0.26	NONPARAMETRIC
CHROMIUM	97.1	NONPARAMETRIC
COBALT	18.40	NONPARAMETRIC
COPPER	300.24	NORMAL
IRON	16500	NONPARAMETRIC
LEAD	252	NONPARAMETRIC
NICKEL	7.4	NORMAL
SELENIUM	1.4	LOGNORMAL
SILVER	0.83	NORMAL
ZINC	972	NONPARAMETRIC
ANTHRACENE*	63.5	LOGNORMAL
BENZO(A)ANTHRACENE*	500	NONPARAMETRIC
BENZO(A)PYRENE*	261.42	NORMAL
BENZO(B)FLUORANTHENE*	374.14	NORMAL
BENZO(G,H,I)PERYLENE*	211.47	NORMAL
BENZO(K)FLUORANTHENE*	193.86	NONPARAMETRIC
BUTYLBENZYLPHTHALATE*	66	LOGNORMAL
CARBAZOLE*	54	LOGNORMAL
CHRYSENE*	490	NONPARAMETRIC
DIBENZOFURAN*	45	LOGNORMAL
FLUORANTHENE*	525.57	NORMAL
INDENO(1,2,3-CD)PYRENE*	217.69	NORMAL
PHENANTHRENE*	520	NONPARAMETRIC
PYRENE*	562.13	NORMAL

* - UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

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TABLE 21-9
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ARSENIC	5.1	NONPARAMETRIC
BARIUM	47.5	NONPARAMETRIC
CHROMIUM	11.1	NONPARAMETRIC
LEAD	14	NONPARAMETRIC
SELENIUM	1.4	NONPARAMETRIC
1,2-DICHLOROETHENE (TOTAL)*	15	NONPARAMETRIC
2-BUTANONE*	71	NONPARAMETRIC
4-METHYLPHENOL*	72	NONPARAMETRIC
ETHYLBENZENE*	5	NONPARAMETRIC
TOLUENE*	13	NONPARAMETRIC

* - UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 21-10
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SEDIMENT - SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ARSENIC	2.6	NONPARAMETRIC
BARIUM	12.3	NONPARAMETRIC
BERYLLIUM	0.1	NONPARAMETRIC
CADMIUM	0.14	NONPARAMETRIC
LEAD	9.2	NONPARAMETRIC
MANGANESE	9.9	NONPARAMETRIC
BENZO(A)ANTHRACENE*	90	NONPARAMETRIC
BENZO(A)PYRENE*	100	NONPARAMETRIC
BENZO(B)FLUORANTHENE*	160	NONPARAMETRIC
BENZO(G,H,I)PERYLENE*	54	NONPARAMETRIC
BENZO(K)FLUORANTHENE*	50	NONPARAMETRIC
CHRYSENE*	130	NONPARAMETRIC
FLUORANTHENE*	150	NONPARAMETRIC
PHENANTHRENE*	120	NONPARAMETRIC
PYRENE*	230	NONPARAMETRIC

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

carcinogenic and noncarcinogenic risks for industrial exposure to surface soil are discussed in Section 21.7.1.6 and presented in Tables 21-11 and 21-12, respectively.

21.7.1.2 Future Industrial Employee

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 20 are 2.7E-06 (ingestion), 8.8E-07 (dermal contact), and 7.5E-09 (inhalation of COPCs in fugitive dust). The principal COPC contributing to the subsurface soil cancer risk is arsenic (ingestion, 100 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 20 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic health effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soils at Site 20 in Tables 21-13 and 21-14, respectively.

21.7.1.3 Future Residential Receptor

Surface Soil

The estimated total cancer risks for the residential receptor for exposure to COPCs in surface soil at Site 20 are within the 1E-04 to 1E-06 target acceptable risk range. The principal COPC contributing to the surface soil cancer risk is arsenic (via ingestion and dermal contact).

The conservative preliminary baseline risk assessment yielded an estimated noncarcinogenic HI with a value greater than 1.0 for the future residential employee assuming exposure to COPCs in surface soil at Site 20. (Dermal contact exposures contributed the significant portion of risk.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for residential exposure to surface soil are discussed in Section 21.7.1.6 and presented in Tables 21-15 and 21-16, respectively.

TABLE 21-11
RME CARCINOGENIC RISK TO CURRENT INDUSTRIAL RECEPTORS - SITE 20
SURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	1.3E-07	N/A	2.8E-11
BENZO(A)PYRENE	6.7E-07	N/A	1.4E-10
BENZO(B)FLUORANTHENE	9.5E-08	N/A	2.1E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	4.9E-09	N/A	1.1E-12
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	3.8E-10	N/A	7.0E-14
CHRYSENE	1.3E-09	N/A	2.7E-13
DIBENZOFURAN	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
INDENO(1,2,3-CD)PYRENE	5.6E-08	N/A	1.2E-11
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	7.5E-06	7.4E-06	4.2E-09
BARIUM	N/A	N/A	N/A
BERYLLIUM	4.2E-07	N/A	7.8E-11
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	8.9E-06	7.4E-06	4.5E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
**CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 21-12
RME NONCARCINOGENIC HQS, CURRRENT INDUSTRIAL RECEPTORS - SITE 20
SURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ANTHRACENE	2.1E-07	N/A	3.8E-11
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BUTYLBENZYLPHTHALATE	3.2E-07	N/A	6.0E-11
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DIBENZOFURAN	1.1E-05	N/A	2.0E-09
FLUORANTHENE	1.3E-05	N/A	2.4E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	1.8E-05	N/A	3.4E-09
ARSENIC	4.7E-02	4.6E-02	8.7E-06
BARIUM	4.3E-04	N/A	7.9E-06
BERYLLIUM	5.5E-05	N/A	1.0E-08
COBALT	7.0E-05	N/A	1.3E-08
COPPER	2.1E-04	N/A	3.8E-08
LEAD	N/A	N/A	N/A
ZINC	9.0E-05	N/A	1.7E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 21-13
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 20
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
2-BUTANONE	N/A	N/A	N/A
4-METHYLPHENOL	N/A	N/A	N/A
ETHYLBENZENE	N/A	N/A	N/A
TOLUENE	N/A	N/A	N/A
ARSENIC	2.7E-06	8.8E-07	1.5E-09
BARIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	6.0E-09
LEAD	N/A	N/A	N/A
SELENIUM	N/A	N/A	N/A
TOTAL RISK	2.7E-06	8.8E-07	7.5E-09

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 21-14
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 20
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTAL)	1.6E-06	5.1E-06	3.0E-10
2-BUTANONE	1.2E-07	3.6E-07	3.0E-11
4-METHYLPHENOL	1.4E-05	7.3E-05	2.6E-09
ETHYLBENZENE	4.9E-08	1.9E-07	9.7E-12
TOLUENE	6.4E-08	2.0E-07	1.6E-11
ARSENIC	1.7E-02	5.5E-03	3.1E-06
BARIUM	6.6E-04	5.2E-03	1.2E-05
CHROMIUM	2.2E-03	3.4E-02	4.0E-07
LEAD	N/A	N/A	N/A
SELENIUM	2.7E-04	1.1E-04	5.1E-08

TABLE 21-15
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 20
SURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	5.7E-07	N/A	1.7E-11
BENZO(A)PYRENE	3.0E-06	N/A	8.9E-11
BENZO(B)FLUORANTHENE	4.3E-07	N/A	1.3E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	2.2E-08	N/A	6.6E-13
BUTYLBENZYLPHTHALATE	N/A	N/A	N/A
CARBAZOLE	1.7E-09	N/A	4.3E-14
CHRYSENE	5.6E-09	N/A	1.7E-13
DIBENZOFURAN	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
INDENO(1,2,3-CD)PYRENE	2.5E-07	N/A	7.4E-12
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	3.4E-05	2.5E-05	2.6E-09
BARIUM	N/A	N/A	N/A
BERYLLIUM	1.9E-06	N/A	4.8E-11
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	4.0E-05	2.5E-05	2.8E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 21-16
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 20
SURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		SURFACE SOIL INGESTION BY TARGET ORGAN								
SUBSTANCE	SURFACE SOIL INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	THYROID
ANTHRACENE	2.7E-06									
BENZO(A)ANTHRACENE	N/A									
BENZO(A)PYRENE	N/A									
BENZO(B)FLUORANTHENE	N/A									
BENZO(G,H,I)PERYLENE	N/A									
BENZO(K)FLUORANTHENE	N/A									
BUTYLBENZYLPHTHALATE	4.2E-06									
CARBAZOLE	N/A									
CHRYSENE	N/A									
DIBENZOFURAN	1.4E-04									
FLUORANTHENE	1.7E-04	1.7E-04		1.7E-04	1.7E-04					
INDENO(1,2,3-CD)PYRENE	N/A									
PHENANTHRENE	N/A									
PYRENE	2.4E-04			2.4E-04						
ARSENIC	6.1E-01		6.1E-01							
BARIUM	5.7E-03	5.7E-03				5.7E-03		5.7E-03	5.7E-03	
BERYLLIUM	7.2E-04									
COBALT	9.1E-04	9.1E-04								9.1E-04
COPPER	2.7E-03	2.7E-03		2.7E-03	2.7E-03					
LEAD	N/A	N/A					N/A			
ZINC	1.2E-03	1.2E-03								
	HI BY TARGET ORGAN	1.1E-02	6.1E-01	3.1E-03	2.9E-03	5.7E-03		5.7E-03	5.7E-03	9.1E-04

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 21-16
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 20
SURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
ANTHRACENE	N/A	4.1E-11
BENZO(A)ANTHRACENE	N/A	N/A
BENZO(A)PYRENE	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A
BUTYLBENZYLPHTHALATE	N/A	6.3E-11
CARBAZOLE	N/A	N/A
CHRYSENE	N/A	N/A
DIBENZOFURAN	N/A	2.2E-09
FLUORANTHENE	N/A	2.5E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	3.6E-09
ARSENIC	3.8E-01	9.2E-06
BARIUM	N/A	8.4E-06
BERYLLIUM	N/A	1.1E-08
COBALT	N/A	1.4E-08
COPPER	N/A	4.0E-08
LEAD	N/A	N/A
ZINC	N/A	1.8E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Subsurface Soil

The estimated total cancer risks for the future lifetime resident assuming exposure to COPCs in subsurface soil (assuming subsurface soil become future surface soil) at Site 20 are 1.2E-05 (ingestion), 2.9E-06 (dermal contact), and 4.6E-09 (inhalation of COPCs in fugitive dust). The subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The principal COPC contributing to the subsurface soil cancer risk is arsenic (ingestion, 100 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the future child resident assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 20 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic health effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs effects are presented for future residential receptors exposed to subsurface soil at Site 20 in Tables 21-17 and 21-18, respectively.

21.7.1.4 Future Recreational Receptor

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 20 are 5.8E-08 (ingestion) and 2.0E-08 (dermal contact). This sediment cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The estimated individual HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 20 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 20 in Tables 21-19 and 21-20, respectively.

21.7.1.5 Lead Results

Lead was not found above the EPA level of concern (400 mg/kg) in soil samples taken during the RI.

The IEUBK Lead Model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 20 exposures are presented in Appendix I.

TABLE 21-17
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 20
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
2-BUTANONE	N/A	N/A	N/A
4-METHYLPHENOL	N/A	N/A	N/A
ETHYLBENZENE	N/A	N/A	N/A
TOLUENE	N/A	N/A	N/A
ARSENIC	1.2E-05	2.9E-06	9.2E-10
BARIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	3.7E-09
LEAD	N/A	N/A	N/A
SELENIUM	N/A	N/A	N/A
TOTAL RISK	1.2E-05	2.9E-06	4.6E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUES ARE ESTABLISHED FOR THSI CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 21-18
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 20
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOTAL)	2.1E-05	4.2E-05	3.2E-10
2-BUTANONE	1.5E-06	3.0E-06	3.2E-11
4-METHYLPHENOL	1.8E-04	6.0E-04	2.8E-09
ETHYLBENZENE	6.4E-07	1.6E-06	1.0E-11
TOLUENE	8.3E-07	1.6E-06	1.7E-11
ARSENIC	2.2E-01	4.5E-02	3.3E-06
BARIUM	8.7E-03	4.2E-02	1.3E-05
CHROMIUM	2.8E-02	2.8E-01	4.2E-07
LEAD	N/A	N/A	N/A
SELENIUM	3.6E-03	8.7E-04	5.4E-08

TABLE 21-19
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 20
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
BENZO(A)ANTHRACENE	7.2E-10	2.9E-10
BENZO(A)PYRENE	8.0E-09	1.1E-08
BENZO(B)FLUORANTHENE	1.3E-09	5.1E-10
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	4.0E-11	1.6E-11
CHRYSENE	1.0E-11	4.1E-12
FLUORANTHENE	N/A	N/A
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
ARSENIC	4.3E-08	1.8E-09
BARIUM	N/A	N/A
BERYLLIUM	4.7E-09	1.9E-08
CADMIUM	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
TOTAL RISK	5.8E-08	3.2E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 21-20
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 20
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
CHRYSENE	NA	NA
FLUORANTHENE	4.8E-07	1.9E-07
PHENANTHRENE	NA	NA
PYRENE	9.8E-07	3.9E-07
ARSENIC	1.1E-03	4.6E-05
BARIUM	2.2E-05	2.2E-05
BERYLLIUM	2.6E-06	1.0E-05
CADMIUM	3.6E-05	2.8E-05
LEAD	NA	NA
MANGANESE	2.5E-04	3.3E-04

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

21.7.1.6 Amended Risk Assessment

The amended risk assessment recalculated the cancer and non-cancer risks at Site 20 for future residential receptors and future industrial employees assuming exposure to COPCs in surface soil.

Comparison to Background

Cadmium, chromium, iron, selenium, and silver were eliminated from consideration as surface soil COPCs based on a comparison of average levels to twice the background level. However, since arsenic is a class A carcinogen, it could not be eliminated from consideration. Table 21-2 presents the comparison of COPCs to background concentrations. Nickel was eliminated based on comparison to background upper 95 percent UTLs.

Consideration of Modified Dermal Absorption and Target Organ Grouping

Surface soil cancer and noncancer risks were recalculated using modified soil-to-skin absorption factors for three chemicals and excluding dermal effects for other COPCs. Revised risks were within the target range for the residential child and the current industrial receptor for each exposure route (ingestion, dermal, and inhalation of dust), but the sum of these three HIs exceeded 1.0 for the residential child receptor. Surface soil ingestion risks were grouped by target organ, which then yielded an acceptable worst-case sum (i.e., the ungrouped HIs from dermal and inhalation plus the maximum of the HIs from ingestion yielded a total RME HI of less than 1.0 for the future residential child, exposure to surface soil).

Estimated RME carcinogenic risks and noncarcinogenic HIs are presented for the current industrial receptor exposed to surface soil in Tables 21-11 and 21-12, respectively. Estimated RME carcinogenic risks and noncarcinogenic HIs are presented for the future residential child receptor exposed to surface soil in Tables 21-15 and 21-16, respectively.

21.7.2 Conclusions

Surface soil, subsurface soil, and sediment were sampled at Site 20. The potential receptors for this site were current industrial, future industrial and residential, and recreational receptors. The cancer risks associated with the future residential and current industrial (surface soil) exposure scenarios were within the mid-range of the target risk range. Arsenic (via ingestion of and dermal contact with surface soil) was the major COPC that contributed to these cancer risks. The noncarcinogenic HIs associated with the current industrial (surface soil) and future residential (surface soil) exposure scenarios were less than 1.0; the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Lead soil

concentrations were below EPA guidelines. These lead concentrations are not expected to be associated with significant increases in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 20 in Table 21-21 for surface soil, subsurface soil, and sediment.

21.8 ECOLOGICAL RISK ASSESSMENT

21.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Site 20 consists primarily of developed and grassy areas. The entire area behind Building 544 is asphalt or mowed grass. The site is surrounded by wetlands and wooded areas. NJDEP Geographic Information System data initially indicated that wetlands completely surround the site. However, ground-truthing of the site revealed that wetlands were only present to the east and northeast of the site, and the areas to the south and southeast are upland areas. The wetlands are dominated by red maple and comprised of Manahawkin muck soils. Uplands to the south and southwest are dominated by pitch pine and white oak. A drainage depression runs around the site border and drains into the wetlands to the northeast. The edge of the upland and wetland areas surrounding the site is a few feet higher in elevation than the site; therefore, all runoff from the site drains into the depression. Water is present in the depression only after periods of heavy rainfall. There is rarely any surface water on or near the site, and water in the wetlands to the northeast is normally about 20 inches below the ground surface. The closest surface water body to Site 20 is an upper reach of Hockhockson Brook, located approximately 500 feet east of the site. As such, the site is located within the Hockhockson Brook Watershed. Site 10 is located several hundred yards to the northeast, but Site 20 is not located relatively close to other RI sites.

Minimal terrestrial habitat of ecological value is present on the site, and the drainage depression contains no aquatic habitat. The wetlands and wooded areas adjacent to the site provide excellent habitat, primarily for terrestrial ecological receptors. Most terrestrial mammals found on the base, including white-tailed deer, gray and red fox, and several species of small mammals, are expected to utilize the wetlands and uplands surrounding the site. Avian species found on the base that are attracted to wooded areas are also expected to be present in the surrounding areas. No sensitive habitats, other than the wetlands, and no threatened or endangered species are present on or near the site.

TABLE 21-21
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 20
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk					Estimated Hazard Index**					
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident			Future Recreational Child
									Child	Child	Adult	
Surface Soil	Incidental Ingestion	8.9E-06^	N/A	N/S	4.0E-05^	N/A	4.8E-02^	N/A	N/S	6.1E-01@	N/A	N/A
	Dermal Contact	7.4E-06^	N/A	N/S	2.5E-05^	N/A	4.6E-02^	N/A	N/S	3.8E-01^	N/A	N/A
	Inhalation of Fugitive Dust	4.5E-09^	N/A	N/S	2.8E-09^	N/A	1.7E-05^	N/A	N/S	1.8E-05^	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	2.7E-06	1.2E-05	N/S	N/A	N/A	2.0E-02	2.6E-01	N/S	N/A	N/A
	Dermal Contact	N/A	8.8E-07	2.9E-06	N/S	N/A	N/A	4.5E-02	3.7E-01	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	7.5E-09	4.6E-09	N/S	N/A	N/A	1.6E-05	1.7E-05	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/A	5.8E-08	N/A	N/A	N/A	N/A	N/A	1.4E-03
	Dermal Contact	N/A	N/A	N/A	N/A	3.2E-08	N/A	N/A	N/A	N/A	N/A	4.4E-04
Groundwater	Ingestion	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/A	N/S
TOTAL		1.6E-05	3.6E-06	1.5E-05	6.5E-05	9.0E-08	9.4E-02	6.5E-02	6.3E-01	9.89E-01	-	1.9E-03

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Amended result is maximum HI for individual target organs.

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Contaminant Sources, Release Mechanisms, and Migration Pathways

In general, the major release pathway from the site is overland runoff. Precipitation runoff may carry constituents to off-site wetland areas to the northeast via the drainage depression. The site topography precludes overland runoff to the upland areas to the south and southwest. In addition to runoff as a contaminant migration pathway, infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a chemical may be carried with the flow of groundwater to downgradient locations. Groundwater from the site may eventually discharge to surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. Nonetheless, the scarcity of surface water near the site, even in the wetlands, inhibits significant migration via this pathway.

Exposure Routes

Terrestrial wildlife associated with the Site 20 area may be exposed to surface soil contaminants via incidental ingestion of soil or ingestion of contaminated food items. This is of concern only in the forested wetland area, since migration to upland areas is unlikely. Terrestrial receptors may also come into contact with contaminants in drainage depression surface water by using it as drinking water, although this pathway is generally insignificant, and water is normally absent in the depression. Semi-aquatic organisms inhabiting the wetlands may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated prey. However, the lack of significant surface water in the wooded wetlands precludes the existence of an extensive aquatic community. As a result, the terrestrial receptor exposure routes described above are more applicable for receptors in the wetlands. Semi-aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water, although this route is minimal due to the scarcity of surface water near the site.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1993 RI/FS and 1995 RI activities for this site. In particular, contaminants detected in Site 20 surface soils and drainage ditch sediments were considered preliminary COPCs. However, due to the low levels of the COPCs, and other factors as described in Section 21.8.2, a quantitative ecological risk assessment was considered not applicable.

21.8.2 Summary and Conclusions

Site 20 is mostly developed and contains minimal terrestrial habitat. A drainage depression drains the entire site, but is small with ephemeral flow, and hence, provides no aquatic habitat. The surrounding areas contain some wetland habitats. Nearby wooded areas also provide excellent upland habitats. Groundwater-to-surface water contaminant migration is unlikely, but runoff from Site 20 to the wetlands east of the site is possible via the drainage depression.

Although the drainage depression contains no aquatic habitat, four sediment samples were collected in the depression and one in the grit area in the southeastern section of the site during 1993 RI/FS activities to ascertain whether contaminants are migrating off-site. Elevated levels of several metals, including chromium, copper, nickel, lead, and zinc, were detected in drainageway sediments. Several SVOCs, including some PAHs, were detected in the grit area sample. However, the grit area and contaminated areas in the drainage depression were removed in 1994.

A sediment sample was taken where the drainage depression exits the site during 1995 RI activities. No excavation has occurred in this area. Due to topography, all runoff exits the site via this pathway, the sediment sample was taken in this area to determine possible off-site migration to the wetlands. Surface soil samples were collected at the site, but were taken in areas that contain limited terrestrial habitat (former grit storage areas). However, potential contaminant runoff from these soils should collect in the drainage ditch and, therefore, be present in drainage depression sediments. Concentrations of inorganics in this sediment sample were low, with all concentrations similar to background. Some PAHs were present in this sample, but were also present in low concentrations. The low levels of inorganics and organics where the drainage depression exits the site suggests limited off-site contaminant migration. However, since both the site and the drainage depression are relatively small, and since the potential contaminant source has already been removed, future off-site migration would most likely be limited. For these reasons, quantitative ecological risk assessment at this site was considered not applicable (since any risk numbers would be mitigated by the factors discussed above). Potential risks to ecological receptors at Site 20 are considered to be low, and the site was excluded from quantitative ecological risk assessment.

21.9 EVALUATION AND RECOMMENDATIONS

21.9.1 Evaluation Summary

The human health risk assessment indicates that there is no present or future scenario of carcinogenic risk above the target acceptable range. The comparison COPCs with corresponding HIs exceeding 1, to background concentrations, indicates that this site is within the range of background risk.

The removal action appears to have been effective since metals concentrations in soils were determined to be within the range of background.

Low levels of inorganics and organics where the drainage depression exits the site suggests limited off-site contaminant migration at a level of potential ecological concern. However, since both the site and the drainage depression are relatively small, and since the potential contaminant source has already been removed, future off-site migration would most likely be limited.

21.9.2 Recommendations

No further action appears necessary.

22.0 SITE 22: PAINT CHIP DISPOSAL AREA

22.1 SITE BACKGROUND AND PHYSICAL SETTING

Site 22 is a former paint chip disposal area where waste sand blasting material and paint wastes were disposed. The site is located south of Building D-2 and previously consisted of approximately 50 square feet of stressed vegetation and discolored (black) soils (IAS, 1983). The discolored soils resulted from past grit blasting and painting operations. However, the discolored soils and stressed vegetation are no longer visible at the site. The ground surface at the site is predominantly sand and gravel.

A macadam road services the site from Midway Road. The site is bordered to the north by a railroad siding and to the east by a marshy area. A shallow drainage depression, measuring approximately 275 feet in length and 0.5 to 1 foot in depth, runs the length of the site behind Building D-2, and discharges toward the southeast to a marsh. Figure 22-1 shows the site layout.

22.2 PREVIOUS INVESTIGATIONS

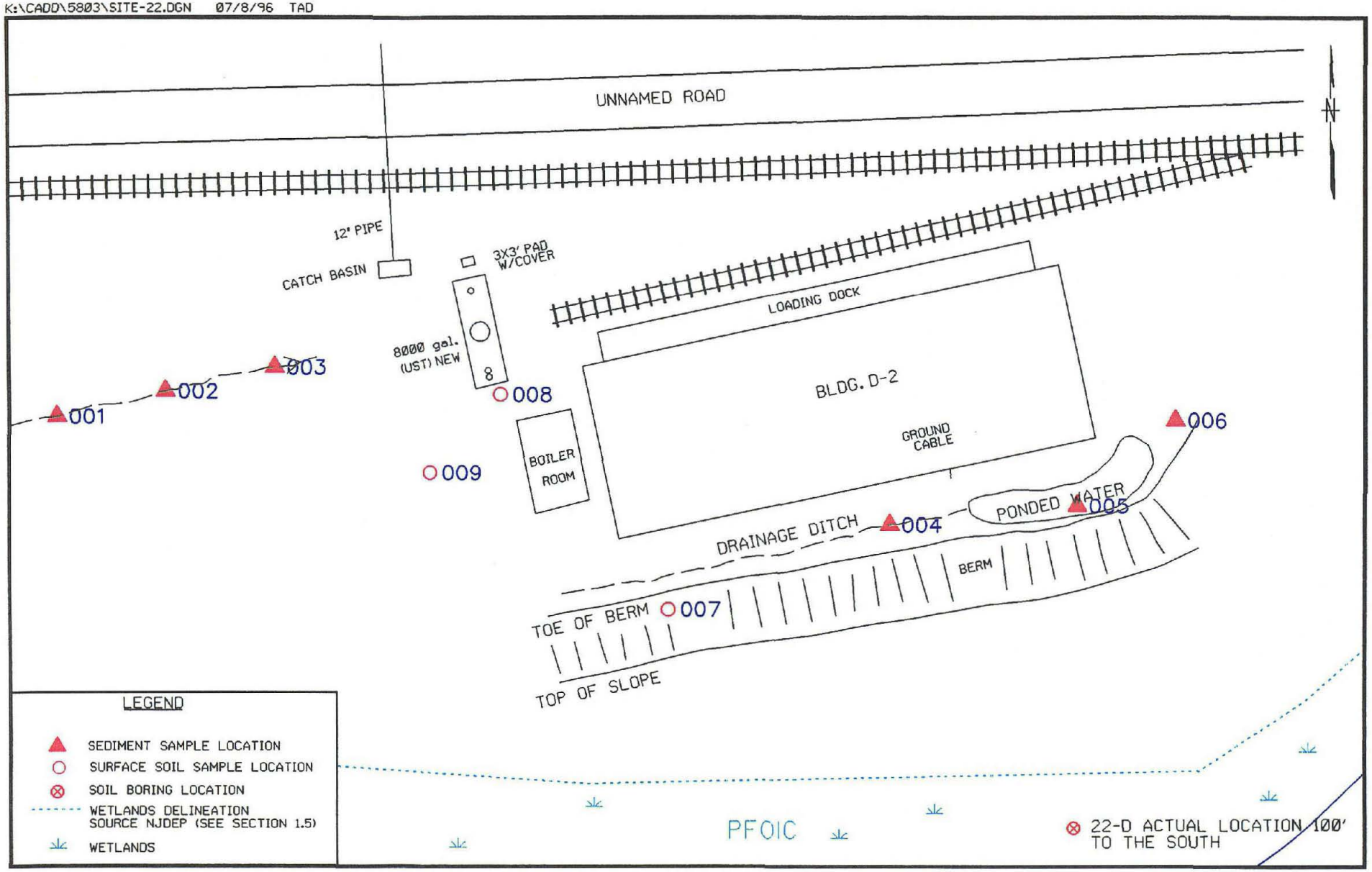
22.2.1 Summary of Activities and Results

The 1983 IAS consisted of interviews and concluded minimal impact based on a small area (50 square feet) of stressed vegetation and discolored soil behind building D-2. The site was not recommended for a confirmation study.

A site investigation (Confirmation Study) in 1986 consisted of four soil samples obtained from areas of stained soils at a depth of 0-3 feet. These soil samples were obtained in the general vicinity of the subsurface soil samples 22-007, 22-008 and 22-009 obtained during the RI in 1992 (see Figure 22-1). Soil samples were analyzed for TPH and EPTOX metals. Analytical results from the 1986 SI indicated that no metals above EPTOX limits, and a maximum TPH of 45.8 mg/kg were found in site soil samples taken.

During the RI/FS (1993), six soil samples were collected at three locations designated as stained areas. Traces of paint stains were barely evident at the surface and were limited to black and red staining on the surface. The sample locations are identified as sample numbers 22-007, 22-008, and 22-009. Figure 22-1 shows the existing sample locations from the Paint Chip Disposal Area. Three shallow samples (0 to 1 ft bgs) were analyzed for TAL inorganics with cyanide, BNAs, and pesticides/PCBs. Three deep samples (approximately 2 ft bgs) were analyzed for VOCs. Although several metals were detected at elevated concentrations, the concentrations of these metals were within the normal range for naturally occurring soils. Very low concentrations of volatile and semivolatile compounds were detected in some samples. The pesticide compound 4,4-DDT was found in one sample.

K:\CADD\5803\SITE-22.DGN 07/8/96 TAD



SAMPLING LOCATIONS

SITE 22 - PAINT CHIP DISPOSAL AREA

0 40 80

SCALE IN FEET

FIGURE 22-1

Brown & Root Environmental

Six sediment samples (22-001 through 22-006) were collected in the drainage ditch south of Building D-2. Samples were analyzed for TAL inorganics, BNAs, TPH, and pesticides/PCBs. Several semivolatile derivative compounds of anthracene, pyrene, and chrysene were detected at elevated levels. Other semivolatile compounds were detected at estimated (J) levels. The pesticide compound 4,4-DDT was found in sample 22-003. Some metals were detected at slightly elevated levels, but were within the normal range for naturally occurring soils.

22.2.2 Summary of Conclusions

The IAS concluded that no further study was indicated.

The SI confirmed that site soils were not at a level of concern for TPH.

The RI found low levels of semivolatile organic compounds, metals and DDT in the soil.

22.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on limited investigations, follow-up remedial investigation activities were developed to meet the following objectives:

Compare metals levels to background conditions.

Perform risk analysis to determine if further action is required.

22.3 REMEDIAL INVESTIGATION SAMPLING ACTIVITIES

Sampling and analysis during previous investigations were biased toward areas of visible soil staining or discoloration. In addition, samples were obtained from drainageways from these areas to gauge the potential for off-site transport of compounds. No groundwater samples have been obtained because the amount of waste disposed, based on observed residues on the soil, is considered to be minimal. Low levels of heavy molecular weight PAHs and phthalates found in site soils have very little potential for migration to groundwater.

Based on the lack of significant contamination noted in samples collected during previous investigations, no additional samples were collected at the site during this phase of investigation. The data collected previously at the site is re-evaluated in Sections 22.5, 22.6, and 22.7.

22.4 SITE CHARACTERISTICS

22.4.1 Geology

Regional mapping placed Site 22 in the outcrop area of the Kirkwood Formation; upper colluvium may be present at the site. The upper colluvium consists of massive sand and gravel and may contain quartz and ironstone pebbles. The Kirkwood Formation consists of gray and tan, very fine- to medium-grained quartz sand and dark-colored, micaceous, diatomaceous clay. The presence of upper colluvium or the Kirkwood Formation beneath the site cannot be confirmed because no soil borings were drilled at the site. However, the lithology of the sediments encountered in borings at Site 23 generally agrees with the published description of the upper colluvium and the Kirkwood and Vincentown Formations. Site 23 is located about 700 feet north-northwest of the site. In general, the borings at Site 23 encountered yellowish-brown, fine-to coarse-grained sand (possible representative of the upper colluvium), brownish and olive, fine- to medium-grained sand (probably representative of the Kirkwood Formation) and greenish-gray, glauconitic, fine- to medium-grained sand (probably representative of the Vincentown Formation).

22.4.2 Hydrogeology

Groundwater conditions at the site cannot be confirmed because no wells were installed at the site. However, groundwater in the Kirkwood and Vincentown aquifer beneath Site 23, and presumably Site 22, occurs under unconfined conditions and the formations are interpreted to be hydraulically interconnected. The direction of shallow groundwater flow in the aquifer beneath Site 23, as indicated by the August and October groundwater contour maps for Site 23, is toward the north-northeast.

22.5 NATURE AND EXTENT OF CONTAMINATION

22.5.1 Subsurface Soil

Eight subsurface soil samples were collected including two duplicates at Site 22 (figure 22-1) during the 1992 RI/FS. Tables 22-1 and 22-2 present the occurrence and distribution of inorganic and organic chemicals, respectively, in site-related subsurface soil samples and compare them to background values as presented in Section 31. Table 22-1a presents a comparison of detected compounds to ARARs and TBCs. Figure 22-2 shows sample locations and concentrations of compounds which exceed ARARs.

22.5.1.1 Inorganics

Concentrations of most metals in site-related subsurface soil samples were similar to the ranges associated with background samples. Site related concentrations of arsenic, chromium, and lead were detected below the background concentration range. However, these inorganic compounds are EPA designated carcinogenic inorganic chemicals and therefore are included as COPCs.

TABLE 22-1
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOIL AT SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	REPRESENTATIVE CONCENTRATION
ALUMINUM*	8 / 8	675 - 5310	5370.00	3 / 3	1370 - 4350	2930.00	NO	4350
ARSENIC	8 / 8	1.35 - 14.4	13.29	3 / 3	1.9 - 3.3	2.63	NO	3.3
BARIUM*	8 / 8	0.92 - 31	17.92	3 / 3	5.3 - 9.6	7.37	NO	9.6
BERYLLIUM*	2 / 8	0.12 - 0.28	0.28	3 / 3	0.22 - 0.45	0.32	YES	0.45
CALCIUM	8 / 8	28.6 - 799	577.55	3 / 3	9.7 - 55.2	34.77	NO	55.20
CHROMIUM*	8 / 8	4.7 - 59.5	54.73	3 / 3	17.1 - 48.2	37.37	NO	48.2
COPPER	8 / 8	0.97 - 8.6	8.66	3 / 3	2.5 - 17.2	8.13	YES	17.20
IRON*	8 / 8	3745 - 62500	40871.25	3 / 3	5520 - 9480	7780.00	NO	9480
LEAD*	8 / 8	1.4 - 39.4	24.33	3 / 3	6.3 - 29.8	14.70	NO	29.80
MAGNESIUM	8 / 8	18.5 - 619	504.05	3 / 3	131 - 661	414.67	NO	661
MANGANESE*	8 / 8	2.6 - 214	92.51	3 / 3	5 - 11.2	7.40	NO	11
NICKEL	4 / 8	1.8 - 7.2	4.75	1 / 3	2.8	1.22	NO	2.8
POTASSIUM	7 / 8	95 - 792	793.35	3 / 3	530 - 2270	1503.33	YES	2270
SELENIUM*	2 / 8	0.57 - 0.93	0.79	1 / 3	0.35	0.22	NO	0.35
SODIUM	8 / 8	17.5 - 94.8	79.35	3 / 3	21.7 - 97.4	50.30	NO	97
VANADIUM*	8 / 8	11.05 - 64	64.71	3 / 3	12.6 - 36.1	24.83	NO	36.10
ZINC	6 / 8	1.1 - 50.7	31.35	3 / 3	5.3 - 33.3	14.733333	NO	33.30

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 22-2
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,1,1-TRICHLOROETHANE	NOT DETECTED	-	-	1 / 3	2	2
4,4'-DDT	NOT DETECTED	-	-	2 / 3	4 - 5.2	5
ANTHRACENE	NOT DETECTED	-	-	1 / 2	82	82
BENZO(A)ANTHRACENE	NOT DETECTED	-	-	1 / 2	172	172
BENZO(A)PYRENE	NOT DETECTED	-	-	1 / 2	210	210
BENZO(B)FLUORANTHENE	NOT DETECTED	-	-	1 / 2	161	161
BENZO(G,H,I)PERYLENE	NOT DETECTED	-	-	1 / 2	100	100
BENZO(K)FLUORANTHENE	NOT DETECTED	-	-	1 / 2	130	130
BIS(2-ETHYLHEXYL)PHTHALAT	NOT DETECTED	-	-	1 / 2	97	97
CHRYSENE	NOT DETECTED	-	-	1 / 2	171.5	172
DI-N-BUTYLPHTHALATE	3 / 3	48 - 48	48	2 / 2	60 - 71	71
FLUORANTHENE	NOT DETECTED	-	-	1 / 2	580	580
INDENO(1,2,3-CD)PYRENE	NOT DETECTED	-	-	1 / 2	97	97
PHENANTHRENE	NOT DETECTED	-	-	1 / 2	155.5	155.50
PYRENE	NOT DETECTED	-	-	1 / 2	570	570

TABLE 22-1a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 22

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	22-007-S001	22-007-S002	22-008-S001	22-008-S001-DU	22-008-S002	22-009-S001	ARARS & TBCs		
LOCATION:	22-007-S001	22-007-S002	22-008-S001	22-008-S001	22-008-S002	22-009-S001	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	1370	n/a	3070	n/a	n/a	4350	-	-	-
arsenic	3.3	n/a	2.7	n/a	n/a	1.9	20.0	20.0	-
barium	7.2	n/a	5.3	n/a	n/a	9.6	700	47000	-
beryllium	0.22	n/a	0.45	n/a	n/a	0.30	1.00	1.00	-
calcium	55.2	n/a	39.4	n/a	n/a	9.7	-	-	-
chromium, total	17.1	n/a	48.2	n/a	n/a	46.8	-	500	-
copper	4.7	n/a	17.2	n/a	n/a	2.5	600	600	-
iron	8340	n/a	9480	n/a	n/a	5520	-	-	-
lead	29.8	n/a	6.3	n/a	n/a	8.0	400	600	-
magnesium	131	n/a	661	n/a	n/a	452	-	-	-
manganese	11.2	n/a	6.0	n/a	n/a	5.0	-	-	-
nickel	0.80 U	n/a	2.8	n/a	n/a	0.89 U	250	2400	-
potassium	530	n/a	2270	n/a	n/a	1710	-	-	-
selenium	0.31 U	n/a	0.30 U	n/a	n/a	0.35	63.0	3100	-
sodium	97.4	n/a	31.8	n/a	n/a	21.7	-	-	-
vanadium	12.6	n/a	36.1	n/a	n/a	25.8	370	7100	-
zinc	5.6	n/a	33.3	n/a	n/a	5.3	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
anthracene	440 U	n/a	82.0 J	440 U	n/a	480 U	10000000	10000000	100000
benzo(a)anthracene	440 U	n/a	280 J	64.0 J	n/a	480 U	900	4000	500000
benzo(a)pyrene	440 U	n/a	210 J	440 U	n/a	480 U	660	660	100000
benzo(b)fluoranthene	71.0 J	n/a	260 J	62.0 J	n/a	480 U	900	4000	50000
benzo(g,h,i)perylene	440 U	n/a	100 J	440 U	n/a	480 U	-	-	-
benzo(k)fluoranthene	52.0 J	n/a	200 J	60.0 J	n/a	480 U	900	4000	500000
benzoic acid	2200 U	n/a	54.0 J	2200 U	n/a	2400 U	-	-	-
bis(2-ethylhexyl)phthalate	440 U	n/a	450 U	97.0 J	n/a	480 U	49000	210000	100000
chrysene	440 U	n/a	270 J	73.0 J	n/a	480 U	9000	40000	500000
di-n-butylphthalate	58.0 J	n/a	450 U	71.0 J	n/a	60.0 J	5700000	10000000	100000

TABLE 22-1a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 22

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	22-007-S001	22-007-S002	22-008-S001	22-008-S001-DU	22-008-S002	22-009-S001	ARARS & TBCs		
LOCATION:	22-007-S001	22-007-S002	22-008-S001	22-008-S001	22-008-S002	22-009-S001	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS			
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
fluoranthene	110 J	n/a	580	190 J	n/a	480 U	2300000	10000000	100000
indeno(1,2,3-cd)pyrene	440 U	n/a	97.0 J	440 U	n/a	480 U	900	4000	500000
phenanthrene	440 U	n/a	230 J	81.0 J	n/a	480 U	-	-	-
pyrene	74.0 J	n/a	570	120 J	n/a	480 U	1700000	10000000	100000
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
1,1,1-trichloroethane	n/a	6.0 U	n/a	n/a	6.0 U	n/a	210000	1000000	50000
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDT	4.0 J	n/a	20.0 U	19.0 U	n/a	5.2 J	2000	9000	500000

TABLE 22-1a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 22

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	22-009-S002	22-009-S002-DU	---	---	---	---	ARARS & TBCs		
LOCATION:	22-009-S002	22-009-S002	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1992 RI/FS	1992 RI/FS							
INORGANICS	**mg/kg**	**mg/kg**					**mg/kg**	**mg/kg**	**mg/kg**
aluminum	n/a	n/a					-	-	-
arsenic	n/a	n/a					20.0	20.0	-
barium	n/a	n/a					700	47000	-
beryllium	n/a	n/a					1.00	1.00	-
calcium	n/a	n/a					-	-	-
chromium, total	n/a	n/a					-	500	-
copper	n/a	n/a					600	600	-
iron	n/a	n/a					-	-	-
lead	n/a	n/a					400	600	-
magnesium	n/a	n/a					-	-	-
manganese	n/a	n/a					-	-	-
nickel	n/a	n/a					250	2400	-
potassium	n/a	n/a					-	-	-
selenium	n/a	n/a					63.0	3100	-
sodium	n/a	n/a					-	-	-
vanadium	n/a	n/a					370	7100	-
zinc	n/a	n/a					1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
anthracene	n/a	n/a					10000000	10000000	100000
benzo(a)anthracene	n/a	n/a					900	4000	500000
benzo(a)pyrene	n/a	n/a					660	660	100000
benzo(b)fluoranthene	n/a	n/a					900	4000	50000
benzo(g,h,i)perylene	n/a	n/a					-	-	-
benzo(k)fluoranthene	n/a	n/a					900	4000	500000
benzoic acid	n/a	n/a					-	-	-
bis(2-ethylhexyl)phthalate	n/a	n/a					49000	210000	100000
chrysene	n/a	n/a					9000	40000	500000
di-n-butylphthalate	n/a	n/a					5700000	10000000	100000

TABLE 22-1a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 22

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	22-009-S002	22-009-S002-DU	---	---	---	---	ARARS & TBCs		
LOCATION:	22-009-S002	22-009-S002	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1992 RI/FS	1992 RI/FS							
SEMIVOLATILES	**ug/kg**	**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
fluoranthene	n/a	n/a					2300000	10000000	100000
indeno(1,2,3-cd)pyrene	n/a	n/a					900	4000	500000
phenanthrene	n/a	n/a					-	-	-
pyrene	n/a	n/a					1700000	10000000	100000
VOLATILES	**ug/kg**	**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
1,1,1-trichloroethane	2.0 J	6.0 U					210000	1000000	50000
PESTICIDES	**ug/kg**	**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDT	n/a	n/a					2000	9000	500000

TABLE 22-1a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

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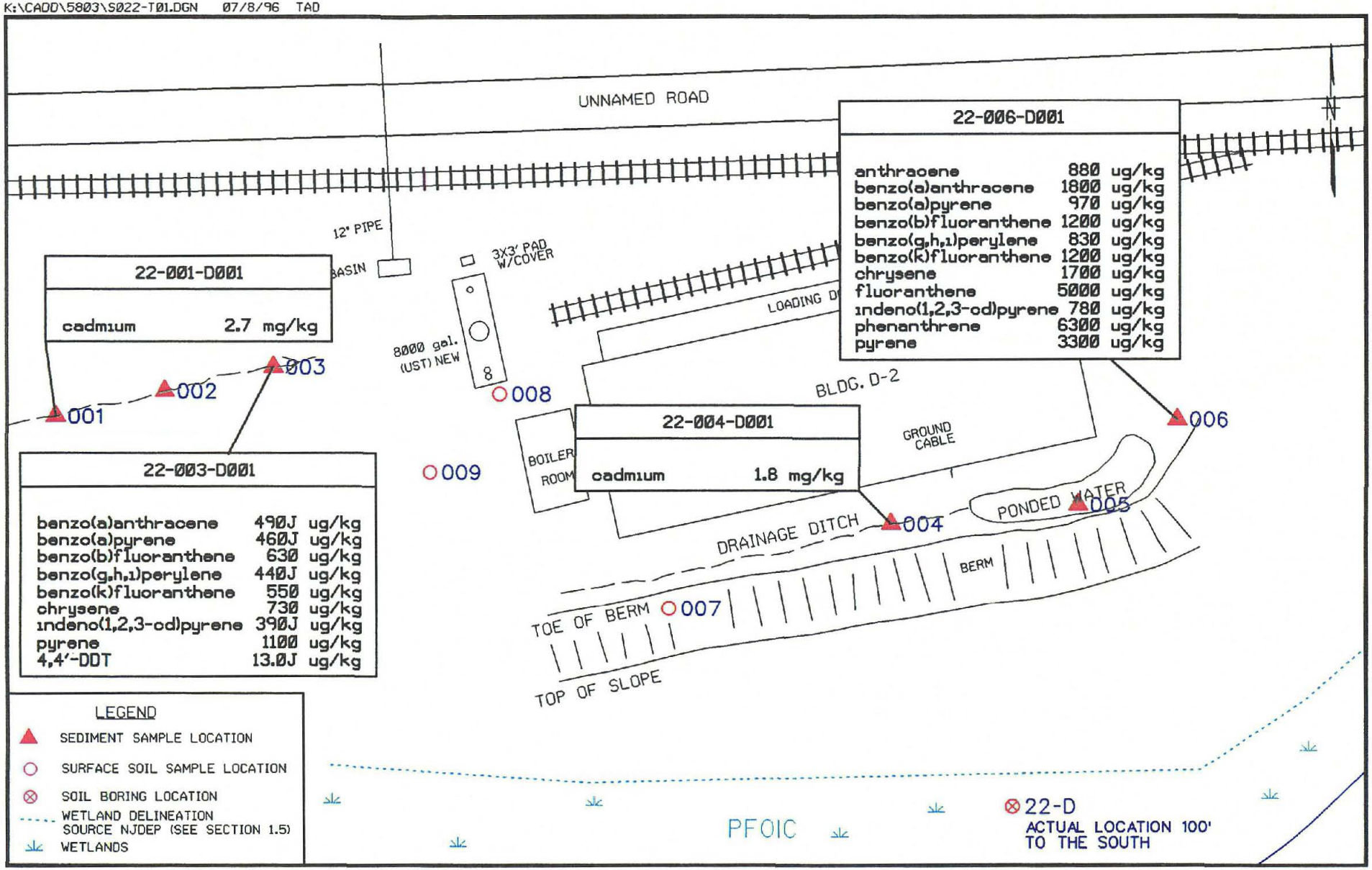

CONCENTRATIONS ABOVE SCREENING LEVELS

SITE 22 - PAINT CHIP DISPOSAL AREA

0 40 80

SCALE IN FEET

FIGURE 22-2

Brown & Root Environmental

Beryllium, an EPA designated carcinogenic inorganic chemical, was detected above background levels in samples 22-008-S001 (0.45 mg/kg) and 22-009-S001 (0.30 mg/kg).

Copper was detected above background concentrations in sample 22-008-S001 (17.2 mg/kg).

No inorganic chemicals were detected above New Jersey state standards.

22.5.1.2 Organics

Because most organics on the TCL are not naturally occurring, compounds with concentration levels below background and New Jersey state standards are included as COPCs. Site-related subsurface soil samples exhibited low levels of eleven PAHs, bis(2-ethylhexyl) phthalate, 4,4'-DDT, and 1,1,1-trichloroethane.

No organic compounds were detected above state standard levels.

Di-n-butyl phthalate was detected at concentrations above background levels. Concentrations of 58 ug/kg, 71 ug/kg, and 60 ug/kg were detected in samples 22-007-S001, 22-008-S001-DU, and 22-009-S001, respectively.

22.5.2 Sediment

Seven sediment samples, including one duplicate were collected at Site 22 (Figure 22-1) during the 1992 RI/FS. Tables 22-3 and 22-4 present the occurrence and distribution of inorganic and organic chemicals, respectively, in site related samples and compare them to background values. Table 22-3a presents a comparison of detected compounds to ARARs and TBCs.

22.5.2.1 Inorganics

Concentrations of most metals in site-related sediment samples were similar to the ranges associated with background samples. However, these inorganic compounds are EPA designated carcinogenic inorganic chemicals and therefore are included as COPCs.

Cadmium and lead, EPA designated carcinogenic inorganic chemicals, were detected above background and ecological screening criteria in site-related sediment samples. Concentrations of cadmium were detected above background and ecological screening criteria in samples 22-001-D001 (2.7 mg/kg) and 22-004-D001 (1.8 mg/kg), respectively. Lead was detected above background and ecological toxicity screening criteria sample 22-003-D001 (106 mg/kg) and above background in sample 22-001-D001 (42.9 mg/kg).

TABLE 22-3
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	5492.67	5 / 5	1180 - 3930	2328.00	NO	3930
ARSENIC	2 / 3	2.4 - 6.2	5.95	5 / 5	0.94 - 2.9	2.07	NO	2.9
BARIUM	3 / 3	3.9 - 10.6	14.07	5 / 5	1.1 - 16.5	8.28	NO	16.5
BERYLLIUM	1 / 3	0.57	0.67	5 / 5	0.13 - 0.36	0.24	NO	0.36
CADMIUM	NOT DETECTED	-	-	3 / 5	0.93 - 2.7	1.25	YES	2.70
CALCIUM	3 / 3	179 - 518	685.33	5 / 5	56.6 - 1260	576.33	YES	1260
CHROMIUM	3 / 3	4.3 - 56	43.13	5 / 5	11.6 - 31.8	19.06	NO	31.80
COBALT	1 / 3	2.1	3.30	2 / 5	1.1 - 5.2	1.52	NO	3.50
COPPER	3 / 3	1.5 - 13	12.47	5 / 5	0.77 - 18.3	6.59	NO	18.30
IRON	3 / 3	228 - 7650	6578.67	5 / 5	1505 - 13400	5703.01	NO	13400
LEAD	3 / 3	4.6 - 34.3	30.60	5 / 5	5.957 - 106	37.63	YES	106
MAGNESIUM	3 / 3	60.7 - 256	306.47	5 / 5	171 - 641	378.11	YES	641
MANGANESE	3 / 3	4.6 - 9.2	13.80	5 / 5	2.4 - 155	39.78	YES	101.64
NICKEL	2 / 3	2.1 - 6	7.93	1 / 5	8.6	2.09	NO	5.56
POTASSIUM	2 / 3	86.1 - 681	589.40	5 / 5	342 - 678	522.60	NO	678
SELENIUM	NOT DETECTED	-	-	2 / 5	0.37 - 0.38	0.25	YES	0.36
SODIUM	3 / 3	26.6 - 116	115.27	5 / 5	10.3 - 67.1	38.64	NO	67.10
VANADIUM	3 / 3	5.9 - 42.7	36.93	5 / 5	9.5 - 29	16.50	NO	29
ZINC	3 / 3	14.2 - 26.9	37.33	5 / 5	4 - 119	39.58	YES	119

Note: Selected COPCsare indicated in boldface type.

TABLE 22-4
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDT	1 / 3	19	19	1 / 2	13	13
ACENAPHTHENE	NOT DETECTED	-	-	1 / 3	300	300
ANTHRACENE	NOT DETECTED	-	-	2 / 3	71 - 880	880
BENZO(A)ANTHRACENE	2 / 3	140 - 560	560	2 / 3	490 - 1800	1800
BENZO(A)PYRENE	2 / 3	160 - 590	590	2 / 3	460 - 970	970
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	3 / 3	71 - 1200	1200
BENZO(G,H,I)PERYLENE	2 / 3	130 - 380	380	2 / 3	440 - 830	830
BENZO(K)FLUORANTHENE	2 / 3	150 - 470	470	3 / 3	52 - 1200	1200
BIS(2-ETHYLHEXYL)PHTHALAT	NOT DETECTED	-	-	1 / 3	77	77
CHRYSENE	2 / 3	250 - 940	940	2 / 3	730 - 1700	1700
DI-N-BUTYLPHTHALATE	NOT DETECTED	-	-	3 / 3	58 - 69	69
DIBENZ(A,H)ANTHRACENE	NOT DETECTED	-	-	2 / 3	64 - 220	220
FLUORANTHENE	2 / 3	300 - 1800	1800	3 / 3	110 - 5000	5000
FLUORENE	1 / 3	190	190	1 / 3	150	150
INDENO(1,2,3-CD)PYRENE	2 / 3	110 - 310	310	2 / 3	390 - 780	780
PHENANTHRENE	2 / 3	200 - 1900	1900	2 / 3	610 - 6300	6300
PYRENE	2 / 3	350 - 1900	1900	3 / 3	74 - 3300	3300

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TABLE 22-3a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 22

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	22-001-D001	22-003-D001	22-004-D001	22-005-D001	22-006-D001	22-006-D001-DU	---	ARARS & TBCs
LOCATION:	22-001-D001	22-003-D001	22-004-D001	22-005-D001	22-006-D001	22-006-D001	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS		
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**		**mg/kg**
aluminum	3930	2220	3010	1300	2360	0.031		-
arsenic	2.9	2.5	2.8	1.2	0.94	18.0 U		8.20 L
barium	16.5	8.0	9.2	1.1	6.6	4.0 U		40.0 B
beryllium	0.26	0.27	0.16	0.13	0.22	0.50		-
cadmium	2.7 E	0.90 U	1.8 E	0.75 U	0.93	0.34 U		1.20 L
calcium	1260	422	671	56.6	944	0.10		-
chromium, total	14.3	31.8	24.0	11.6	13.6	6.3 U		81.0 L
cobalt	5.2	1.1	0.93 U	0.75 U	0.93 U	3.4 U		50.0 T
copper	18.3	4.6	5.3	0.77	4.0	n/a		34.0 L
iron	13400	7090	3970	2550	3010	0.051		-
lead	42.9	106 E	26.9	6.4	11.9	0.014		47.0 L
magnesium	641	558	318	171	405	0.058		-
manganese	155	23.7	9.5	2.4	8.3	0.90 U		460 O
nickel	8.6	0.94 U	1.0 U	0.79 U	1.0 U	3.6 U		21.0 L
potassium	342	678	678	450	465	142 U		-
selenium	0.38	0.34 U	0.37	0.31 U	0.35 U	1.3 U		-
sodium	67.1	36.6	57.6	10.3	42.9	0.26		-
vanadium	21.4	29.0	12.5	9.5	10.1	2.6 U		-
zinc	119	20.9	35.6	4.0	36.8	0.0048		150 L
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**
acenaphthene	n/a	500 U	n/a	n/a	300 J	n/a		620 Q
anthracene	n/a	71.0 J	n/a	n/a	880 E	n/a		330 F
benzo(a)anthracene	n/a	490 E J	n/a	n/a	1800 E	n/a		330 F
benzo(a)pyrene	n/a	460 E J	n/a	n/a	970 E	n/a		430 L
benzo(b)fluoranthene	n/a	630 E	n/a	n/a	1200 E	n/a		330 F
benzo(g,h,i)perylene	n/a	440 E J	n/a	n/a	830 E	n/a		330 F
benzo(k)fluoranthene	n/a	550 E	n/a	n/a	1200 E	n/a		330 F
bis(2-ethylhexyl)phthalate	n/a	500 U	n/a	n/a	77.0 J	n/a		890000000 S

TABLE 22-3a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 22

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	22-001-D001	22-003-D001	22-004-D001	22-005-D001	22-006-D001	22-006-D001-DU	---	ARARS & TBCs
LOCATION:	22-001-D001	22-003-D001	22-004-D001	22-005-D001	22-006-D001	22-006-D001	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS		
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**
chrysene	n/a	730 E	n/a	n/a	1700 E	n/a		330 F
di-n-butylphthalate	n/a	69.0 J	n/a	n/a	68.0 J	n/a		11000 P
dibenz(a,h)anthracene	n/a	64.0 J	n/a	n/a	220 J	n/a		330 F
fluoranthene	n/a	1500	n/a	n/a	5000 E	n/a		2900 Q
fluorene	n/a	500 U	n/a	n/a	150 J	n/a		540 P
indeno(1,2,3-cd)pyrene	n/a	390 E J	n/a	n/a	780 E	n/a		330 F
phenanthrene	n/a	610	n/a	n/a	6300 E	n/a		850 Q
pyrene	n/a	1100 E	n/a	n/a	3300 E	n/a		660 L
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**
4,4'-DDT	n/a	13.0 E J	n/a	n/a	110 U	n/a		1.60 L

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 22

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	22-001-D001	22-002-D001	22-003-D001	22-004-D001	22-005-D001	22-006-D001	---	ARARS & TBCs
LOCATION:	22-001-D001	22-002-D001	22-003-D001	22-004-D001	22-005-D001	22-006-D001	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS	1992 RI/FS		
MISCELLANEOUS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**		**mg/kg**
petroleum hydrocarbons	27.0	5.9	12.0	15.0	13.0	48.0		-

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

Cobalt (5.2 mg/kg), copper (18.3 mg/kg), iron (13,400 mg/kg), manganese (155 mg/kg), and zinc (119 mg/kg) were detected above background levels in sample 22-001-D001. Manganese was also detected above background in samples 22-003-D001 (23.7 mg/kg) and 22-004-D001 (9.5 mg/kg).

22.5.2.2 Organics

Because most organics on the TCL are not naturally occurring, compounds with concentrations levels below background, New Jersey state standards and ecological criteria are included as COPCs. Site-related sediment samples exhibited low levels of fluorene.

Acenapthene (300 ug/kg), bis(2-ethylhexyl) phthalate (77 ug/kg), di-n-butyl phthalate (68 ug/kg), and dibenz(1,h)anthracene (220 ug/kg) were detected above background levels in sample 22-006-D001. Di-n-butyl phthalate (69 ug/kg), dibenz(a,h)anthracene (64 ug/kg), and phenanthrene (610 ug/kg) were detected in sample 22-003-D001 above background levels.

Ten PAHs and one pesticide were detected in site-related samples at concentrations above background levels and ecological toxicity screening criteria. Anthracene (880 ug/kg) and fluoranthene (5,000 ug/kg) were detected in high concentrations in sample 22-006-D001. Benzo(a)anthracene (490 and 1,800 ug/kg), benzo(a)pyrene (460 and 970 ug/kg), benzo(b)flouranthene (630 and 1,200 ug/kg), benzo(g,h,i)perylene (440 and 830 ug/kg), benzo(k)fluoranthene (550 and 1,200 ug/kg), chrysene (730 and 1,700 ug/kg), indeno(1,2,3-cd)pyrene (390 and 780 ug/kg), and pyrene (1,100 and 3,300 ug/kg) were detected in samples 22-003-D001 and 22-006-D001, respectively. 4,4'-DDT was detected in sample 22-003-D001 (13 ug/kg).

22.5.2.3 Miscellaneous Parameters

Miscellaneous parameter analyses of six sediment samples consisted of petroleum hydrocarbons (5.9 mg/kg to 48 mg/kg). Petroleum hydrocarbon levels in sediment did not exceed background.

22.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 22 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 22.6.1. Persistence of detected chemicals in the environment is discussed in Section 22.6.2. Section 22.6.3 presents a brief discussion of contaminant trends.

22.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 22 indicate two metals, cadmium and lead, and several PAHs are present in sediment at levels greater than background and greater than ecological toxicity screening criteria. In addition, 1,1,1-trichloroethane, 4,4'-DDT, and two phthalates were detected at low concentrations, above background, but below NJDEP conservative soil cleanup criteria.

The physical transport data for the detected contaminants are presented in Table 2-10. Bis(2-ethylhexyl)phthalate and di-n-butylphthalate, detected in soil and sediment samples, are common plasticizers that can slowly leach from discarded plastics in the environment.

1,1,1-Trichloroethene exhibits a high degree of water solubility and volatility; hence, this substance may migrate through leaching to groundwater or evaporation from soil.

PAHs, detected in soil and sediment, are considered relatively immobile and are not expected to leach to groundwater or migrate readily except through erosional dispersion.

Many metals are adsorbed onto soil and sediment easily but may also exist in dissolved or suspended forms. The primary migration route for metals present in near-surface soils is considered to be erosional transport towards the drainage ditch.

22.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Transformation of a chemical to degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The product chemical(s) may or may not be significantly different toxicologically or different from a physical transport perspective. If the transformational process is known or suspected, product chemicals can be predicted and extent of transformation can be determined from chemical reaction rate data. Other transformational processes may be identified empirically from analytical data.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater, saturated zone soils, surface water, and sediment) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

PAHs present in soil or sediment can be biodegraded but the rate of degradation is slower for the higher molecular weight compounds. The rate of degradation depends on a number of factors including oxygen, carbon sources, nutrients, pH, moisture, and appropriate acclimatized organisms.

A variety of unicellular and multicellular organisms take up and accumulate phthalate esters, and bioaccumulation is considered an important fate process (Clement Associates, 1985). Biodegradation is also considered an important fate process. Because phthalate esters are degraded under most conditions and can be metabolized by multicellular organisms, it is unlikely that long-term bioaccumulation or biomagnification occurs.

The trace level of 1,1,1-trichloroethene detected in subsurface soil may attenuate over time through volatilization, leaching, and/or biodegradation.

22.6.3 Observed Chemical Contaminant Trends

PAHs and phthalates were detected in several shallow soil and sediment samples, but the concentrations are considered relatively low. PAHs are found in heavy fuels, oils, combustion residues, and tar. The original source of PAHs found at Site 22 is not known; however, this concentration range is not unusual for urban or suburban areas where residues from burning could be present. The pattern of PAH contamination in the drainage ditch sediments is potentially related to the presence of PAHs in areas near the sampled surface soils, although low levels of PAHs concievably could be associated with erosional transport from other unknown source locations.

Cadmium and lead were the only metals detected in Site 22 sediments that might indicate a pattern of contamination related to paint chip disposal. Although several other metals were present at levels greater than the range of background samples collected for the 1995 RI, generally the ranges found at Site 22 are within or similar to ranges detected in suburban soil throughout New Jersey (NJDEP, 1993).

1,1,1-Trichloroethane was detected at a trace level in only one soil sample, but was not detected in the duplicate of this sample. Based on this sporadic detection at levels below the quantitation limit, it should not be concluded that there is a potential for widespread VOC contamination at this site.

22.6.4 Conclusions

Low levels of heavy molecular weight PAHs and phthalates detected in soils and sediment at Site 22 have very little or no potential for impacts to groundwater, and downstream migration is expected to remain limited. 1,1,1-Trichloroethane detected in one subsurface soil is potentially mobile in the environment; however, the concentration is extremely low and does not appear indicative of widespread or significant contamination.

Of the metals detected in soil and sediment, only cadmium and lead were detected at levels that suggests a relationship to paint chip disposal; other metals detected at Site 22 are within background ranges for the current investigation or within ranges documented for New Jersey soils. The low levels of cadmium and lead at Site 22 are not expected to produce groundwater impacts or significant sediment contamination at distances farther downstream.

22.7 BASELINE RISK ASSESSMENT

This section present the results of the baseline risk assessment for Site 22. The risk assessment was performed using the approach outlined in Section 2.4. Tables 22-5 and 22-6 provide the selected COPCs and representative concentrations of inorganics and organics in site-related subsurface soil and sediment, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The result of the conservative baseline risk assessment was greater than 1E-04 for cancer risk and greater than a value of 1.0 for non-cancer risk; therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. Section 22.7.1.4 discusses the modifications made to the conservative preliminary baseline risk assessment.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remedial procedures are identified for a site.

22.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of current land use (industrial employee) and hypothetical future land use (residential, recreational, and industrial receptors).

22.7.1.1 Future Industrial Employee

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil at Site 22 are 1.9E-05 (ingestion), 2.7E-05 (dermal contact), and 3.0E-08 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate ARARs. The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 89 percent of the cancer risk for this pathway; and dermal contact, 21 percent of the cancer risk for this pathway) and beryllium (dermal contact, 78 percent of the cancer risk for this pathway).

TABLE 22-5
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

SUBSTANCE	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	4350	NONPARAMETRIC
ARSENIC	3.3	NONPARAMETRIC
BARIUM	9.6	NONPARAMETRIC
BERYLLIUM	0.45	NONPARAMETRIC
CHROMIUM	48.2	NONPARAMETRIC
COPPER	17.20	NONPARAMETRIC
IRON	9480	NONPARAMETRIC
LEAD	29.80	NONPARAMETRIC
MAGNESIUM	661	NONPARAMETRIC
MANGANESE	11.20	NONPARAMETRIC
POTASSIUM	2270	NONPARAMETRIC
SELENIUM	0.35	NONPARAMETRIC
VANADIUM	36.10	NONPARAMETRIC
ZINC	33.30	NORMAL
1,1,1-TRICHLOROETHANE	2	LOGNORMAL
4,4'-DDT	5.2	NONPARAMETRIC
ANTHRACENE	82	NONPARAMETRIC
BENZO(A)ANTHRACENE	172	NONPARAMETRIC
BENZO(A)PYRENE	210	NONPARAMETRIC
BENZO(B)FLUORANTHENE	161	NONPARAMETRIC
BENZO(G,H,I)PERYLENE	100	NONPARAMETRIC
BENZO(K)FLUORANTHENE	130	NONPARAMETRIC
BIS(2-ETHYLHEXYL)PHTHALAT	97	NONPARAMETRIC
CHRYSENE	171.5	NONPARAMETRIC
DI-N-BUTYLPHTHALATE	71	NONPARAMETRIC
FLUORANTHENE	580	NONPARAMETRIC
INDENO(1,2,3-CD)PYRENE	97	NONPARAMETRIC
PHENANTHRENE	155.5	NONPARAMETRIC
PYRENE	570	NONPARAMETRIC

*Organics are in ug/kg

TABLE 22-6
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SEDIMENT - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

SUBSTANCE	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	3930	NONPARAMETRIC
ARSENIC	2.9	NONPARAMETRIC
BARIUM	16.5	NONPARAMETRIC
BERYLLIUM	0.36	NONPARAMETRIC
CADMIUM	2.70	NONPARAMETRIC
CHROMIUM	31.80	NONPARAMETRIC
COBALT	3.50	NORMAL
COPPER	18.30	NONPARAMETRIC
IRON	13400	NONPARAMETRIC
LEAD	106	NONPARAMETRIC
MANGANESE	101.64	NORMAL
NICKEL	5.56	NORMAL
SELENIUM	0.36	NORMAL
SODIUM	67.10	NONPARAMETRIC
VANADIUM	29	NONPARAMETRIC
ZINC	119	NONPARAMETRIC
4,4'-DDT	13	NONPARAMETRIC
ACENAPHTHENE	300	NONPARAMETRIC
ANTHRACENE	880	NONPARAMETRIC
BENZO(A)ANTHRACENE	1800	NONPARAMETRIC
BENZO(A)PYRENE	970	NONPARAMETRIC
BENZO(B)FLUORANTHENE	1200	NONPARAMETRIC
BENZO(G,H,I)PERYLENE	830	NONPARAMETRIC
BENZO(K)FLUORANTHENE	1200	NONPARAMETRIC
BIS(2-ETHYLHEXYL)PHTHALATE	77	NONPARAMETRIC
CHRYSENE	1700	NONPARAMETRIC
DI-N-BUTYLPHTHALATE	69	NONPARAMETRIC
DIBENZ(A,H)ANTHRACENE	220	LOGNORMAL
FLUORANTHENE	5000	NONPARAMETRIC
FLUORENE	150	NONPARAMETRIC
INDENO(1,2,3-CD)PYRENE	780	NONPARAMETRIC
PHENANTHRENE	6300	NONPARAMETRIC
PYRENE	3300	NONPARAMETRIC

*Organics are in ug/kg

The estimated individual noncarcinogenic HQs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becoming future surface soils) are less than one for ingestion, dermal contact, and inhalation of fugitive dust pathways. Adverse noncarcinogenic health effects are not anticipated when the HI is below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for the future industrial receptors exposed to subsurface soils at Site 22 in Tables 22-7 and 22-8, respectively.

22.7.1.2 Future Residential Receptor

The conservative preliminary baseline risk assessment yielded an estimated total cancer risk greater than 1E-04 for the future lifetime resident assuming exposure to COPCs in surface soil (assuming subsurface soils become future surface soils). In addition, this risk assessment yielded an estimated noncarcinogenic HI with a value greater than 1.0 for the future residential child assuming exposure to subsurface soil. (Ingestion and dermal contact exposures contributed the significant portion of cancer and non-cancer risks.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for residential exposure to surface soil are discussed in Section 22.7.1.4 and presented in Tables 22-9, 22-9a, and 22-10.

22.7.1.3 Future Recreational Receptor

The estimated total cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 22 are 1.9E-07 (ingestion) and 6.9E-08 (dermal contact). This sediment cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The estimated carcinogenic HIs for the future recreational child assuming exposure to COPCs in sediment during wading at Site 22 are 1.2E-02 (ingestion) and 1.3E-02 (dermal contact). Adverse noncarcinogenic health effects are not anticipated when the HI is below 1.0.

Estimated carcinogenic risks and noncarcinogenic adverse HQs are presented for future recreational receptors exposed to sediment at Site 22 in Tables 22-11 and 22-12, respectively.

22.7.1.3 Lead Results

Lead was not found above the EPA level of concern (400 mg/kg) in soil samples taken during the RI.

The IEUBK Lead model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 22 exposures are presented in Appendix I.

TABLE 22-7
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 22
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,1,1-TRICHLOROETHANE	N/A	N/A	N/A
4,4'-DDT	5.9E-10	N/A	1.3E-13
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	4.4E-08	N/A	9.5E-12
BENZO(A)PYRENE	5.4E-07	N/A	1.2E-10
BENZO(B)FLUORANTHENE	4.1E-08	N/A	8.9E-12
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	3.3E-09	N/A	7.2E-13
BIS(2-ETHYLHEXYL)PHTHALATE	4.7E-10	N/A	8.8E-14
CHRYSENE	4.4E-10	N/A	9.5E-14
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
INDENO(1,2,3-CD)PYRENE	2.5E-08	N/A	5.3E-12
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	1.7E-05	1.7E-05	3.8E-09
COPPER	N/A	N/A	N/A
TOTAL RISK	1.8E-05	1.7E-05	4.0E-09

**CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 22-8
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 22
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,1,1-TRICHLOROETHANE	2.2E-08	N/A	4.3E-12
4,4'-DDT	9.8E-06	N/A	1.8E-09
ANTHRACENE	2.7E-07	N/A	5.0E-11
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	4.7E-06	N/A	8.8E-10
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	6.9E-07	N/A	1.3E-10
FLUORANTHENE	1.4E-05	N/A	2.6E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	1.9E-05	N/A	3.4E-09
ARSENIC	1.1E-02	1.1E-02	2.0E-06
COPPER	4.2E-04	N/A	7.8E-08

TABLE 22-9
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 22
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,1,1-TRICHLOROETHANE	N/A	N/A	N/A
4,4'-DDT	2.7E-09	N/A	8.1E-14
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	2.0E-07	N/A	5.8E-12
BENZO(A)PYRENE	2.4E-06	N/A	7.1E-11
BENZO(B)FLUORANTHENE	1.8E-07	N/A	5.5E-12
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	1.5E-08	N/A	4.4E-13
BIS(2-ETHYLHEXYL)PHTHALATE	2.1E-09	N/A	5.4E-14
CHRYSENE	2.0E-09	N/A	5.8E-14
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
INDENO(1,2,3-CD)PYRENE	1.1E-07	N/A	3.3E-12
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	7.7E-05	5.6E-05	2.4E-09
COPPER	N/A	N/A	N/A
TOTAL RISK	8.0E-05	5.6E-05	2.4E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 22-9a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 22
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,1,1-TRICHLOROETHANE	N/A	N/A	N/A
4,4'-DDT	4.3E-10	N/A	2.5E-14
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	3.2E-08	N/A	1.8E-12
BENZO(A)PYRENE	3.9E-07	N/A	2.2E-11
BENZO(B)FLUORANTHENE	3.0E-08	N/A	1.7E-12
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	2.4E-09	N/A	1.4E-13
BIS(2-ETHYLHEXYL)PHTHALATE	3.4E-10	N/A	1.7E-14
CHRYSENE	3.1E-10	N/A	1.8E-14
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
INDENO(1,2,3-CD)PYRENE	1.8E-08	N/A	1.0E-12
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	9.9E-06	1.4E-05	5.8E-10
COPPER	N/A	N/A	N/A
TOTAL RISK	1.0E-05	1.4E-05	6.1E-10

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
• CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 22-10
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 22
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
1,1,1-TRICHLOROETHANE	2.8E-07	N/A	4.5E-12
4,4'-DDT	1.3E-04	N/A	1.9E-09
ANTHRACENE	3.5E-06	N/A	5.2E-11
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	6.2E-05	N/A	9.3E-10
CHRYSENE	N/A	N/A	N/A
DI-N-BUTYLPHTHALATE	9.1E-06	N/A	1.4E-10
FLUORANTHENE	1.9E-04	N/A	2.8E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	2.4E-04	N/A	3.6E-09
ARSENIC	1.4E-01	8.7E-02	2.1E-06
COPPER	5.5E-03	N/A	8.2E-08

TABLE 22-11
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 22
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDT	4.8E-11	1.2E-11
ACENAPHTHENE	N/A	N/A
ANTHRACENE	N/A	N/A
BENZO(A)ANTHRACENE	1.4E-08	5.7E-09
BENZO(A)PYRENE	7.8E-08	1.0E-07
BENZO(B)FLUORANTHENE	9.6E-09	3.8E-09
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	9.6E-10	3.8E-10
BIS(2-ETHYLHEXYL)PHTHALATE	1.2E-11	4.7E-12
CHRYSENE	1.4E-10	5.4E-11
DI-N-BUTYLPHTHALATE	N/A	N/A
DIBENZ(A,H)ANTHRACENE	1.8E-08	3.5E-08
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
INDENO(1,2,3-CD)PYRENE	6.2E-09	2.5E-09
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
ALUMINUM	N/A	N/A
ARSENIC	4.8E-08	2.0E-09
BARIUM	N/A	N/A
BERYLLIUM	1.7E-08	6.7E-08
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
NICKEL	N/A	N/A
SELENIUM	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	1.9E-07	2.2E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 22-12
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 22
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDT	3.3E-06	8.2E-07
ACENAPHTHENE	6.4E-07	2.5E-07
ANTHRACENE	3.8E-07	1.5E-07
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	4.9E-07	1.9E-07
CHRYSENE	NA	NA
DI-N-BUTYLPHTHALATE	8.8E-08	1.9E-08
DIBENZ(A,H)ANTHRACENE	NA	NA
FLUORANTHENE	1.6E-05	6.3E-06
FLUORENE	4.8E-07	1.9E-07
INDENO(1,2,3-CD)PYRENE	NA	NA
PHENANTHRENE	NA	NA
PYRENE	1.4E-05	5.6E-06
ALUMINUM	5.0E-04	4.0E-04
ARSENIC	1.2E-03	5.2E-05
BARIUM	3.0E-05	3.0E-05
BERYLLIUM	9.2E-06	3.6E-05
CADMIUM	6.9E-04	5.5E-04
CHROMIUM	8.1E-04	1.6E-03
COBALT	7.5E-06	5.9E-06
COPPER	5.8E-05	3.9E-06
IRON	5.7E-03	4.5E-03
LEAD	NA	NA
MANGANESE	2.6E-03	3.4E-03
NICKEL	3.6E-05	9.4E-06
SELENIUM	9.2E-06	4.5E-07
VANADIUM	5.3E-04	2.1E-03
ZINC	5.1E-05	8.0E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

22.7.1.4 Amended Risk Assessment

The amended risk assessment recalculated the cancer and non-cancer risks at Site 22 for future residential receptors assuming exposure to COPCs in and subsurface soil.

Comparison to Background

Aluminum, barium, chromium, iron, lead, manganese, selenium, and vanadium were eliminated from consideration as subsurface soil COPCs based on a comparison of average levels to twice the background level. However, since arsenic is a class A carcinogen, it could not be eliminated from consideration. Beryllium was eliminated from consideration based on a statistical evaluation of background concentrations of metals. The site related maximum concentration of beryllium detected in subsurface soil was 0.45 mg/kg compared to a upper tolerance limit (UTL) value of 1.22 mg/kg for beryllium in background subsurface soils. Table 22-1 presents the comparison of COPCs to background concentrations.

Consideration of Modified Dermal Absorption and Target Organ Grouping

As discussed in Section 2.4.6.2, cancer and non-cancer risks were recalculated using modified soil-to-skin absorption factors for three chemicals and excluding dermal effects for other COPCs. After these steps, the revised RME non-cancer HIs for the soil ingestion, dermal contact, and dust inhalation pathways yield a total HI which is less than 1.0 for the future residential child exposed to subsurface soil (assuming subsurface soil becomes future surface soil).

For the future lifetime resident exposed to COPCs in subsurface soil at Site 22, the final RME cancer risks for the ingestion and dermal contact exposure pathways are individually within the target acceptable risk range, but the sum of these cancer risks (total risk) was approximately 1E-04, the upper end of the target risk range. Arsenic is the principal COPC contributing to subsurface soil RME cancer risks (ingestion - 94 percent of the cancer risk for this exposure pathway; dermal contact - 100 percent of the cancer risk for this pathway).

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soil (assuming subsurface soil becomes future surface soil) in Tables 22-9 and 22-10, respectively.

Application of Central Tendencies Guidance

Central tendency assumptions were applied to calculate cancer risks for exposure to COPCs in subsurface soil for future residential receptors. Central tendency generates a lower risk estimate than RME because it assumes typical rather than upper range receptor behavior patterns related to the ingested dose. Based on this evaluation, the central tendency cancer risks for the soil ingestion, dermal contact, and dust

inhalation pathways yield a sum which is less than 1E-04 for the future residential receptor exposed to subsurface soil (assuming subsurface soil becomes future surface soil).

22.7.2 Conclusions

Subsurface soil and sediment were sampled at Site 22. The potential receptors considered for this site were future industrial, residential, and recreational receptors. The total RME cancer risk associated with the future residential (subsurface soil) exposure scenario was approximately 1E-04; the upper end of the target risk range. However, the RME estimate for the future residential receptor is probably overconservative because a central tendency calculation shows that cancer risks are more likely to be within the mid-range of the target acceptable risk range.

The RME cancer risk associated with the future industrial (subsurface soil) exposure scenario was approximately 5E-05; within the target acceptable risk range. The cancer risk associated with the future recreational (sediment) exposure scenario via ingestion and dermal contact was below 1E-06. Arsenic (via ingestion of and dermal contact with subsurface soil) was the major COPC that contributed to the cancer risk for the future residential receptor and the future industrial receptor exposure scenarios.

Noncarcinogenic HQs associated with the future residential and future industrial (subsurface soil) exposure scenarios and the future recreational (sediment) exposure scenario were below 1.0; the cutoff point below which adverse effects are not expected to occur.

Lead concentrations detected at the site were below the EPA guidelines are not expected to be associated with significant increases in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

The amended risk assessment procedure resulted in the elimination of all COPCs with which had calculated risk above target guideline limits. Arsenic could not be eliminated from consideration because it is a class A carcinogen.

Risk characterization results (total RME cancer risks and noncarcinogenic HIs) are presented for all potential receptors at Site 22 in Table 22-13 for subsurface soil and sediment. Table 22-13a presents the relevant central tendency risk estimates associated with potential receptors for subsurface soil.

22.8 ECOLOGICAL RISK ASSESSMENT

22.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Site 22 is bordered on the west and south by a berm. The area between the berm and Building D-2 is

covered with grass. Site 23 is located north of Site 22, and the two areas are separated by a road, railroad bed, and a drainage ditch on the north side of the road. A culvert runs under the road at the northwest corner of the site. A grassy swale (small drainage ditch) enters the site northwest of Building D-2 and runs behind the building, inside the bermed area. All drainage within the bermed area flows toward this swale. Water generally flows in the swale behind the site only after periods of heavy rainfall, and water occasionally pools near the southeast corner of the building. The swale exits the site near the northeastern corner of Building D-2 and runs southeast, adjacent to the railroad tracks that run parallel to the road. In this area, the swale is extremely shallow and usually dry; water is present only after heavy rainfall. The swale converges with a small upper tributary of Hockhockson Brook 500 feet from the site. The tributary originates near Site 4, approximately 300 yards west of Site 22. Site 22 is located within the Hockhockson Brook Watershed. A red maple swamp is located south of the Site 22 berm. The upper tributary of Hockhockson Brook runs through the swamp. Site 22 is a small area which contains limited habitat of marginal value, while the adjacent wooded swamp provides excellent wetland habitat, primarily for terrestrial receptors. Most terrestrial mammals and birds found on the site are expected to utilize the swamp, as well as semi-aquatic organisms, such as mink and muskrat. No sensitive habitats, other than the wetlands, or threatened or endangered species exist on or around Site 22.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathway from the site is overland runoff, and to a lesser extent, infiltration of contaminants. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and surface soils, particularly to the swale. The berm inhibits overland runoff or erosion from reaching the swamp, but runoff may leave the site via the swale. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a contaminant may be carried with the flow of groundwater to downgradient locations. Groundwater from the site may eventually discharge to surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. The direction of groundwater under the site is not fully known, although groundwater at Site 23, 200 feet north of Site 22, flows to the north-northeast. If groundwater conditions are the same, flow would be away from the swamp south of Site 22. As a result, the possibility of groundwater-to-surface migration appears to be minimal.

Exposure Routes

Terrestrial receptors at Site 22 may be exposed to surface soil contaminants via incidental ingestion of soil or by ingestion of contaminated food items, although this is expected to be minimal since terrestrial habitat is limited near the site. Terrestrial receptors may also come into contact with contaminants in Site 22 surface water by using it for drinking, although this pathway is generally insignificant. Terrestrial vegetation may also be exposed to contaminants in surface soils at Site 22. However, since the only vegetation present is mowed turfgrass, risks to terrestrial plants were not investigated. Aquatic organisms inhabiting off-site wetlands may be exposed to contaminants via direct contact with surface water and sediments,

TABLE 22-13
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk					Estimated Hazard Index**						
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident				Future Recreational Child
									Child	Adult	Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.8E-05^	8.0E-05^	N/A	N/A	N/A	1.1E-02^	1.5E-01^	N/A	N/A	N/A	N/A
	Dermal Contact	N/A	1.7E-05^	5.6E-05^	N/A	N/A	N/A	1.1E-02^	8.7E-02^	N/A	N/A	N/A	N/A
	Inhalation of Fugitive Dust	N/A	4.0E-09^	2.4E-09^	N/A	N/A	N/A	2.1E-06^	2.2E-06^	N/A	N/A	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/A	1.9E-07	N/A	N/A	N/A	N/A	N/A	N/A	1.2E-02
	Dermal Contact	N/A	N/A	N/A	N/A	2.2E-07	N/A	N/A	N/A	N/A	N/A	N/A	1.3E-02
Groundwater	Ingestion	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/A	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/A	N/A	N/S
TOTAL		-	3.5E-05	1.4E-04	-	4.1E-07	-	2.2E-02	2.3E-01	-	-	-	2.5E-02

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.

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TABLE 22-13a
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk					Estimated Hazard Index**						
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident				Future Recreational Child
									Child	Adult	Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	1.0E-05^	N/A	N/A	N/A	N/R	N/R	N/A	N/A	N/A	N/A
	Dermal Contact	N/A	N/R	1.4E-05^	N/A	N/A	N/A	N/R	N/R	N/A	N/A	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/R	6.1E-10^	N/A	N/A	N/A	N/R	N/R	N/A	N/A	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/A	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/A	N/A	N/S
	TOTAL	-	-	2.4E-05	-	-	-	-	-	-	-	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.

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incidental ingestion of surface water and sediments, and consumption of contaminated prey. Nonetheless, the absence of runoff from the site to the swamp precludes most exposure routes for aquatic or semi-aquatic organisms in the swamp. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water, although this route appears to be insignificant due to presumed groundwater flow away from the swamp.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1993 RI/FS activities for this site. In particular, contaminants detected in Site 22 drainage swale sediments and surface soils were considered preliminary COPCs.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

22.8.2 Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminated sediments and surface soil. Sediment and surface soil ET values are presented in Tables 2-29 and 2-30, respectively.

22.8.3 Preliminary Exposure Assessment

Representative exposure point contaminant concentrations in sediments and surface soil used for this initial screening were obtained from data generated during 1993 RI/FS activities. The maximum detected contaminant concentrations in sediments and surface soils were conservatively used as representative exposure point concentrations. Potential risks from contaminants in surface soils were investigated for terrestrial animals, but potential risks to terrestrial plants were not investigated since the only terrestrial vegetation present is mowed turfgrass. Background concentrations were maximum values detected in facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

22.8.4 Risk Characterization

In Site 22 sediments, the inorganics cadmium and lead each exceeded the most conservative ETs available, and were retained as final COPCs, but did not exceed less conservative ETs (Table 22-14). Of the organics detected in Site 22 sediments, 4,4-DDT exceeded the most conservative ET available, but did not exceed a less conservative value. Fluoranthene, a PAH, exceeded the only ET value available. Several other PAHs exceeded the most conservative ETs available, and were retained as final COPCs, but did not exceed less conservative values, and the PAHs benzo(a)anthracene, phenanthrene, and pyrene exceeded both most and less conservative values. Aluminum, beryllium, selenium, and vanadium were conservatively retained as final COPCs in sediments since no suitable ET values were available.

In Site 22 surface soils, the inorganics aluminum, chromium, and vanadium exceeded ET values and were retained as final COPCs (Table 22-15). In addition, several PAHs exceeded ET values and were retained as final COPCs. No suitable ETs were available for bis(2-ethylhexyl)phthalate or di-n-butylphthalate, and hence, they were conservatively retained as final COPCs in surface soil.

The toxicological properties of final COPCs in sediments and surface soils are summarized in Appendix M.

22.8.5 Summary and Conclusions

Site 22 provides only limited habitat of relatively poor ecological value, while the swamp to the south provides excellent wetland habitat. Most of the swamp is wooded, and hence, provides habitat primarily for terrestrial and semi-aquatic receptors. A drainage swale runs along the inside border of the berm and receives all overland flow in the area. The swale exits the site and runs southeast along the railroad tracks. A small tributary of Hockhockson Brook runs through the swamp and connects with the drainage swale several hundred feet southeast of the site. Runoff of contaminants to the swamp is precluded by the berm that surrounds most of the site, but runoff may exit the site via the swale. Groundwater-to-surface water contaminant migration in the wetlands is unlikely due to the presumed direction of groundwater flow.

Representative contaminant concentrations used for this assessment were obtained from 1993 RI/FS surface soil samples taken inside the berm and sediment samples taken where the swale enters the site and runs around the building (Figure 22-1). In sediments, some inorganics exceeded most conservative ET values, but their HQ values were indicative of low potential risk. Aluminum, beryllium, and vanadium were conservatively retained as final COPCs in sediments since no suitable ETs were available, but all of these inorganics were present in concentrations lower than background. No suitable ET was available for selenium. This inorganic was not detected in background, but was present in only low levels in two of five samples. The organochlorine 4,4'-DDT and several PAHs exceeded most conservative ET values,

TABLE 22-14
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	5/5	3940	3930.0	NA		Retained-No suitable threshold available
Arsenic	5/5	6.2	2.90	8.2	0.35	Eliminated-Does not exceed threshold
Barium	5/5	10.6	16.5	40.00	0.41	Eliminated-Does not exceed threshold
Beryllium	5/5	0.57	0.36	NA		Retained-No suitable threshold available
Cadmium	3/5	ND	2.7	1.2/9.6	2.25/0.28	Retained-HQ > 1
Chromium	5/5	56	31.8	81	0.39	Eliminated-Does not exceed threshold
Cobalt	2/5	2.1	5.2	50.00	0.10	Eliminated-Does not exceed threshold
Copper	5/5	13	18.3	34	0.54	Eliminated-Does not exceed threshold
Lead	5/5	34.3	106.0	47/218	2.25/0.49	Retained-HQ > 1
Manganese	5/5	9.2	155	460.00	0.34	Eliminated-Does not exceed threshold
Nickel	1/5	6	5.56	21	0.26	Eliminated-Does not exceed threshold
Selenium	2/5	ND	0.38	NA		Retained-No suitable threshold available
Vanadium	5/5	42.7	29.0	NA		Retained-No suitable threshold available
Zinc	5/5	26.9	119.0	150.0	0.79	Eliminated-Does not exceed threshold
Organics[3]						
4,4'-DDT	1/2	19.0	13.0	1.6/46	8.13/0.28	Retained-HQ > 1
Acenapthene	1/3	ND	300.0	620.00	0.48	Eliminated-Does not exceed threshold
Anthracene	2/3	ND	880.0	330.00/1700.0	2.67/0.52	Retained-HQ > 1
Benzo(a)anthracene	2/3	560.0	1800.0	330.00/1600.0	5.45/1.13	Retained-HQ > 1
Benzo(a)pyrene	2/3	590.0	970.0	430/1600	2.25/0.61	Retained-HQ > 1
Benzo(b)fluoranthene	3/3	490.0	1200.0	330.00/1700.0	3.64/0.71	Retained-HQ > 1
Benzo(g,h,i)perylene	2/3	380.0	830.0	330.00/1700.0	2.52/0.49	Retained-HQ > 1
Benzo(k)fluoranthene	3/3	470.0	1200.0	330.00/1700.0	3.64/0.71	Retained-HQ > 1
Bis(2-ethylhexyl)phthalate	1/3	ND	77.0	8.90E+08	0.00	Eliminated-Does not exceed threshold
Chrysene	2/3	940.0	1700.0	330.00/2800.0	5.15/0.61	Retained-HQ > 1

TABLE 22-14
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Di-n-butylphthalate	2/3	ND	69.0	11,000.0	0.01	Eliminated-Does not exceed threshold
Dibenzo(a,h)anthracene	2/3	ND	220.0	330.00	0.67	Eliminated-Does not exceed threshold
Fluoranthene	3/3	1800.0	5000.0	2900.00	1.72	Retained-HQ > 1
Fluorene	1/3	190.0	150.0	540.00	0.28	Eliminated-Does not exceed threshold
Indeno(1,2,3-cd)pyrene	2/3	310.0	780.0	330.00/1700.0	2.36/0.46	Retained-HQ > 1
Phenanthrene	2/3	1900.0	6300.0	850/1500	7.41/4.2	Retained-HQ > 1
Pyrene	3/3	1900.0	3300.0	660/2600	5.0/1.27	Retained-HQ > 1

ND = None detected
NA = No suitable threshold was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in ug/kg

TABLE 22-15
SURFACE SOIL CONTAMINANTS OF POTENTIAL CONCERN - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	3/3	5310	4350.0	600	7.25	Retained-HQ > 1
Arsenic	3/3	14.4	3.30	60	0.06	Eliminated-Does not exceed threshold
Barium	3/3	15.8	9.60	3000	0.00	Eliminated-Does not exceed threshold
Beryllium	3/3	0.28	0.45	NA		Retained-No suitable threshold available
Chromium	3/3	59.5	48.2	0.4	120.0	Retained-HQ > 1
Copper	3/3	6.6	17.2	50	0.17	Eliminated-Does not exceed threshold
Lead	3/3	39.4	29.8	500	0.06	Eliminated-Does not exceed threshold
Manganese	3/3	93.9	11.2	100	0.11	Eliminated-Does not exceed threshold
Nickel	1/3	4.0	2.8	200	0.01	Eliminated-Does not exceed threshold
Selenium	1/3	0.56	0.35	70	0.00	Eliminated-Does not exceed threshold
Vanadium	3/3	61.6	36.1	20	1.8	Retained-HQ > 1
Zinc	3/3	50.7	33.3	200	0.17	Eliminated-Does not exceed threshold
Organics						
1,1,1-Trichloroethane	1/3	ND	2.0	300	0.01	Eliminated-Does not exceed threshold
4,4'-DDT	2/3	ND	5.0	100	0.05	Eliminated-Does not exceed threshold
Anthracene	1/2	ND	82.0	100	0.82	Eliminated-Does not exceed threshold
Benzo(a)anthracene	1/2	ND	172.0	100	1.72	Retained-HQ > 1
Benzo(a)pyrene	1/2	ND	210.0	100	2.1	Retained-HQ > 1
Benzo(b)fluoranthene	1/2	ND	161.0	100	1.61	Retained-HQ > 1
Benzo(g,h,i)perylene	1/2	ND	100.0	100	1.0	Retained-HQ > 1
Benzo(k)fluoranthene	1/2	ND	130.0	100	1.30	Retained-HQ > 1
Bis(2-ethylhexyl)phthalate	1/2	ND	97.0	NA		Retained-No suitable threshold available
Chrysene	1/2	ND	172.0	100	1.72	Retained-HQ > 1
Di-n-butylphthalate	2/2	48	71.0	NA		Retained-No suitable threshold available
Fluoranthene	1/2	84	580.0	100	5.80	Retained-HQ > 1
Indeno(1,2,3-cd)pyrene	1/2	ND	97.0	100	0.97	Eliminated-Does not exceed threshold

TABLE 22-15
SURFACE SOIL CONTAMINANTS OF POTENTIAL CONCERN - SITE 22
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Phenanthrene	1/2	ND	155.5	100	1.56	Retained-HQ > 1
Pyrene	1/2	ND	570.0	100	5.70	Retained-HQ > 1

ND = None Detected
NA = No suitable threshold was available
* all organic values are in ug/kg

but all HQ values were indicative of low potential risk, with the exception of phenanthrene and pyrene. These PAHs slightly exceeded less conservative ETs.

In Site 22 soils, HQs for inorganics were indicative of low potential risk, with the exception of chromium. Nonetheless, the maximum concentration of chromium was less than background. Beryllium was conservatively retained as a final COPC since no suitable ET was available, but was present in a low concentration that was comparable to background. HQ values for organics in surface soils were all indicative of low potential risk. Two phthalates were conservatively retained as COPCs in lieu of suitable thresholds, but were not detected in high concentrations. In addition, phthalates are ubiquitous in the environment and phthalate toxicosis in fish and wildlife is rare.

In summary, HQ values for final COPCs in Site 22 sediments and surface soils were indicative of low potential risk, with the exception of some PAHs in sediments and chromium in surface soil. The areas where these contaminants were detected, in the drainage swale, contains no aquatic habitat. As a result, potential risks to ecological receptors on and around Site 22 appear insignificant. Yet, it is possible that PAHs could migrate and contribute to potential contamination in the Hockhockson Brook Watershed, although the closest surface water is several hundred feet to the southeast. The organics detected have an affinity for organic fractions in sediments, and water flow in the swale is ephemeral. Thus, they have low potential for migration. However, limited removal of contaminated surface soils and sediments near the building could remove the potential contaminant source and preclude future downstream migration.

22.9 EVALUATION AND RECOMMENDATIONS

22.9.1 Evaluation Summary

Metals concentrations in soils were determined to be within the range of background.

All COPCs contributing to risk above the guideline range, or to HQs above one, were less than the corresponding background concentration. However, arsenic which is a class A carcinogen, cannot be removed from consideration.

PAHs and metals found in sediments at levels above ecological toxicity threshold values could migrate with surface water runoff.

22.9.2 Recommendations

The presence of metals in the shallow subsurface soil appears to be a result of surface disposal of paint chips and paint sludge. The limited extent of contamination (vertically and horizontally) would facilitate a limited soil removal, with disposal according to visual inspection for evidence of paint particles in the soil.

Limited removal of contaminated soils and sediments near the building would preclude migration of potentially ecotoxic compounds to downstream ecological receptors. Post excavation soil sampling would be required if interim soil remediation efforts are implemented.

23.0 SITE 23: PAINT DISPOSAL AREA

23.1 SITE BACKGROUND AND PHYSICAL SETTING

The paint disposal area near Building D-5 was used from the early 1970s until approximately 1993 for paint wastes from repainting and stenciling torpedoes, aerial bombs, and other large ordnance. The site consists of approximately 200 square feet of ground surface west of the northwest corner of building D-5 where paint disposal to the ground surface reportedly occurred in the past (IAS). Figure 23-1 is a map of the site. During 1993 SI work at the site, a small amount of paint residue was present inside the fence line, southwest of Building D-5; no such residue was visible during an October 1993 preliminary RI site visit, nor was an area of bare ground evident. Considering the contradictory reports of where the "site" was, and the metals concentrations found in shallow soil samples taken, it seems likely that paint wastes may have been dumped anywhere on the ground near Building D-5 to the west or southwest. If a removal action occurred in the past, it has not been documented.

The building D-5 complex was constructed into a naturally sloping hillside. Natural grade is higher to the north and east making a natural soil "berm" wall about 20 feet high on those sides. To the west and southwest, an earthen berm has been placed about 20 feet high to complete the soil berm enclosure of the D-5 complex on three sides. A drainage ditch is present west of the building, within the bermed area. A small wetland is located northwest and uphill of the building, which appears to be the source of a small stream which runs intermittently in the drainage ditch west of D-5.

The site is partially paved, and overland runoff flows radially across the site into shallow drainage depressions that surround the site on three sides. The drainage flows toward the southeast. A tributary of Hockhockson Brook is located approximately 500 feet southwest of the site. SI work indicated that a shallow perched-water layer may be present above the water-table aquifer at the site. Shallow groundwater generally flows toward the north-northeast.

23.2 PREVIOUS INVESTIGATIONS

23.2.1 Summary of Activities and Results

The 1983 IAS, consisting of interviews and observations, concluded that a bare area of approximately 200 square feet had been used for paint disposal to surface soil. The site was not recommended for confirmation study because it was believed that the amount of paint dumped on the area was not enough to pose a significant environmental or public health hazard.

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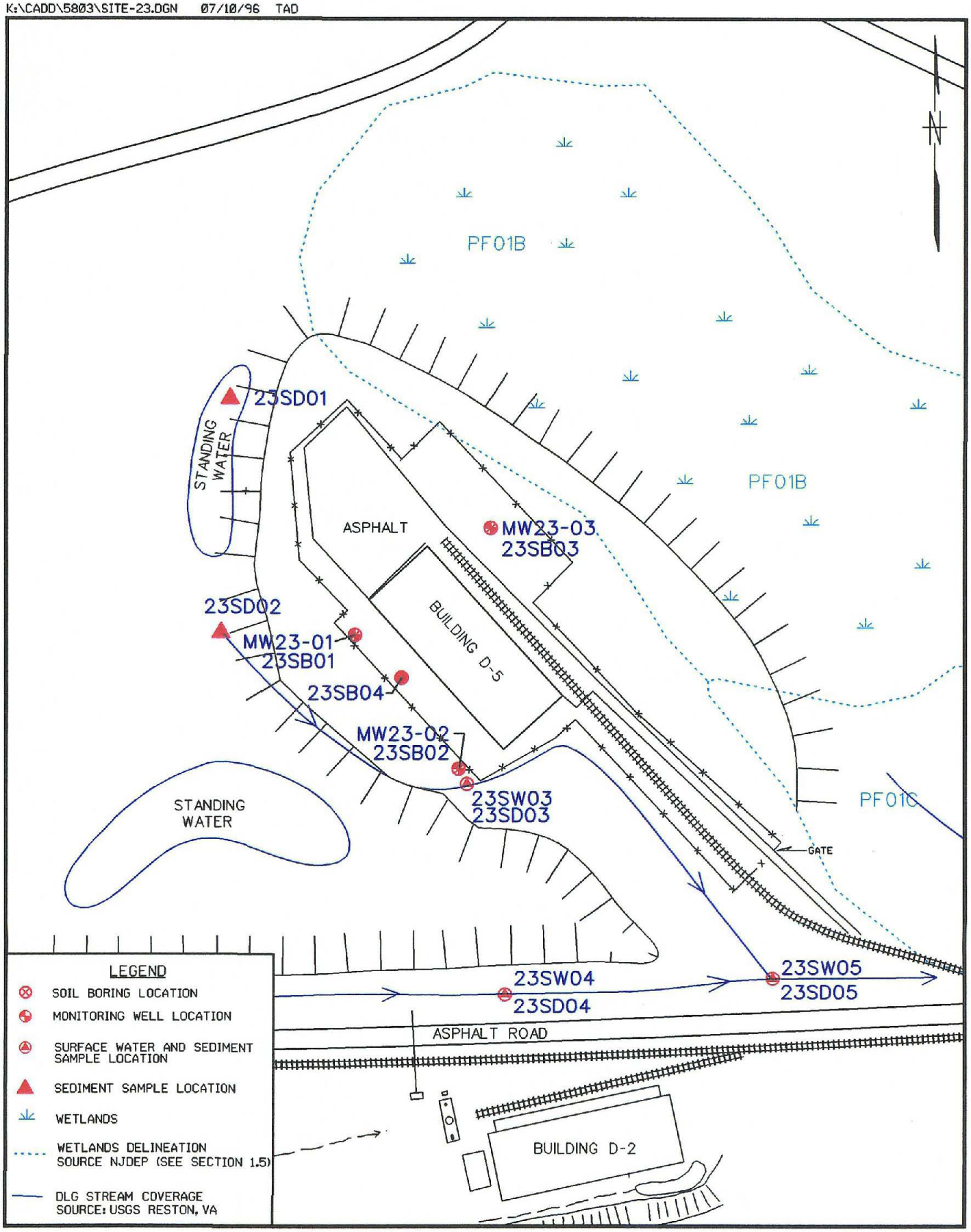

SAMPLE LOCATIONS

SITE 23 - PAINT DISPOSAL AREA

0 100 200

SCALE IN FEET

FIGURE 23-1

Brown & Root Environmental

During the 1993 SI, six soil samples (from 0 to 3 feet bgs), eight sediment samples, and one hydropunch groundwater sample were collected for analysis. Sample analysis indicated that low levels of VOCs and metals were present in soil samples, the highest levels of chromium and lead were detected in a soil sample taken west of Building D-5 in the vicinity of RI soil boring 23 SB 04. Low levels of organics and one pesticide were detected in sediment, and elevated metals were detected in sediments. Groundwater contained low levels of organics and some elevated levels of metals.

23.2.2 Summary of Conclusions

Surface soils had slight signs of surface from paint residues. Elevated levels of metals (mainly chromium and lead) at concentrations sometimes above regulatory guideline limits were, found in soil and sediments. Elevated levels of lead and chromium were also found in groundwater samples. Low levels of organics were found in direct-push groundwater samples.

23.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations, follow-up remedial investigation activities were developed to meet the following objectives:

- Determine vertical extent of soil contamination in soil west of Building D-5.
- Determine whether surface water or wetland has been impacted by past practices.
- Investigate groundwater quality in the area of former paint dumping.
- Compare metals data to background levels and risk based criteria.
- Determine impact of turbidity on metals results by using the low-flow sampling technique.

23.3 RI FIELD INVESTIGATIONS

Between July and October 1995, B&R Environmental conducted the following field investigation activities at Site 23:

- Sampling and analysis of subsurface soil samples from three soil borings and one hand-auger boring (Section 23.3.1).

- Drilling and installation of three shallow permanent monitoring wells (Section 23.3.2).
- Sampling and analysis of groundwater from the wells (Section 23.3.2).
- Measurement of static water-levels in the wells (Section 23.3.2).
- Execution of slug tests in two of the wells (Section 20.3.3).
- Sampling and analysis of surface water (Section 23.3.4)
- Sampling and analysis of sediment (Section 23.3.5)

B&R Environmental surveyed to establish the horizontal locations and vertical elevations of the surface water and sediment sample locations and the newly installed sample locations. Surveying notes are provided in Appendix F.

23.3.1 Soil Borings and Subsurface Soil Sampling

Three soil borings, which were converted into monitoring wells (MW23-01, MW23-02, and MW23-03), were drilled in July 1995 to investigate subsurface soil quality. All three samples were taken in the area suspected to have been used for paint waste dumping. Figure 23-1 shows sample locations. The borings ranged in depth from 26 to 27 feet bgs. Saturated conditions were encountered in the borings from 17 to 19 feet below grade. Subsurface soil samples were collected continuously to the water table using a 3-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. Maximum HNu readings in the borings ranged from 0.3 to 1 ppm or less than 10 ppm action level. Soil boring log sheets were prepared for each boring to evaluate subsurface lithologies (see Appendix C).

MW23-01 is located near the northwestern corner of Building D-5. MW23-02 is located southwest of the southwestern corner of the building, where surface paint residue was observed previously. MW23-03 is located east of the railroad siding and east of Building D-5. All three soil borings were sampled at two depth intervals. One sample, from MW23-02, was collected at the perched-water zone; at the other two borings, a sample was collected from the interval that showed the highest HNu readings. A second sample from each boring was collected from the interval directly above the water table.

B&R Environmental collected one subsurface soil sample (23 SB 04-02) in August 1995 from the base of the 1.5-inch-diameter pipe on the western side of Building D-5. This sample was collected to determine whether the 1.5-inch-diameter pipe is a source of compounds that could adversely affect the quality of the

site. The subsurface soil sample, collected from 18 to 30 inches bgs, consisted of grayish-brown, fine- to medium-grained sand. A hand auger was used to bore to the desired depth, and the soil sample was placed directly into the appropriate bottleware. The auger hole was backfilled with the removed cuttings.

All the subsurface soil samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, and TAL metals analyses. A sample from each location was also submitted to GP Environmental Services for explosives analysis. Soil boring characteristics and sample information are summarized in Table 23-1.

23.3.2 Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

B&R Environmental installed three shallow permanent monitoring wells (MW23-01 through MW23-03) at the site in July 1995 to gauge groundwater quality at the site (Figure 23-1). The borings ranged in depth from 26 to 27 feet bgs, and saturated conditions were encountered from 17 to 19 feet below grade during drilling. The borings were drilled to approximately 8 feet below the water table and completed as cased wells, screened across the water table. Monitoring well characteristics are summarized in Table 23-2.

Subsurface soil samples were collected continuously to the water table. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. Soil boring log sheets were prepared for each boring to evaluate subsurface lithologies (see Appendix C).

The wells were constructed with 2-inch I.D., flush-jointed and threaded, Schedule 40 PVC well casing and 2-inch I.D., Schedule 40, 0.10-foot slotted PVC well screen fitted with a PVC bottom cap. Ten-foot screens were installed in the wells. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 2 feet above the top of the screen. An approximately 3-foot-thick annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height approximately 1 foot bgs. The wells were completed with 2-foot-high standpipes. A 4- by 4-foot concrete pad, keyed into the well annulus, was placed at ground level around the standpipe. Monitoring well construction sheets are in Appendix C.

Table 23-1
Site 23 Soil Boring Characteristics Summary
NWS Earle Colts Neck, New Jersey

Soil Boring Number	Total Depth[1] (feet)	Ground Surface Elevation[2]	Laboratory Sample Number	Laboratory Sample Depth Interval[1] (feet)	Analytical Parameters[3]
MW23-1	27	117.69	23 SB 01-04	4 to 6	TCL VOC, TCL SVOC, TCL PCBs/pesticides, TAL metals, explosives, moisture, and pH
			23 SB 01-16	16 to 18	
MW23-2	26	115.98	23 SB 02-02	2 to 4	TCL VOC, TCL SVOC, TCL PCBs/pesticides, TAL metals, explosives, moisture, and pH
			23 SB 02-16	16 to 18	
MW23-3	26	113.41	23 SB 03-06	6 to 8	TCL VOC, TCL SVOC, TCL PCBs/pesticides, TAL metals, explosives, moisture, and pH
			23 SB03-14	14 to 16	
			23 SB03-16	16 to 18	TCL VOC only
23 SB 04	2.5	116.5	23 SB04-02	1.5 to 2.5	TCL VOC, TCL SVOC, TCL PCBs/pesticides, TAL metals, and explosives

(1) In feet below grade.
(2) In feet above mean sea level.
(3) STET

Table 23-2
Site 23 Monitoring Well Characteristics Summary
NWS Earle, Colts Neck, New Jersey

Monitoring Well Number	Total Depth[1] (feet)	Ground Surface Elevation[2]			Diameter (inches)	Screened Interval Depth[1] (feet)	Filter Pack Interval Depth(1) (feet)	Date Installed
		Top of Concrete[2] Pad (feet)	Top of PVC Riser[2]	Top of Standpipe[2] (feet)				
MW23-01	27	117.69	119.62	120.19	2	17 - 27	15 - 27	7/7/95
MW23-02	26	115.98	118.22	118.85	2	16 - 26	14 - 26	7/7/95
MW23-03[3]	24	113.46	113.19	113.46	2	14 - 24	12 - 24	7/7/95

Note: All wells were constructed with Schedule 40 polyvinyl chloride (PVC) well casing.

(1) In feet below grade. Reading obtained during monitoring well installation. See Table 23-3 for more accurate measurements.
(2) In feet above mean sea level.
(3) Well is flush mounted.

The wells were developed several days after installation. Groundwater temperature, pH, conductivity, and turbidity were monitored during development. The wells were developed until removed water was visibly clear of suspended solids. One-hundred twenty gallons of water were removed from both MW23-01 and MW23-03. Sixty gallons of water were removed from MW23-02.

Static-Water-Level Measurements

To define groundwater flow directions and horizontal and vertical groundwater gradients, B&R Environmental collected two rounds of static-water-level measurements. The first round of water-level measurements was collected on August 7, 1995, and the second on October 17, 1995. Static-water levels were measured from the top of PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation ranged from approximately 96.33 to 96.79 feet above MSL during the first round of measurements and from approximately 95.73 to 95.86 feet above MSL during the second round of measurements. During the October 17, 1995 water-level measurement round, MW23-03 was not measured because the (flush-mounted) monitoring well was below standing water. Water-level measurements are summarized in Table 23-3.

Groundwater Sampling

The B&R Environmental team obtained groundwater samples from the three newly installed monitoring wells (MW23-01 through MW23-03) to determine groundwater quality at the site and to provide data for use in the risk assessment and evaluation of remedial action alternatives. The wells were sampled in August 1995. Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Prior to sampling, B&R Environmental purged the wells using the micro-purge protocol to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure little or no drawdown in water levels occurred throughout the purge and sample process.

The three groundwater samples (23 GW 01 through 23 GW 03) were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, and TAL metals analyses. A sample from each well was also submitted to GP Environmental Services for explosives analysis. Filtered groundwater samples were collected from 23 GW 02 and 23 GW 03, due to high turbidity in the water, and submitted to Lancaster Laboratories for dissolved TAL metals analysis (at the direction of NORTHDIV). Sample log sheets are presented in Appendix D.

TABLE 23-3
SITE 23 STATIC-WATER-LEVEL MEASUREMENT SUMMARY
NWS EARLE COLTS NECK, NEW JERSEY

Monitoring Well Number	August 7, 1995			October 17, 1995		
	Depth to Water Table(1) (feet)	Top of PVC Riser(2)	Elevation of Water Table(2)	Depth to Water Table(1) (feet)	Top of PVC Riser(2)	Elevation of Water Table(2)
MW23-01	23.02	119.62	96.60	23.89	119.62	95.73
MW23-02	21.43	118.22	96.79	22.36	118.22	95.86
MW23-03	16.86	113.19	96.33	not measured	113.19	-

(1) In feet below top of riser.
(2) In feet above mean sea level.

23.3.3 Slug Testing

Rising-head slug tests were performed in July 1995 in MW23-01 and MW23-02 according to the procedure presented in Section 2.1.1.4. Slug test data and calculations are presented in Appendix H.

23.3.4 Surface Water Sampling

Due to dry conditions during the summer, B&R Environmental could not collect samples 23 SW 01 and 3 SW 02. Four surface water samples, including one field duplicate (23 SW 03, 23 SW 04, 23 SW 05, and Dup-20), were collected in August 1995 (Figure 23-2). 23 SW 03 was collected from ponded water southwest of Building D-5 (near MW23-02) to determine if the area surrounding the site has been impacted by site activities. 23 SW 04 was collected upstream of 23 SW 05, along a drainage ditch located south of Building D-5. 23 SW 05 and DUP-20 were collected from the confluence of two drainage ditches located southeast of Building D-5. Both locations were sampled to determine if wetlands surrounding the site have been impacted by site activities. Both drainage ditches may receive runoff from the site. The field team collected surface water samples by dipping the sample bottle directly into the water. No field measurements were obtained during sampling. The surface water samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, and TAL metals analysis and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix C.

23.3.5 Sediment Sampling

Six sediment samples, including one field duplicate (23 SD 01, 23 SD 02, 23 SD 03, 2 23 SD 04, 23 SD 05, and Dup-20), were collected in August 1995 (Figure 23-2). 23 SD 01, collected from a marsh area north of Building D-5, consisted of gray to black sandy clay. 23 SD 02, collected from a marsh area northwest of Building D-5, consisted of grayish-brown, fine- to coarse-grained sand. Both samples were collected to determine if wetlands surrounding the site have been impacted by site activities; however, these two sample locations are actually at a higher elevation than the site and represent background locations. 23 SD 03 was collected from the same location as 23 SW 03 to determine if the area surrounding the site has been impacted by site activities. The sediment material consisted of tan silty clay. 23 SD 04 was collected from the same location as 23 SW 04 and consisted of orange gray, coarse-grained silty sand. 23 SD 05 and DUP-20 were collected from the same location as 23 SW 05 and consisted of grayish-brown sandy silt with pebbles. 23 SD 04 and 23 SD 05 were collected to determine if sediments leaving the site have been impacted by site activities. Both locations may receive runoff from the site.

The sediment samples were collected using a stainless-steel trowel from 0 to 6 inches below the sediment/water interface (or 0 to 6 inches bgs in the case of a dry streambed). The sediment material was

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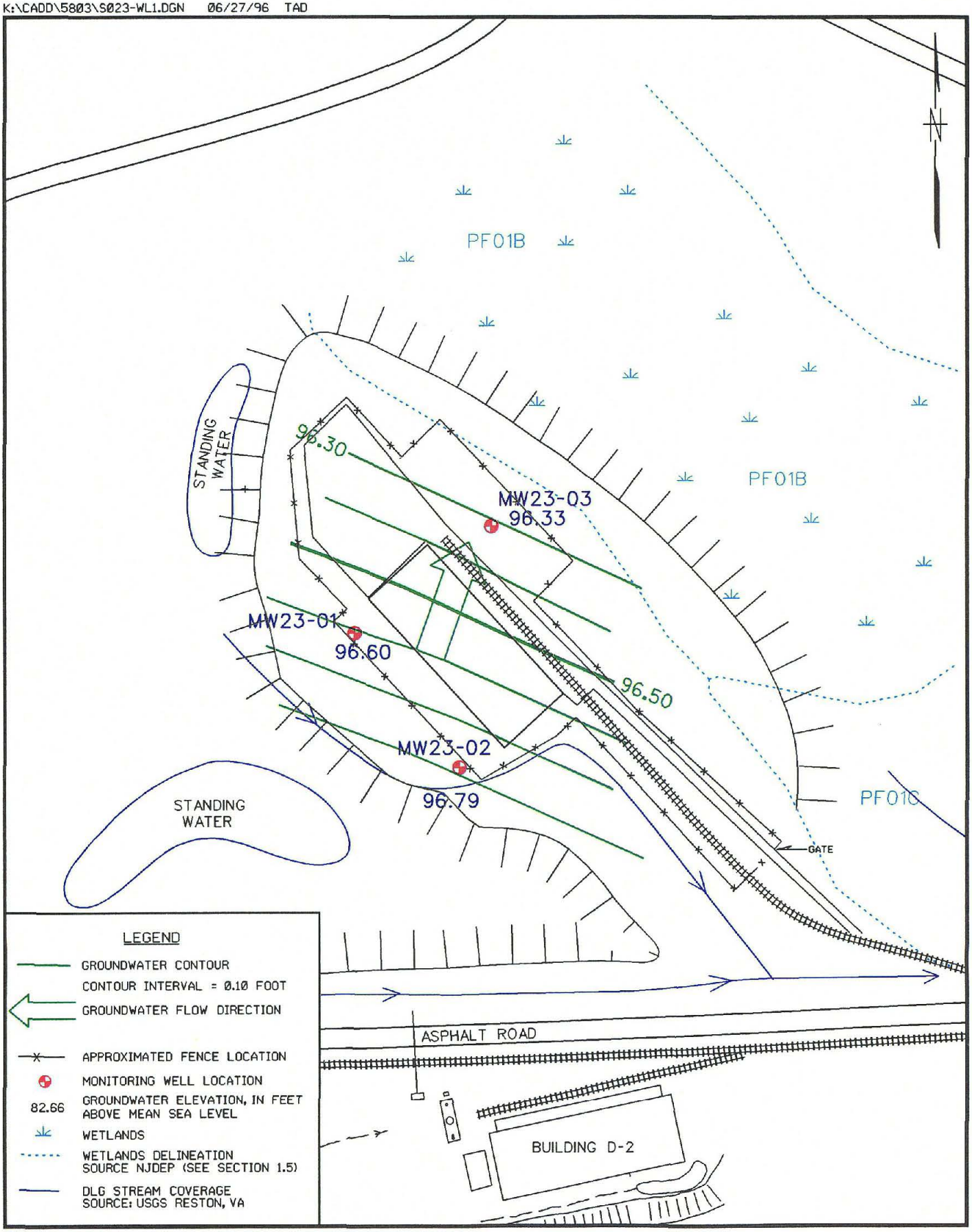


GROUNDWATER CONTOUR MAP AUGUST 7, 1995

SITE 23 - PAINT DISPOSAL AREA

FIGURE 23-2

0 100 200

SCALE IN FEET

Brown & Root Environmental

transferred directly to the required bottleware via the stainless-steel trowel. The sediment samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, and TAL metals analyses and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix C.

23.4 SITE CHARACTERISTICS

23.4.1 Geology

Regional mapping places Site 23 in the outcrop area of the Kirkwood Formation; upper colluvium may be present at the site. The upper colluvium has a maximum thickness of 10 feet, the Kirkwood Formation ranges between 60 to 100 feet in thickness, and the soil borings are no more than 27 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the upper colluvium and the Kirkwood and Vincentown Formations. Assuming a portion of the Kirkwood Formation was removed by erosion, it is possible that at least one of the soil borings penetrated the underlying Vincentown Formation. In general, the borings encountered yellowish-brown, fine- to coarse-grained sand (possibly representative of the upper colluvium), brown and olive, fine- to medium-grained sand (probably representative of the Kirkwood Formation), and greenish-gray, glauconitic, fine- to medium-grained sand (probably representative of the Vincentown Formation). Mainside is located above the updip limit of the Piney Point, Shark River, and Manasquan Formations; therefore, the glauconitic sand is interpreted to be part of the Vincentown Formation.

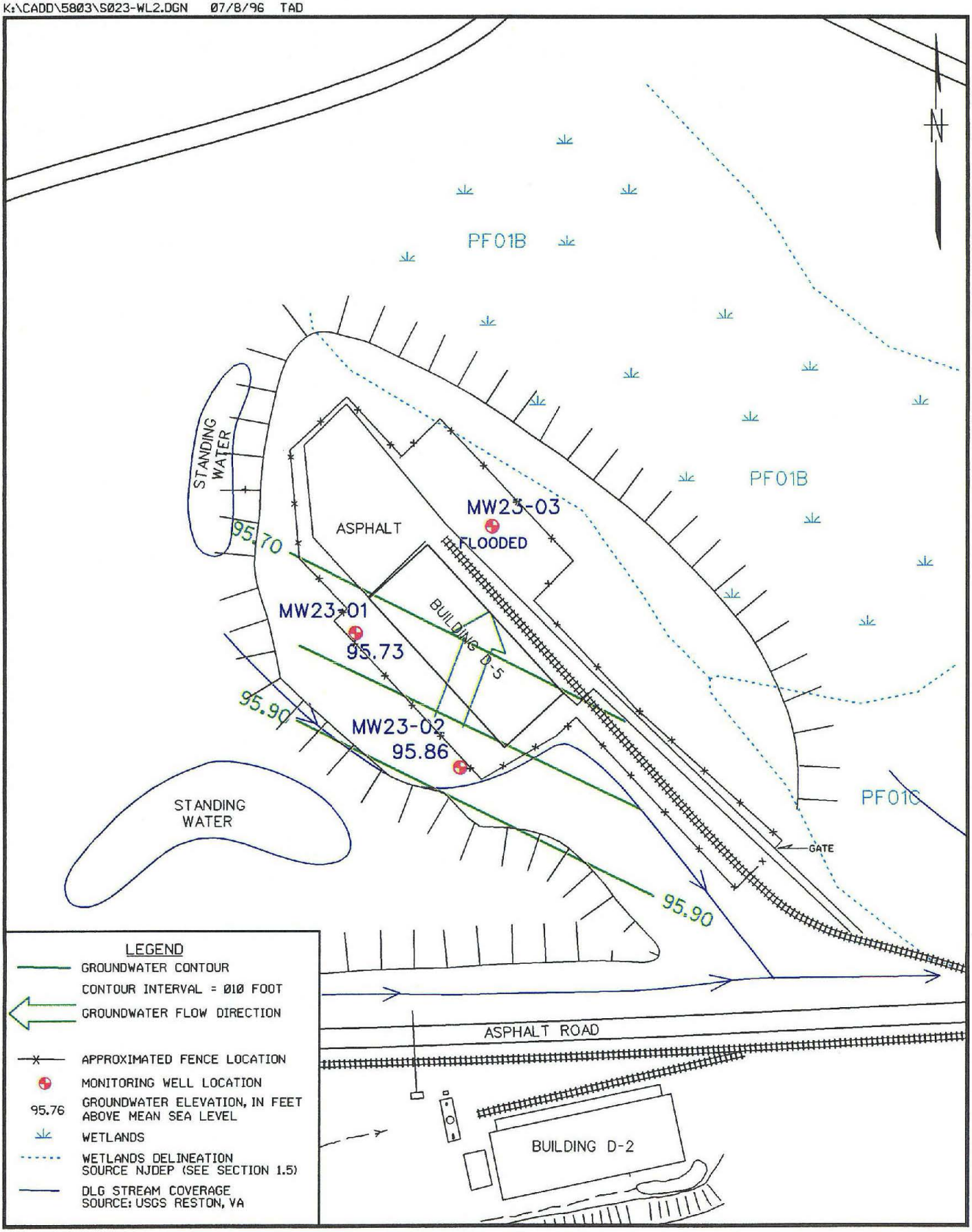
Based upon the boring log descriptions, the wells penetrated the upper colluvium and the Kirkwood and Vincentown Formations.

23.4.2 Hydrogeology

Groundwater in the upper colluvium, Kirkwood, and Vincentown aquifer beneath the site occurs under unconfined conditions and the formations are interpreted to be hydraulically interconnected. Static-water-level measurements and water-table elevations are summarized in Table 23-3. Groundwater elevations for August 1995 and October 1995 are contoured on Figures 23-2 and 23-3, respectively. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October groundwater contour maps, is toward the north-northeast. There does not appear to be a significant seasonal variation in groundwater flow direction.

Based on boring log descriptions, the wells are screened across the contact between the Kirkwood and Vincentown Formations. The hydraulic conductivities calculated for MW23-01 and MW23-02 are 2.79 x

K:\CADD\5803\S023-WL2.DGN 07/8/96 TAD



GROUNDWATER CONTOUR MAP OCTOBER 17, 1995

SITE 23 - PAINT DISPOSAL AREA

FIGURE 23-3

0 100 200

SCALE IN FEET

Brown & Root Environmental

10^{-3} cm/sec (7.91 ft/day) and 2.04 x 10^{-3} cm/sec (5.78 ft/day), respectively. Appendix H contains slug test data and calculations.

23.5 NATURE AND EXTENT OF CONTAMINATION

23.5.1 Subsurface Soils

Seven site-related subsurface soil samples (23 SB 01-04, 23 SB 01-16, 23 SB 02-02, 23 SB 02-16, 23 SB 03-06, 23 SB 03-14, and 23 SB 04-02) were collected at Site 23 (Figure 23-1). Tables 23-4 and 23-5 present the occurrence and distribution of inorganic chemicals detected in site-related subsurface soil samples and compare them to background as presented in Section 31. Tables 23-4a and 23-4b present a comparison of detected compounds to ARARs and TBCs. Figure 23-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

23.5.1.1 Inorganics

Most metals were detected in site-related samples at concentrations similar to background samples. Concentrations slightly greater than the range of background samples were noted for chromium in sample 23 SB 02-02 and for vanadium in sample 23 SB 01-16.

23.5.1.2 Organics

Fluoranthene (40 ug/kg and 84 ug/kg) and pyrene (46 ug/kg) were detected in background subsurface soil samples. One site-related surface soil sample (23 SB 04-02) revealed notable levels of several PAHs, including benz(a)anthracene (19,000 ug/kg), benzo(a)pyrene (13,000 ug/kg), benzo(b)fluoranthene (14,000 ug/kg), benzo(k)fluoranthene (5,000 ug/kg), carbazole (2,800 ug/kg), chrysene (19,000 ug/kg), dibenzofuran (1,500 ug/kg), dibenz(a,h)anthracene (2,100 ug/kg), indeno(1,2,3-cd)pyrene (5,600 ug/kg), fluoranthene (38,000 ug/kg), phenanthrene (20,000 ug/kg), and pyrene (32,000 ug/kg). Bis(2-ethylhexyl) phthalate (380 ug/kg to 590 ug/kg) was detected in two subsurface soil samples. Gamma-BHC was detected in one site-related subsurface soil sample at a concentration of 0.039 ug/kg. Explosives were not detected in subsurface soil samples.

23.5.1.3 Miscellaneous Parameters

Miscellaneous parameter analyses of the subsurface soils collected at Site 23 consisted of pH and moisture. Results are presented in Appendix A

TABLE 23-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOIL AT SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5370.00	4 / 4	2450 - 3040	2697.5	NO	3040
ARSENIC	8 / 8	1.35 - 14.4	13.29	4 / 4	6.7 - 16.2	10.48	NO	16.2
BARIUM	8 / 8	0.92 - 31	17.92	4 / 4	0.66 - 6.1	2.49	NO	6.1
BERYLLIUM*	2 / 8	0.12 - 0.28	0.28	4 / 4	0.26 - 0.69	0.46	YES	0.69
CADMIUM	1 / 8	0.57	0.58	4 / 4	0.85 - 1.5	1.02	YES	1.40
CALCIUM	8 / 8	28.6 - 799	577.55	4 / 4	60.3 - 718	319.58	NO	718
CHROMIUM	8 / 8	4.7 - 59.5	54.73	4 / 4	53.8 - 91.2	70.55	YES	91.2
COPPER	8 / 8	0.97 - 8.6	8.66	1 / 4	1.6	0.80	NO	1.6
IRON	8 / 8	3745 - 62500	40871.25	4 / 4	10900 - 22300	14025	NO	20524
LEAD*	8 / 8	1.4 - 39.4	24.33	4 / 4	2.4 - 9.8	6.30	NO	9.8
MAGNESIUM	8 / 8	18.5 - 619	504.05	4 / 4	516 - 1080	759	YES	1080
MANGANESE	8 / 8	2.6 - 214	92.51	1 / 4	1.3	0.57	NO	1.14
MERCURY	8 / 8	0.03 - 0.17	0.13	2 / 4	0.008 - 0.012	0.01	NO	0.012
NICKEL	4 / 8	1.8 - 7.2	4.75	2 / 4	1.1 - 1.8	0.98	NO	1.8
POTASSIUM	7 / 8	95 - 792	793.35	4 / 4	1510 - 3210	2275	YES	3210
SODIUM	8 / 8	17.5 - 94.8	79.35	4 / 4	21.1 - 28.1	23.98	NO	28.1
THALLIUM	4 / 8	0.7 - 1.9	1.38	4 / 4	0.9 - 1.6	1.23	NO	1.6
VANADIUM*	8 / 8	11.05 - 64	64.71	4 / 4	79.8 - 178	115.95	YES	178
ZINC	6 / 8	1.1 - 50.7	31.35	4 / 4	6.8 - 10.7	8.58	NO	10.7

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 23-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
ACENAPHTHENE	NOT DETECTED	-	-	1 / 7	2700	1243.91
BENZO(A)ANTHRACENE	NOT DETECTED	-	-	1 / 7	19000	8097.30
BENZO(A)PYRENE	NOT DETECTED	-	-	1 / 7	13000	5574.57
BENZO(B)FLUORANTHENE	NOT DETECTED	-	-	1 / 7	14000	5995.03
BENZO(G,H,I)PERYLENE	NOT DETECTED	-	-	1 / 7	6800	2967.76
BENZO(K)FLUORANTHENE	NOT DETECTED	-	-	1 / 7	5000	2210.94
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	2 / 7	380 - 590	387.53
CARBAZOLE	NOT DETECTED	-	-	1 / 7	2800	1285.95
CHRYSENE	NOT DETECTED	-	-	1 / 7	19000	8097.30
DIBENZ(A,H)ANTHRACENE	NOT DETECTED	-	-	1 / 7	2100	991.64
DIBENZOFURAN	NOT DETECTED	-	-	1 / 7	1500	739.38
FLUORANTHENE	2 / 8	40 - 84	84	1 / 7	38000	16085.93
FLUORENE	NOT DETECTED	-	-	1 / 7	2900	1328.00
GAMMA-BHC (LINDANE)	NOT DETECTED	-	-	1 / 7	0.039	0.039
INDENO(1,2,3-CD)PYRENE	NOT DETECTED	-	-	1 / 7	5600	2463.22
PHENANTHRENE	NOT DETECTED	-	-	1 / 7	20000	8517.75
PYRENE	1 / 8	46	46	1 / 7	32000	13563.20

TABLE 23-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SB01-04	23SB01-16	23SB02-02	23SB02-16	23SB03-06	23SB03-14	ARARS & TBCs		
LOCATION:	23SB01	23SB01	23SB02	23SB02	23SB03	23SB03	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	2450	3040	1430	1270	2790	2510	-	-	-
arsenic	6.7	16.2	2.2	10.4	7.9	11.1	20.0	20.0	-
barium	6.1	0.66	2.5	2.3	1.3	1.9	700	47000	-
beryllium	0.26	0.69	0.049	0.17	0.51	0.39	1.00	1.00	-
cadmium	0.87	1.5 E	0.35	1.1 E	0.86	0.85	1.00	100	-
calcium	718	424	68.1	31.9	76.0	60.3	-	-	-
chromium, total	53.8	91.2	13.1	45.7	67.3	69.9	-	500	-
copper	1.6	1.1 U	5.6	1.0 U	1.0 U	1.1 U	600	600	-
iron	10900	22300	3620	15200	11400	11500	-	-	-
lead	8.7 J	9.8 J	4.8 J	4.5 J	2.4	4.3 J	400	600	-
magnesium	734	1080	75.5	230	706	516	-	-	-
manganese	1.3	0.65 U	3.7	0.64 U	0.63 U	0.66 U	-	-	-
mercury	0.012 J	0.0068 UJ	0.019 J	0.0069 UJ	0.0067 UJ	0.0080 J	14.0	270	-
nickel	1.0 U	1.8	1.0 U	1.0 U	1.1	1.0 U	250	2400	-
potassium	1510	3210	298	880	2530	1850	-	-	-
sodium	28.1	24.2	26.9	18.2	22.5	21.1	-	-	-
thallium	1.6 J	1.2 J	1.9 J	0.91 J	0.90 J	1.2 J	2.00	2.00	-
vanadium	79.8	178	13.9	86.5	103	103	370	7100	-
zinc	8.8 J	10.7 J	23.8 J	8.1 J	6.8 J	8.0 J	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
acenaphthene	390 U	370 U	390 U	360 U	360 U	380 U	3400000	10000000	100000
anthracene	390 U	370 U	390 U	360 U	360 U	380 U	10000000	10000000	100000
benzo(a)anthracene	390 U	370 U	390 U	360 U	360 U	380 U	900	4000	500000
benzo(a)pyrene	390 U	370 U	390 U	360 U	360 U	380 U	660	660	100000
benzo(b)fluoranthene	390 U	370 U	390 U	360 U	360 U	380 U	900	4000	50000
benzo(g,h,i)perylene	390 U	370 U	390 U	360 U	360 U	380 U	-	-	-
benzo(k)fluoranthene	390 U	370 U	390 U	360 U	360 U	380 U	900	4000	500000
bis(2-ethylhexyl)phthalate	590	370 U	390 U	360 U	360 U	380 U	49000	210000	100000

TABLE 23-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SB01-04		23SB01-16		23SB02-02		23SB02-16		23SB03-06		23SB03-14		ARARS & TBCs		
LOCATION:	23SB01		23SB01		23SB02		23SB02		23SB03		23SB03		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
carbazole	390	U	370	U	390	U	360	U	360	U	380	U	-	-	-
chrysene	390	U	370	U	390	U	360	U	360	U	380	U	9000	40000	500000
dibenz(a,h)anthracene	390	U	370	U	390	U	360	U	360	U	380	U	660	660	100000
dibenzofuran	390	U	370	U	390	U	360	U	360	U	380	U	-	-	-
fluoranthene	390	U	370	U	390	U	360	U	360	U	380	U	2300000	10000000	100000
fluorene	390	U	370	U	390	U	360	U	360	U	380	U	2300000	10000000	100000
indeno(1,2,3-cd)pyrene	390	U	370	U	390	U	360	U	360	U	380	U	900	4000	500000
phenanthrene	390	U	370	U	390	U	360	U	360	U	380	U	-	-	-
pyrene	390	U	370	U	390	U	360	U	360	U	380	U	1700000	10000000	100000
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
gamma-BHC (Lindane)	2.0	U	1.9	U	0.039	JN	1.9	U	1.8	U	1.9	U	520	2200	50000

TABLE 23-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SB04-02	---	---	---	---	---	ARARS & TBCs		
LOCATION:	23SB04	---	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI								
INORGANICS	**mg/kg**						**mg/kg**	**mg/kg**	**mg/kg**
aluminum	1300						-	-	-
arsenic	5.3						20.0	20.0	-
barium	4.0						700	47000	-
beryllium	0.20 U						1.00	1.00	-
cadmium	0.57 U						1.00	100	-
calcium	243						-	-	-
chromium, total	152						-	500	-
copper	1.2						600	600	-
iron	3420						-	-	-
lead	12.0						400	600	-
magnesium	77.9						-	-	-
manganese	3.6						-	-	-
mercury	0.0022 U						14.0	270	-
nickel	1.3 U						250	2400	-
potassium	237						-	-	-
sodium	28.0						-	-	-
thallium	0.79 UJ						2.00	2.00	-
vanadium	16.4						370	7100	-
zinc	42.0						1500	1500	-
SEMIVOLATILES	**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
acenaphthene	2700 J						3400000	10000000	100000
anthracene	5400						10000000	10000000	100000
benzo(a)anthracene	19000 E						900	4000	500000
benzo(a)pyrene	13000 E						660	660	100000
benzo(b)fluoranthene	14000 E						900	4000	50000
benzo(g,h,i)perylene	6800						-	-	-
benzo(k)fluoranthene	5000 E						900	4000	500000
bis(2-ethylhexyl)phthalate	380 J						49000	210000	100000

TABLE 23-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SB04-02	---	---	---	---	---	ARARS & TBCs		
LOCATION:	23SB04	---	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI								
SEMIVOLATILES	**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
carbazole	2800 J						-	-	-
chrysene	19000 E						9000	40000	500000
dibenz(a,h)anthracene	2100 E J						660	660	100000
dibenzofuran	1500 J						-	-	-
fluoranthene	38000						2300000	10000000	100000
fluorene	2900 J						2300000	10000000	100000
indeno(1,2,3-cd)pyrene	5600 E						900	4000	500000
phenanthrene	20000						-	-	-
pyrene	32000 J						1700000	10000000	100000
PESTICIDES	**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
gamma-BHC (Lindane)	1.9 U						520	2200	50000

TABLE 23-4a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

· - No standard is available for this chemical in this classification.

TABLE 23-4b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SB01-04	23SB01-16	23SB02-02	23SB02-16	23SB03-06	ARARS & TBCs		
LOCATION:	23SB01	23SB01	23SB02	23SB02	23SB03	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS								
moisture %	15.2	11.0	15.1	9.0	8.1	-	-	-
pH	7.0	6.9	4.7	4.0	4.3	-	-	-

TABLE 23-4b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SB03-14	23SB04-02	---	---	---	ARARS & TBCs		
LOCATION:	23SB03	23SB04	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI						
MISCELLANEOUS								
moisture %	12.2	n/a				-	-	-
pH	4.2	n/a				-	-	-

TABLE 23-4b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

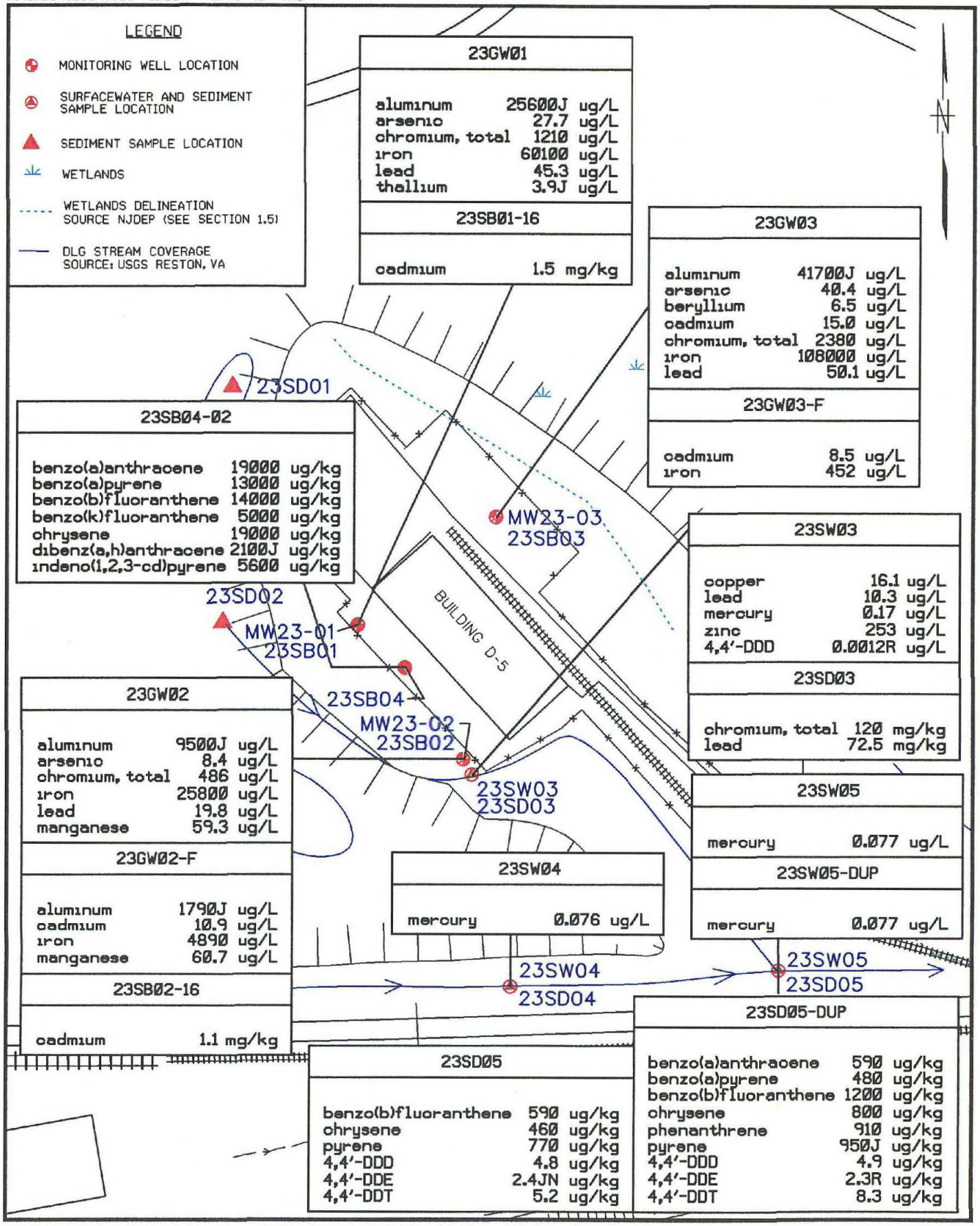
E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

K:\CADD\5803\S023-T01.DGN 07/8/96 TAD



CONCENTRATIONS ABOVE SCREENING LEVELS

SITE 23 - PAINT DISPOSAL AREA

FIGURE 23-4

Brown & Root Environmental

23.5.2 Sediment

Five sediment samples were collected at Site 23: 23 SD 01 through 23 SD 05 (Figure 23-1). Tables 23-6 and 23-7 present the occurrence and distribution of inorganic and organic chemicals in site-related sediment samples and compare them to background. Table 23-6a presents a comparison of detected compounds to ARARs and TBCs. Figure 23-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

23.5.2.1 Inorganics

Concentrations of metals in all site-related sediment samples were similar to the ranges of background samples.

23.5.2.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-c,d)pyrene, fluoranthene, fluorene, and pyrene were detected in background sediment samples at a range from 110 ug/kg to 1,900 ug/kg. Similar PAHs were detected in sediment samples collected at Site 23 at concentrations generally within the same range as background samples. 4,4'-DDT (19 ug/kg), 4,4'-DDD (4.9 ug/kg to 21 ug/kg), and gamma-chlordane (0.095 ug/kg), were detected in background sediment samples. These pesticides were detected at similar concentration ranges in the site-related sediment samples, including 4,4'-DDT (6.75 ug/kg), 4,4'-DDD (0.38 ug/kg to 4.85 ug/kg), and gamma-chlordane (0.38 ug/kg). 1,2,4-Trichlorobenzene was detected in one site-related sample (23 SD 03) at a concentration of 75 ug/kg. Explosives were analyzed for but were not detected in sediment samples.

23.5.3 Groundwater

Three site-related groundwater samples (23 GW 01 through 23 GW 03) were collected at Site 23 (Figure 23-1). Tables 23-8 and 23-9 present the occurrence and distribution of inorganic and organic chemicals detected in site-related groundwater samples and compare them to background. Table 23-8a presents a comparison of detected compounds to ARARs and TBCs. Figure 23-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

TABLE 23-6
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SEDIMENT AT SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	5492.67	5 / 5	1260 - 2660	2089.00	NO	2660.00
ARSENIC	2 / 3	2.4 - 6.2	5.95	5 / 5	1.6 - 4.7	2.63	NO	4.70
BARIUM	3 / 3	3.9 - 10.6	14.07	5 / 5	4.1 - 16.7	8.92	NO	16.70
CADMIUM	NOT DETECTED	-	-	2 / 5	0.71 - 1.2	0.59	YES	1.20
CALCIUM	3 / 3	179 - 518	685.33	5 / 5	187 - 410	265.70	NO	397.16
CHROMIUM	3 / 3	4.3 - 56	43.13	5 / 5	14.05 - 120	37.19	NO	81.36
COPPER	3 / 3	1.5 - 13	12.47	5 / 5	2.2 - 6.7	4.37	NO	6.70
IRON	3 / 3	228 - 7650	6578.67	5 / 5	5400 - 13200	8642.00	YES	12957.55
LEAD	3 / 3	4.6 - 34.3	30.60	5 / 5	4.1 - 72.5	21.28	NO	48.87
MAGNESIUM	3 / 3	60.7 - 256	306.47	5 / 5	115 - 269.5	179.50	NO	269.50
MANGANESE	3 / 3	4.6 - 9.2	13.80	5 / 5	3.7 - 9.95	6.85	NO	9.95
MERCURY	1 / 3	0.068	0.05	3 / 5	0.0041 - 0.057	0.02	NO	0.04
NICKEL	2 / 3	2.1 - 6	7.93	4 / 5	1.4 - 4.5	2.63	NO	4.50
POTASSIUM	2 / 3	86.1 - 681	589.40	5 / 5	207 - 458	319.40	NO	458.00
SODIUM	3 / 3	26.6 - 116	115.27	5 / 5	24.9 - 40.7	31.79	NO	39.77
VANADIUM	3 / 3	5.9 - 42.7	36.93	5 / 5	12 - 20.8	16.70	NO	20.80
ZINC	3 / 3	14.2 - 26.9	37.33	5 / 5	9.7 - 71.3	31.10	NO	71.30

Note: Selected COPCs are indicated in boldface type.

TABLE 23-7
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,2,4-TRICHLOROBENZENE	NOT DETECTED	-	-	1 / 5	75	75
4,4'-DDD	2 / 3	4.9 - 21	21	3 / 5	0.38 - 4.85	4.85
4,4'-DDT	1 / 3	19	19	1 / 5	6.75	5.16
ALPHA-CHLORDANE	NOT DETECTED	-	-	2 / 5	0.37 - 0.55	0.55
ANTHRACENE	NOT DETECTED	-	-	1 / 5	65	65
BENZO(A)ANTHRACENE	2 / 3	140 - 560	560	2 / 5	110 - 590	590
BENZO(A)PYRENE	2 / 3	160 - 590	590	2 / 5	110 - 480	480
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	2 / 5	220 - 895	652.44
BENZO(G,H,I)PERYLENE	2 / 3	130 - 380	380	2 / 5	99 - 165	165
BENZO(K)FLUORANTHENE	2 / 3	150 - 470	470	2 / 5	71 - 150	150
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	5 / 5	50 - 400	270.61
CHRYSENE	2 / 3	250 - 940	940	2 / 5	180 - 630	630
DIBENZ(A,H)ANTHRACENE	NOT DETECTED	-	-	1 / 5	54	54
DIETHYLPHTHALATE	1 / 3	44	44	1 / 5	180	180
FLUORANTHENE	2 / 3	300 - 1800	1800	2 / 5	240 - 1000	719.57
FLUORENE	1 / 3	190	190	1 / 5	50	50
GAMMA-CHLORDANE	1 / 3	0.095	0.095	1 / 5	0.38	0.38
INDENO(1,2,3-CD)PYRENE	2 / 3	110 - 310	310	2 / 5	99 - 200	200
PHENANTHRENE	2 / 3	200 - 1900	1900	2 / 5	180 - 725	544.48
PYRENE	2 / 3	350 - 1900	1900	2 / 5	350 - 770	770

TABLE 23-6a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SD01	23SD02	23SD03	23SD04	23SD05	23SD05-DUP	---	ARARS & TBCs
LOCATION:	23SD01	23SD02	23SD03	23SD04	23SD05	23SD05	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI		
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**		**mg/kg**
aluminum	1970	2660	2590	1260	1950	1980		-
arsenic	4.7	3.1	1.6	2.0	1.8	1.7		8.20 L
barium	11.1	6.4	16.7	6.3	4.6	3.6		40.0 B
cadmium	1.2 J	0.60 U	0.77 U	0.71 J	0.68 U	0.71 U		1.20 L
calcium	410	187	191	269	249	294		-
chromium, total	15.6	18.1	120 E	18.2	15.7	12.4		81.0 L
copper	4.9	6.7	2.2	2.4	5.9	5.4		34.0 L
iron	8130	5400	8940	13200	7830	7250		-
lead	11.3	13.8	72.5 E	4.1	5.0	4.4		47.0 L
magnesium	172	115	138	203	257	282		-
manganese	8.5	5.5	3.7	6.6	10.5	9.4		460 O
mercury	0.018 J	0.057 J	0.0028 U	0.0027 U	0.0041 J	0.0025 U		0.150 L
nickel	4.0	1.4	4.5	1.6 U	2.5	2.4		21.0 L
potassium	351	207	348	458	321	145		-
sodium	36.3	24.9	40.7	28.6	24.6	32.3		-
vanadium	20.1	16.5	14.1	20.8	12.8	11.2		-
zinc	35.0	15.9 J	71.3	9.7 J	17.7 J	23.6		150 L
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**
1,2,4-trichlorobenzene	600 U	380 U	75.0 J	450 U	430 U	440 U		9200
anthracene	600 U	380 U	490 U	450 U	54.0 J	76.0 J		330 F
benzo(a)anthracene	600 U	380 U	490 U	110 J	320 J	590 E		330 F
benzo(a)pyrene	600 U	380 U	490 U	110 J	320 J	480 E		430 L
benzo(b)fluoranthene	600 U	380 U	490 U	220 J	590 E	1200 E		330 F
benzo(g,h,i)perylene	600 U	380 U	490 U	99.0 J	220 J	110 J		330 F
benzo(k)fluoranthene	600 U	380 U	490 U	71.0 J	150 J	440 U		330 F
bis(2-ethylhexyl)phthalate	62.0 J	52.0 J	400 J	50.0 J	50.0 J	440 U		890000000 S
chrysene	600 U	380 U	490 U	180 J	460 E	800 E		330 F
dibenz(a,h)anthracene	600 U	380 U	490 U	450 U	54.0 J	440 U		330 F

TABLE 23-6a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SD01		23SD02		23SD03		23SD04		23SD05		23SD05-DUP		---	ARARS & TBCs	
LOCATION:	23SD01		23SD02		23SD03		23SD04		23SD05		23SD05		---	Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**			**ug/kg**	
diethylphthalate	600	U	380	U	490	U	450	U	180	J	440	U		630000	P
fluoranthene	600	U	380	U	490	U	240	J	700		1300			2900	Q
fluorene	600	U	380	U	490	U	450	U	50.0	J	440	U		540	P
indeno(1,2,3-cd)pyrene	600	U	380	U	490	U	99.0	J	230	J	170	J		330	F
phenanthrene	600	U	380	U	490	U	180	J	540		910	E		850	Q
pyrene	600	U	380	U	490	U	350	J	770	E	950	E J		660	L
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**			**ug/kg**	
4,4'-DDD	0.80	J	3.8	U	0.20	R	0.38	JN	4.8	E	4.9	E		1.60	L
4,4'-DDE	6.0	U	3.8	U	4.9	U	4.5	U	2.4	E JN	2.3	E R		2.20	L
4,4'-DDT	6.0	U	3.8	U	4.9	U	4.5	U	5.2	E	8.3	E		1.60	L
aldrin	3.1	U	2.0	U	2.5	U	2.3	U	2.2	U	1.2	JN		-	
alpha-chlordane	0.66	R	0.37	J	0.55	J	2.3	U	2.2	U	2.3	U		7.00	O
delta-BHC	1.0	R	2.0	U	2.5	U	2.3	U	2.2	U	2.3	U		-	
gamma-chlordane	3.1	U	2.0	U	0.38	JN	2.3	U	2.2	U	2.3	U		7.00	O
heptachlor epoxide	3.1	U	2.0	U	2.5	U	2.3	U	0.36	JN	1.3	R		5.00	O
methoxychlor	30.0	U	20.0	U	25.0	U	23.0	U	22.0	U	3.8	R		19.0	P

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

23.5.3.1 Inorganics

All three unfiltered monitoring well samples exhibited elevated levels of several metals. Unfiltered monitoring well sample 23 GW 03 exhibited the highest concentrations of aluminum, arsenic, beryllium, cadmium, chromium, iron, lead, vanadium, and zinc. This sample and 23 GW 02 required filtering in the field, despite the use of low-flow purge techniques to minimize suspended solids. Filtered sample results from the same location did not exhibit elevated levels of any metals except cadmium (10.9 ug/L in 23 GW 02 and 8.5 ug/L in 23 GW 03) and arsenic (4.1 ug/L in 23 GW 03). Final endpoint turbidity readings for groundwater sampling were 787 NTU (23 GW 01), 457 NTU (23 GW 02) and 871 NTU (23 GW 03).

25.5.3.2 Organics

Endosulfan I (0.0078 ug/L and 0.025 ug/L) was detected in two groundwater samples collected at Site 23. 4,4'-DDT (0.034 ug/L), chloroform (6 ug/L), dieldrin (0.016 ug/L), gamma-BHC (0.0086 ug/L), and heptachlor epoxide (0.013 ug/L) were each detected in one groundwater sample collected at Site 23. No pesticides were detected in background groundwater samples. Explosives were not detected in groundwater samples.

23.5.4 Surface Water

Three surface water samples were collected at Site 23: 23 SW 03 through 23 SW 05 (Figure 23-1). Tables 23-10 and 23-11 present the occurrence and distribution of inorganic and organic chemicals in site-related surface water samples. Table 23-10a presents a comparison of detected compounds to ARARs and TBCs. Figure 23-4 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

23.5.4.1 Inorganics

Concentrations of aluminum, barium, cadmium, chromium, cobalt, iron, and zinc were slightly greater in sample 23 SW 03 than the ranges found in background surface water samples. Metals that are normally of low solubility, such as aluminum, were detected at elevated levels in this sample and suggest that suspended solids may represent a substantial portion of the overall metal concentrations present.

TABLE 23-8
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	11 / 11	287 - 7870	5097.82	3 / 3	9500 - 41700	25600.00	YES	41700
ARSENIC	1 / 11	5.8 - 5.8	4.05	3 / 3	8.4 - 40.4	25.50	YES	40.4
BARIUM*	11 / 11	2.6 - 518	229.60	3 / 3	46 - 298	134.67	NO	298
BERYLLIUM	4 / 11	0.21 - 1.6	0.49	3 / 3	0.98 - 6.5	3.73	YES	6.5
CADMIUM	5 / 11	0.6 - 1.9	1.21	3 / 3	3 - 15	7.13	YES	15
CALCIUM	11 / 11	506 - 17200	8306.55	3 / 3	6450 - 10200	8203.33	NO	10200
CHROMIUM	NOT DETECTED	-	-	3 / 3	486 - 2380	1358.67	YES	2380
COBALT	6 / 11	0.7 - 10.1	4.06	3 / 3	9.9 - 27.2	20.23	YES	27.2
COPPER	9 / 11	0.79 - 13.5	6.53	3 / 3	11.2 - 33.5	21.77	YES	33.5
IRON	11 / 11	153 - 7690	4197.09	3 / 3	25800 - 108000	64633.33	YES	108000
LEAD	3 / 11	2.1 - 3	2.44	3 / 3	19.8 - 50.1	38.40	YES	50.1
MAGNESIUM	11 / 11	273 - 27400	8449.64	3 / 3	2860 - 9900	6733.33	NO	9900
MANGANESE	11 / 11	3.3 - 65	46.18	3 / 3	18.6 - 59.3	42.07	NO	59.3
MERCURY*	11 / 11	0.005 - 0.12	0.12	3 / 3	0.048 - 0.081	0.07	NO	0.081
NICKEL	10 / 11	0.81 - 25.5	11.98	3 / 3	13.2 - 83	58.87	YES	83
POTASSIUM	11 / 11	350 - 3245	2810.55	3 / 3	8660 - 37700	22053.33	YES	37700
SELENIUM*	1 / 11	5.3 - 5.3	4.96	1 / 3	7.5	3.97	NO	7.5
SILVER	NOT DETECTED	-	-	1 / 3	1	0.65	YES	1
SODIUM	11 / 11	1850 - 11650	8449.09	3 / 3	6360 - 28600	14470.00	YES	28600
THALLIUM*	3 / 11	4 - 5.1	5.15	1 / 3	3.9	2.50	NO	3.9
VANADIUM	10 / 11	0.69 - 42.25	16.48	3 / 3	211 - 1140	654.33	YES	1140
ZINC*	6 / 9	3.7 - 348	178.61	3 / 3	199 - 322	267.67	YES	322

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 23-9
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDT	NOT DETECTED	-	-	1 / 2	0.034	0.034
CHLOROFORM	NOT DETECTED	-	-	1 / 3	6	6
DIELDRIN	NOT DETECTED	-	-	1 / 3	0.016	0.016
ENDOSULFAN I	NOT DETECTED	-	-	2 / 2	0.0078 - 0.025	0.025
GAMMA-BHC (LINDANE)	NOT DETECTED	-	-	1 / 2	0.0086	0.0086
HEPTACHLOR EPOXIDE	NOT DETECTED	-	-	1 / 1	0.013	0.013

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TABLE 23-8a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23GW01	23GW02	23GW02-F	23GW03	23GW03-F	---	ARARS & TBCs		
LOCATION:	23GW01	23GW02	23GW02	23GW03	23GW03	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI				
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L		ug/L	ug/L	ug/L
aluminum	25600 E J	9500 E J	1790 E J	41700 E J	104		-	-	200
arsenic	27.7 E	8.4 E	3.3 U	40.4 E	4.1		50.0	-	8.00
barium	46.0	298	33.3	60.0	27.3		2000	2000 a	2000
beryllium	3.7	1.0	0.11 U	6.5 E	0.11 U		4.00	4000 e	20.0
cadmium	3.4	3.0	10.9 E	15.0 E	8.5 E		5.00	5.00 e	4.00
calcium	7960	6450	6010	10200	5640		-	-	-
chromium, total	1210 E	486 E	29.9	2380 E	2.2		100 *	100 a	100
cobalt	23.6	9.9	6.1	27.2	10.2		-	-	-
copper	20.6	11.2	2.6	33.5	2.2		1300	-	1000
iron	60100 E	25800 E	4890 E	108000 E	452 E		-	-	300
lead	45.3 E	19.8 E	8.6 J	50.1 E	1.5 UJ		15.0	-	10.0
magnesium	7440	2860	1020	9900	478		-	-	-
manganese	18.6	59.3 E	60.7 E	48.3	37.3		-	-	50.0
mercury	0.071	0.081	0.026	0.048	0.011		2.00	2.00 b	2.00
nickel	80.4	13.2	17.9	83.0	25.6		100	100 a	100
potassium	19800 J	8660	2420	37700 J	3050		-	-	-
selenium	7.5 J	4.4 U	4.4 U	4.4 U	4.4 U		50.0	-	50.0
silver	1.0	0.94 U	0.94 U	0.94 U	0.94 U		-	100 a	-
sodium	6360	8450	8050	28600	27100		-	-	50000
thallium	3.9 E J	3.6 U	3.6 U	3.6 UJ	3.6 U		2.00	0.400 a	10.0
vanadium	612	211	1.4	1140	1.0		-	-	-
zinc	199	322	86.9	282	66.9		-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L		ug/L	ug/L	ug/L
chloroform	10.0 U	10.0 U	n/a	6.0 J	n/a		100	100 e	6.00
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L		ug/L	ug/L	ug/L
4,4'-DDT	0.074 R	0.034 J	n/a	0.10 U	n/a		-	-	0.100
dieldrin	0.016 JN	0.10 U	n/a	0.10 U	n/a		-	0.500 e	0.0300
endosulfan I	0.025 JN	0.0078 JN	n/a	0.038 R	n/a		-	-	0.400

TABLE 23-8a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23GW01		23GW02		23GW02-F	23GW03		23GW03-F		---	ARARS & TBCs			
LOCATION:	23GW01		23GW02		23GW02	23GW03		23GW03		---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)		NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI		1995 RI		1995 RI	1995 RI		1995 RI						
PESTICIDES	**ug/L**		**ug/L**		**ug/L**	**ug/L**		**ug/L**			**ug/L**	**ug/L**		**ug/L**
gamma-BHC (Lindane)	0.050	U	0.0086	J	n/a	0.034	R	n/a			0.200	0.200	a	0.200
gamma-chlordane	0.0081	R	0.050	U	n/a	0.0089	R	n/a			2.00	2.00	a	0.500
heptachlor	0.050	U	0.050	U	n/a	0.014	R	n/a			0.400	5.00	e	0.400
heptachlor epoxide	0.025	R	0.013	JN	n/a	0.032	R	n/a			0.200	0.100	e	0.200

TABLE 23-8a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

• - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

TABLE 23-10
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE WATER AT SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	265 - 409	705.33	3 / 3	148 - 3670	1333.00	YES	3670
BARIUM	3 / 3	16.3 - 34	53.73	3 / 3	15.1 - 301	110.73	YES	301
CADMIUM	1 / 3	0.18	0.23	1 / 3	1	0.46	YES	1
CALCIUM	3 / 3	462 - 10100	9128.00	3 / 3	5680 - 6140	5913.33	NO	6140
CHROMIUM	3 / 3	0.72 - 2.6	2.71	2 / 3	1.3 - 29.4	10.40	YES	29.4
COBALT	3 / 3	0.81 - 1.9	2.54	3 / 3	0.66 - 1.9	1.14	NO	1.9
COPPER	2 / 3	1.1 - 9.8	7.40	3 / 3	1.3 - 16.1	6.33	NO	16.1
IRON	3 / 3	160 - 702	1040.00	3 / 3	338.5 - 33100	11343.17	YES	33100
LEAD	1 / 3	4.4	3.43	1 / 3	10.3	3.93	YES	10.3
MAGNESIUM	3 / 3	369 - 2770	2525.33	3 / 3	1230 - 2660	2146.67	NO	2660
MANGANESE	3 / 3	14 - 55.5	59.93	3 / 3	3.65 - 36.1	15.32	NO	36.1
MERCURY	2 / 3	0.023 - 0.028	0.04	3 / 3	0.076 - 0.17	0.11	YES	0.17
POTASSIUM	2 / 3	251 - 1850	1482.33	3 / 3	524 - 1430	827.67	NO	1430
SODIUM	NOT DETECTED	-	-	3 / 3	3490 - 9050	5360.00	YES	9050
VANADIUM	2 / 3	0.89 - 0.9	1.32	1 / 3	18.8	6.47	YES	18.8
ZINC	3 / 3	7.6 - 29.4	32.67	1 / 3	253	84.87	YES	253

Note: Selected COPCs are indicated in boldface type.

TABLE 23-11
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE WATER AT SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	1 / 1	1	1
GAMMA-BHC (LINDANE)	NOT DETECTED	-	-	1 / 1	0.0068	0.0068

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TABLE 23-10a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	23SW03	23SW04	23SW05	23SW05-DUP	ARARS & TBCs				
LOCATION:	23SW03	23SW04	23SW05	23SW05	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	3670 J	181	148	148	-	-	-	-	-
barium	301	16.1	15.2	15.0	-	-	-	-	2000
cadmium	1.0	0.38 U	0.38 U	0.38 U	1.10 +	-	-	-	-
calcium	6140	5920	5710	5650	-	-	-	-	-
chromium, total	29.4	1.3	1.0 U	1.0 U	209 +	-	-	-	160
cobalt	1.9	0.66	0.60 U	0.86	-	-	-	-	-
copper	16.1 E	1.6	1.3	1.3	11.0 +	-	-	-	-
iron	33100	591	330	347	-	-	-	-	-
lead	10.3 E	1.5 U	1.5 U	1.5 U	3.20 +	-	-	-	5.00
magnesium	1230	2660	2560	2540	-	-	-	-	-
manganese	36.1	6.2	3.7	3.6	-	-	-	-	-
mercury	0.17 E	0.076 E	0.077 E	0.077 E	0.0120	0.140	0.150	-	-
potassium	1430	524	513	545	-	-	-	-	-
sodium	9050	3490	3520	3560	-	-	-	-	-
vanadium	18.8	0.61 U	0.61 U	0.61 U	-	-	-	-	-
zinc	253 E	1.6 U	1.6 U	1.6 U	101 +	-	-	-	-
SEMIVOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
bis(2-ethylhexyl)phthalate	10.0 U	10.0 U	1.0 J	10.0 U	3.00	1.80	5.90	-	1.76
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
4,4'-DDD	0.0012 E R	0.10 U	0.10 U	0.10 U	-			-	-
gamma-BHC (Lindane)	0.0068 J	0.050 U	0.050 U	0.050 U	0.0800	0.0190	0.0630	0.0800	-

TABLE 23-10a
COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

. - No standard is available for this chemical in this classification.

+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L.

23.5.4.2 Organics

Gamma-BHC and bis(2-ethylhexyl) phthalate were each detected in one site-related surface water sample collected at Site 23 at concentrations of 0.0068 ug/L and 1.0 ug/L, respectively. These compounds were not found in background surface water samples. Explosives were analyzed for but were not detected in site-related surface water samples.

23.6 CONTAMINANT FATE AND TRANSPORT

Various aspects of contaminant fate and transport at Site 23 are discussed in this section. Various chemical and physical properties affecting contaminant migration are discussed in Section 23.6.1. Section 23.6.2 presents a brief discussion of contaminant persistence. Trends in detected contaminants and observed contaminant migration routes are identified and discussed in Section 23.6.3.

23.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at the Site 23 revealed only slightly elevated concentrations of vanadium, chromium, and PAHs in subsurface soil, a low level of 1,2,4-trichlorobenzene in one sediment sample, and elevated levels of several metals in unfiltered groundwater. The physical transport data for the detected contaminants are presented in Table 2-10. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

1,2,4-Trichlorobenzene was detected in a sediment sample but was not found in the surface water or groundwater samples. This compound is somewhat water soluble but also has a degree of affinity for soil. Hence, it is expected to exhibit a limited potential for migration in the dissolved phase. The compound was not detected in previous investigations at Site 23.

Concentrations of several metals were generally greater in non-filtered groundwater samples than in corresponding filtered samples. With the exception of arsenic and cadmium, elevated levels of metals were not present in filtered samples, which indicates the presence of suspended solids. Metals in suspension are expected to have a lower in-situ transport potential than metals in solution. Despite efforts such as installation of dedicated low-flow bladder pumps and adherence to the EPA low-flow sampling procedure, low turbidity samples could not be collected at all wells. The lowest endpoint turbidity value achieved at any Site 23 monitoring well was 457 NTU; therefore, unfiltered metals concentrations are considered higher than representative for the formation.

PAHs, detected in subsurface soil, have limited water solubility and are strongly bound to soil. These compounds are not expected to migrate readily except through surface water erosional dispersion.

Slightly elevated levels of vanadium and chromium were each noted in one subsurface soil sample. The extent to which these metals can be leached from soil and transported in groundwater is largely determined by chemical species present and by environmental factors determining solubility and binding to organic materials.

23.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

1,2,4-Trichlorobenzene exhibits a slight tendency to volatilize and also has been shown to biodegrade in waste treatment studies. Biodegradation rates in the environment would be expected to be slower than in the waste treatability studies where materials and oxygen were provided (Clement Associates, 1985). PAHs exhibit very limited biodegradation rates in soil, with the heavier PAH compounds considered more persistent.

23.6.3 Observed Chemical Contaminant Trends

The presence of suspended solids in samples 23 GW 01, 23 GW 02, and 23 GW 03 is indicated by high turbidity readings and elevated levels of metals, such as aluminum, that are normally relatively insoluble in most common forms. Unfiltered sample results were used in calculations for the groundwater risk assessment according to the recommended conservative approach to this evaluation. Filtered sample results of two wells at Site 23 appear to be more representative of dissolved-phase contamination. Elevated levels of most metals were not generally found in the filtered samples, with the exception of arsenic and cadmium in the filtered aliquot of sample 23 GW 03 and cadmium in the filtered portion of sample 23 GW 02. Note that arsenic was not detected at elevated levels in other media samples. Cadmium was not detected at elevated levels in sediment or subsurface soils.

Concentrations of aluminum, barium, cadmium, chromium, cobalt, iron, lead and zinc were slightly greater in sample 23 SW 03 than the ranges found in background surface water samples. The sediment sample from this location exhibited elevated levels of metals (chromium and lead). The presence of elevated levels of aluminum suggests that suspended solids, rather than dissolved metals, represent a significant portion of the total metals in this sample. The corresponding sediment sample did not reveal elevated levels of metals.

PAHs identified at elevated levels in one subsurface soil sample were not detected in any other media. Vanadium and chromium levels each exhibited elevated concentrations in only one subsurface soil sample. These metals were not detected at elevated levels in filtered groundwater samples, and unfiltered groundwater samples were not considered representative of dissolved-phase groundwater contamination.

23.6.4 Conclusions

PAHs typically are adsorbed strongly onto soil and are not expected to transport quickly from the subsurface soil source areas. 1,2,4-Trichlorobenzene, which was detected in sediment at a low level, exhibits moderate solubility. This compound is expected to have limited persistence due to the potential for volatilization, biodegradation, or gradual leaching or erosional transport from sediment.

Elevated levels of aluminum, arsenic, beryllium, cadmium, chromium, iron, lead, vanadium, and zinc metals in unfiltered groundwater samples may not indicate the potential for groundwater transport for one or more of these metals because suspended solids are present in the unfiltered groundwater samples. Given a geologic formation that does not include conditions conducive to solution channeling or fracture-based flow, metals in suspension are expected to have a lower potential for in-situ transport compared to metals in solution. Only cadmium was detected at slightly elevated levels above the detection limit in filtered groundwater, and this metal was not found at elevated levels in soil and sediment media sampled at Site 23. The historical groundwater data from this site were obtained using hydropunch sampling, which tends to yield turbid samples, so no correlation between the filtered results from this investigation can be made.

Slightly elevated levels of certain metals in surface water are also suggested to be related to suspended solids rather than dissolved-phase concentrations. The metals present in surface water were not associated with any elevated sediment levels and so do not appear to indicate migration of metals from the site.

Chromium and vanadium were the only metals detected at slightly elevated levels in two of the subsurface soil samples. It should be noted that low soil pH (4.04 to 4.69) was present in four of the subsurface soil samples, which could increase the potential for solubilization and transport of metals in the environment.

23.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site 23. The risk assessment was performed using the approach outlined in Section 2.4. Tables 23-12 through 23-15 provide the selected COPCs and representative concentrations of inorganics and organics in site-related subsurface soil, sediment, groundwater, and surface water, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The result of the conservative baseline risk assessment was greater than a value of 1.0 for non-cancer risk and greater than 1E-04 for cancer risk; therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. Section 23.7.1.6 discusses the modifications made to the conservative preliminary baseline risk assessment.

Note that metals risks are based upon unfiltered data; filtered sample results are lower and would yield a lower and less conservative estimate of risk.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation alternatives are identified for a site.

23.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of current land use (industrial employee) and hypothetical future land use (residential, recreational, and industrial receptors).

23.7.1.1 Future Industrial Employee

For the future industrial receptor, the conservative preliminary baseline risk assessment yielded estimated total cancer risks greater than 1E-04 (groundwater) and approximately 1E-04 (subsurface soil). For this receptor, HIs were greater than 1.0 (groundwater). Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. The amended carcinogenic and noncarcinogenic risks for industrial receptors are discussed in Section 23.7.1.7 and presented for subsurface soil in Tables 23-16 and 23-17, respectively. Estimated carcinogenic risks and noncarcinogenic HQs

TABLE 23-12
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ARSENIC	16.2	NONPARAMETRIC
BERYLLIUM	0.69	NONPARAMETRIC
CADMIUM	1.40	NORMAL
CHROMIUM	91.2	NONPARAMETRIC
LEAD	9.8	NONPARAMETRIC
VANADIUM	178	NONPARAMETRIC
ACENAPHTHENE*	1243.91	NORMAL
BENZO(A)ANTHRACENE*	8097.30	NORMAL
BENZO(A)PYRENE*	5574.57	NORMAL
BENZO(B)FLUORANTHENE*	5995.03	NORMAL
BENZO(G,H,I)PERYLENE*	2967.76	NORMAL
BENZO(K)FLUORANTHENE*	2210.94	NORMAL
BIS(2-ETHYLHEXYL)PHTHALATE*	387.53	NORMAL
CARBAZOLE*	1285.95	NORMAL
CHRYSENE*	8097.30	NORMAL
DIBENZ(A,H)ANTHRACENE*	991.64	NORMAL
DIBENZOFURAN*	739.38	NORMAL
FLUORANTHENE*	16085.93	NORMAL
FLUORENE*	1328.00	NORMAL
GAMMA-BHC (LINDANE)*	0.039	LOGNORMAL
INDENO(1,2,3-CD)PYRENE*	2463.22	NORMAL
PHENANTHRENE*	8517.75	NORMAL
PYRENE*	13563.20	NORMAL

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 23-13
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SEDIMENT - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION (mg/kg)	STATISTICAL DISTRIBUTION
ARSENIC	4.70	NONPARAMETRIC
BARIUM	16.70	NONPARAMETRIC
CADMIUM	1.20	NONPARAMETRIC
CHROMIUM	81.36	NORMAL
IRON	12957.55	NONPARAMETRIC
LEAD	48.87	NORMAL
MANGANESE	9.95	NONPARAMETRIC
ZINC	71.30	NONPARAMETRIC
1,2,4-TRICHLOROBENZENE*	75	NONPARAMETRIC
4,4'-DDD*	4.85	NONPARAMETRIC
4,4'-DDT*	5.16	NORMAL
ALPHA-CHLORDANE*	0.55	NONPARAMETRIC
ANTHRACENE*	65	NONPARAMETRIC
BENZO(A)ANTHRACENE*	590	NONPARAMETRIC
BENZO(A)PYRENE*	480	NONPARAMETRIC
BENZO(B)FLUORANTHENE*	652.44	NORMAL
BENZO(G,H,I)PERYLENE*	165	NONPARAMETRIC
BENZO(K)FLUORANTHENE*	150	NONPARAMETRIC
BIS(2-ETHYLHEXYL)PHTHALATE*	270.61	NORMAL
CHRYSENE*	630	NONPARAMETRIC
DIBENZ(A,H)ANTHRACENE*	54	NONPARAMETRIC
DIETHYLPHTHALATE*	180	NONPARAMETRIC
FLUORANTHENE*	719.57	NORMAL
FLUORENE*	50	NONPARAMETRIC
GAMMA-CHLORDANE*	0.38	NONPARAMETRIC
INDENO(1,2,3-CD)PYRENE*	200	NONPARAMETRIC
PHENANTHRENE*	544.48	NORMAL
PYRENE*	770	NONPARAMETRIC

* = UNITS FOR ORGANIC CHEMICALS ARE IN ug/kg

TABLE 23-14
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
GROUNDWATER - SITE 23 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	41700	NONPARAMETRIC
ARSENIC	40.4	NONPARAMETRIC
BARIUM	298	NONPARAMETRIC
BERYLLIUM	6.5	NONPARAMETRIC
CADMIUM	15	NONPARAMETRIC
CHROMIUM	2380	NONPARAMETRIC
COBALT	27.2	NONPARAMETRIC
COPPER	33.5	NONPARAMETRIC
IRON	108000	NONPARAMETRIC
LEAD	50.1	NONPARAMETRIC
MERCURY	0.081	NONPARAMETRIC
NICKEL	83	LOGNORMAL
SELENIUM	7.5	LOGNORMAL
SILVER	1	LOGNORMAL
THALLIUM	3.9	LOGNORMAL
VANADIUM	1140	NONPARAMETRIC
ZINC	322	NONPARAMETRIC
4,4'-DDT	0.034	NONPARAMETRIC
CHLOROFORM	6	LOGNORMAL
DIELDRIN	0.016	LOGNORMAL
ENDOSULFAN I	0.025	NONPARAMETRIC
GAMMA-BHC (LINDANE)	0.0086	NONPARAMETRIC
HEPTACHLOR EPOXIDE	0.013	NONPARAMETRIC

TABLE 23-15
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SURFACE WATER - SITE 23 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	3670	NORMAL
BARIUM	301	NORMAL
CADMIUM	1	LOGNORMAL
CHROMIUM	29.4	NONPARAMETRIC
COBALT	1.9	NONPARAMETRIC
COPPER	16.1	NORMAL
IRON	33100	NORMAL
LEAD	10.3	LOGNORMAL
MERCURY	0.17	NORMAL
VANADIUM	18.8	LOGNORMAL
ZINC	253	LOGNORMAL
BIS(2-ETHYLHEXYL)PHTHALATE	1	NONPARAMETRIC
GAMMA-BHC (LINDANE)	0.0068	NONPARAMETRIC

TABLE 23-16
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 23
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ACENAPHTHENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	2.1E-06	N/A	4.5E-10
BENZO(A)PYRENE	1.4E-05	N/A	3.1E-09
BENZO(B)FLUORANTHENE	1.5E-06	N/A	3.3E-10
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	5.6E-08	N/A	1.2E-11
BIS(2-ETHYLHEXYL)PHTHALATE	1.9E-09	N/A	3.5E-13
CARBAZOLE	9.0E-09	N/A	1.7E-12
CHRYSENE	2.1E-08	N/A	4.5E-12
DIBENZ(A,H)ANTHRACENE	N/A	N/A	7.8E-11
DIBENZOFURAN	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	N/A	N/A	9.1E-16
INDENO(1,2,3-CD)PYRENE	6.3E-07	N/A	1.4E-10
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	8.5E-05	8.4E-05	1.9E-08
CADMIUM	N/A	N/A	1.1E-10
CHROMIUM	N/A	N/A	5.0E-08
VANADIUM	N/A	N/A	N/A
TOTAL RISK	1.0E-04	8.4E-05	7.3E-08

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 23-16a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 23
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ACENAPHTHENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	1.7E-07	N/A	8.0E-11
BENZO(A)PYRENE	1.2E-06	N/A	5.5E-10
BENZO(B)FLUORANTHENE	1.3E-07	N/A	5.9E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	4.8E-09	N/A	2.2E-12
BIS(2-ETHYLHEXYL)PHTHALATE	1.6E-10	N/A	6.3E-14
CARBAZOLE	7.6E-10	N/A	3.0E-13
CHRYSENE	1.7E-09	N/A	8.0E-13
DIBENZ(A,H)ANTHRACENE	N/A	N/A	1.4E-11
DIBENZOFURAN	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	N/A	N/A	1.6E-16
INDENO(1,2,3-CD)PYRENE	5.3E-08	N/A	2.4E-11
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	4.6E-06	9.1E-06	2.2E-09
CADMIUM	N/A	N/A	2.0E-11
CHROMIUM	N/A	N/A	6.9E-09
VANADIUM	N/A	N/A	N/A
TOTAL RISK	6.2E-06	9.1E-06	9.9E-09

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 23-17
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 23
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ACENAPHTHENE	2.0E-05	N/A	3.8E-09
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	N/A	N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	1.9E-05	N/A	3.5E-09
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DIBENZ(A,H)ANTHRACENE	N/A	N/A	N/A
DIBENZOFURAN	N/A	N/A	N/A
FLUORANTHENE	3.9E-04	N/A	7.3E-08
FLUORENE	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	N/A	N/A	N/A
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PYRENE	4.4E-04	N/A	8.2E-08
ARSENIC	5.3E-02	5.2E-02	9.8E-06
CADMIUM	2.7E-03	8.5E-04	1.4E-06
CHROMIUM	1.8E-02	N/A	3.3E-06
VANADIUM	2.5E-02	N/A	4.6E-06

for future industrial receptors exposed to groundwater are presented in Tables 23-18 and 23-19, respectively.

23.7.1.2 Future Residential Receptor

For the future residential receptor, the conservative preliminary baseline risk assessment yielded estimated total cancer risks greater than 1E-04 (subsurface soil and groundwater). For the future residential child, HIs were greater than 1.0 (subsurface soil and groundwater). Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. The amended carcinogenic and noncarcinogenic risks for residential receptors are discussed in Section 23.7.1.7 and presented for subsurface soil in Tables 23-20 and 23-21, respectively. Estimated carcinogenic risks and noncarcinogenic HQs for future residential receptors exposed to groundwater are presented in Tables 23-22 and 23-23, respectively.

23.7.1.3 Future Recreational Receptor

The estimated total RME cancer risks for the future recreational child assuming exposure to COPCs in sediment during wading at Site 23 are 1.3E-07 (ingestion) and 3.3E-09 (dermal contact). The RME cancer risks for exposure to COPCs in surface water during wading at Site 23 are 2.5E-10 (ingestion) and 3.9E-09 (dermal contact). This sediment cancer risk is below the 1E-04 to 1E-06 target acceptable risk range. This surface water cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The estimated RME HIs for the future recreational child, assuming exposure to COPCs in sediment during wading, are less than 1.0 for ingestion and dermal contact exposure pathways. The estimated RME HIs for the future recreational child assuming exposure to COPCs in surface water during wading at Site 23 are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of the HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to sediment at Site 23 in Tables 23-24 and 23-25, respectively. Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future recreational receptors exposed to surface water at Site 23 in Tables 23-26 and 23-27, respectively.

23.7.1.5 Lead Results

Lead was found at concentrations exceeding the EPA action level (15 ug/L) in groundwater samples taken in previous investigations, and in groundwater samples collected using low flow techniques during the 1995

TABLE 23-18
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
4,4'-DDT	4.0E-08	1.3E-07
CHLOROFORM	1.3E-07	1.3E-09
DIELDRIN	8.9E-07	1.9E-07
ENDOSULFAN I	N/A	N/A
GAMMA-BHC (LINDANE)	3.9E-08	2.0E-09
HEPTACHLOR EPOXIDE	4.1E-07	7.5E-08
ALUMINUM	N/A	N/A
ARSENIC	2.1E-04	9.1E-08
BERYLLIUM	9.8E-05	4.0E-06
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
NICKEL	N/A	N/A
SILVER	N/A	N/A
VANADIUM	N/A	N/A
TOTAL RISK	3.1E-04	4.5E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-18a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
4,4'-DDT	4.5E-09	2.0E-08
CHLOROFORM	1.3E-08	1.8E-10
DIELDRIN	9.9E-08	3.1E-08
ENDOSULFAN I	N/A	N/A
GAMMA-BHC (LINDANE)	4.3E-09	3.2E-10
HEPTACHLOR EPOXIDE	4.6E-08	1.2E-08
ALUMINUM	N/A	N/A
ARSENIC	1.5E-05	9.1E-09
BERYLLIUM	6.2E-06	3.6E-07
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
NICKEL	N/A	N/A
SILVER	N/A	N/A
VANADIUM	N/A	N/A
TOTAL RISK	2.1E-05	4.3E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-19
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	THYROID	GROUNDWATER DERMAL CONTACT
4,4'-DDT	6.7E-04				6.7E-04					2.1E-03
CHLOROFORM	5.9E-03			5.9E-03	5.9E-03					5.7E-05
DIELDRIN	3.1E-03				3.1E-03		3.1E-03	3.1E-03		6.8E-04
ENDOSULFAN I	4.1E-05	4.1E-05		4.1E-05						3.5E-06
GAMMA-BHC (LINDANE)	2.8E-04			2.8E-04	2.8E-04					1.4E-05
HEPTACHLOR EPOXIDE	9.8E-03				9.8E-03					1.8E-03
ALUMINUM	4.1E-01									3.3E-03
ARSENIC	1.3E+00		1.3E+00							5.7E-04
BERYLLIUM	1.3E-02									5.2E-04
CADMIUM	2.9E-01			2.9E-01						1.2E-03
CHROMIUM	4.7E+00			4.7E+00						9.5E-02
COBALT	4.4E-03	4.4E-03							4.4E-03	3.6E-05
COPPER	8.2E-03	8.2E-03		8.2E-03	8.2E-03					5.6E-06
IRON	3.5E+00				3.5E+00	3.5E+00				2.9E-02
LEAD	N/A	N/A					N/A			N/A
NICKEL	4.1E-02						4.1E-02			1.1E-04
SILVER	2.0E-03		2.0E-03							4.0E-06
VANADIUM	1.6E+00									6.5E-02
	HI BY TARGET ORGAN	1.3E-02	1.3E+00	5.0E+00	3.6E+00	3.5E+00	4.4E-02	3.1E-03	4.4E-03	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-19a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	THYROID	GROUNDWATER DERMAL CONTACT
4,4'-DDT	4.1E-04				4.1E-04					1.8E-03
CHLOROFORM	3.2E-03			3.2E-03	3.2E-03					4.5E-05
DIELDRIN	1.9E-03				1.9E-03		1.9E-03	1.9E-03		6.0E-04
ENDOSULFAN I	1.6E-05	1.6E-05		1.6E-05						2.0E-06
GAMMA-BHC (LINDANE)	1.7E-04			1.7E-04	1.7E-04					1.3E-05
HEPTACHLOR EPOXIDE	6.0E-03				6.0E-03					1.6E-03
ALUMINUM	2.5E-01									2.9E-03
ARSENIC	5.1E-01		5.1E-01							3.1E-04
BERYLLIUM	4.5E-03									2.6E-04
CADMIUM	8.6E-02			8.6E-02						5.0E-04
CHROMIUM	1.6E+00			1.6E+00						4.8E-02
COBALT	2.0E-03	2.0E-03							2.0E-03	2.4E-05
COPPER	3.3E-03	3.3E-03		3.3E-03	3.3E-03					3.2E-06
IRON	1.3E+00				1.3E+00	1.3E+00				1.5E-02
LEAD	N/A	N/A					N/A			N/A
NICKEL	1.8E-02						1.8E-02			6.9E-05
SILVER	7.8E-04		7.8E-04							2.3E-06
VANADIUM	5.6E-01									3.3E-02
	HI BY TARGET ORGAN	5.3E-03	5.1E-01	1.7E+00	1.3E+00	1.3E+00	2.0E-02	1.9E-03	2.0E-03	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-20
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 23
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
ACENAPHTHENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	9.3E-06	N/A	2.7E-10
BENZO(A)PYRENE	6.4E-05	N/A	1.9E-09
BENZO(B)FLUORANTHENE	6.9E-06	N/A	2.0E-10
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	2.5E-07	N/A	7.5E-12
BIS(2-ETHYLHEXYL)PHTHALATE	8.5E-09	N/A	2.2E-13
CARBAZOLE	4.0E-08	N/A	1.0E-12
CHRYSENE	9.3E-08	N/A	2.7E-12
DIBENZ(A,H)ANTHRACENE	N/A	N/A	4.8E-11
DIBENZOFURAN	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	N/A	N/A	5.6E-16
INDENO(1,2,3-CD)PYRENE	2.8E-06	N/A	8.3E-11
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	3.8E-04	2.8E-04	1.2E-08
CADMIUM	N/A	N/A	7.0E-11
CHROMIUM	N/A	N/A	3.0E-08
VANADIUM	N/A	N/A	N/A
TOTAL RISK	4.6E-04	2.8E-04	4.5E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 23-20a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 23
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
ACENAPHTHENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	1.5E-06	N/A	8.5E-11
BENZO(A)PYRENE	1.0E-05	N/A	5.8E-10
BENZO(B)FLUORANTHENE	1.1E-06	N/A	6.3E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
BENZO(K)FLUORANTHENE	4.1E-08	N/A	2.3E-12
BIS(2-ETHYLHEXYL)PHTHALATE	1.4E-09	N/A	6.7E-14
CARBAZOLE	6.5E-09	N/A	3.2E-13
CHRYSENE	1.5E-08	N/A	8.5E-13
DIBENZ(A,H)ANTHRACENE	N/A	N/A	1.5E-11
DIBENZOFURAN	N/A	N/A	N/A
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	N/A	N/A	1.7E-16
INDENO(1,2,3-CD)PYRENE	4.5E-07	N/A	2.6E-11
PHENANTHRENE	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	3.9E-05	5.7E-05	2.3E-09
CADMIUM	N/A	N/A	2.2E-11
CHROMIUM	N/A	N/A	7.3E-09
VANADIUM	N/A	N/A	N/A
TOTAL RISK	5.3E-05	5.7E-05	1.0E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
*CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 23-21
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 23
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		SUBSURFACE SOIL INGESTION BY TARGET ORGAN							
SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
ACENAPHTHENE	2.7E-04			2.7E-04	2.7E-04			N/A	4.0E-09
BENZO(A)ANTHRACENE	N/A							N/A	N/A
BENZO(A)PYRENE	N/A							N/A	N/A
BENZO(B)FLUORANTHENE	N/A							N/A	N/A
BENZO(G,H,I)PERYLENE	N/A							N/A	N/A
BENZO(K)FLUORANTHENE	N/A							N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	2.5E-04				2.5E-04		2.5E-04	N/A	3.7E-09
CARBAZOLE	N/A							N/A	N/A
CHRYSENE	N/A							N/A	N/A
DIBENZ(A,H)ANTHRACENE	N/A							N/A	N/A
DIBENZOFURAN	N/A							N/A	N/A
FLUORANTHENE	5.1E-03	5.1E-03		5.1E-03	5.1E-03			N/A	7.7E-08
FLUORENE	N/A	N/A				N/A		N/A	N/A
GAMMA-BHC (LINDANE)	N/A			N/A	N/A			N/A	N/A
INDENO(1,2,3-CD)PYRENE	N/A							N/A	N/A
PHENANTHRENE	N/A							N/A	N/A
PYRENE	5.8E-03			5.8E-03				N/A	8.7E-08
ARSENIC	6.9E-01		6.9E-01					4.3E-01	1.0E-05
CADMIUM	3.6E-02			3.6E-02				7.0E-03	1.5E-06
CHROMIUM	2.3E-01			2.3E-01				N/A	3.5E-06
VANADIUM	3.3E-01							N/A	4.9E-06
	HI BY TARGET ORGAN	5.1E-03	6.9E-01	2.8E-01	5.7E-03		2.5E-04		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-21a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 23
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		SUBSURFACE SOIL INGESTION BY TARGET ORGAN							
SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
ACENAPHTHENE	1.3E-04			1.3E-04	1.3E-04			N/A	4.0E-09
BENZO(A)ANTHRACENE	N/A							N/A	N/A
BENZO(A)PYRENE	N/A							N/A	N/A
BENZO(B)FLUORANTHENE	N/A							N/A	N/A
BENZO(G,H,I)PERYLENE	N/A							N/A	N/A
BENZO(K)FLUORANTHENE	N/A							N/A	N/A
BIS(2-ETHYLHEXYL)PHTHALATE	1.2E-04				1.2E-04		1.2E-04	N/A	3.7E-09
CARBAZOLE	N/A							N/A	N/A
CHRYSENE	N/A							N/A	N/A
DIBENZ(A,H)ANTHRACENE	N/A							N/A	N/A
DIBENZOFURAN	N/A							N/A	N/A
FLUORANTHENE	2.6E-03	2.6E-03		2.6E-03	2.6E-03			N/A	7.7E-08
FLUORENE	N/A	N/A				N/A		N/A	N/A
GAMMA-BHC (LINDANE)	N/A			N/A	N/A			N/A	N/A
INDENO(1,2,3-CD)PYRENE	N/A							N/A	N/A
PHENANTHRENE	N/A							N/A	N/A
PYRENE	2.9E-03			2.9E-03				N/A	8.7E-08
ARSENIC	2.2E-01		2.2E-01					2.8E-01	6.7E-06
CADMIUM	1.8E-02			1.8E-02				7.0E-03	1.5E-06
CHROMIUM	9.0E-02			9.0E-02				N/A	2.7E-06
VANADIUM	1.1E-01							N/A	3.2E-06
	HI BY TARGET ORGAN	2.6E-03	2.2E-01	1.1E-01	2.8E-03		1.2E-04		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-22
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
4,4'-DDT	1.7E-07	4.0E-06	3.1E-07
CHLOROFORM	5.4E-07	4.0E-08	7.0E-06
DIELDRIN	3.8E-06	6.2E-06	7.0E-06
ENDOSULFAN I	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	1.7E-07	6.3E-08	4.2E-07
HEPTACHLOR EPOXIDE	1.8E-06	2.4E-06	7.3E-07
ALUMINUM	N/A	N/A	N/A
ARSENIC	9.0E-04	2.1E-06	N/A
BERYLLIUM	4.2E-04	9.4E-05	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	N/A
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
TOTAL RISK	1.3E-03	1.1E-04	1.5E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-22a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
4,4'-DDT	2.5E-08	6.3E-07	1.8E-08
CHLOROFORM	7.0E-08	5.6E-09	3.6E-07
DIELDRIN	5.5E-07	9.8E-07	4.0E-07
ENDOSULFAN I	N/A	N/A	N/A
GAMMA-BHC (LINDANE)	2.4E-08	1.0E-08	2.4E-08
HEPTACHLOR EPOXIDE	2.5E-07	3.8E-07	4.2E-08
ALUMINUM	N/A	N/A	N/A
ARSENIC	8.2E-05	1.8E-07	N/A
BERYLLIUM	3.4E-05	7.1E-06	N/A
CADMIUM	N/A	N/A	N/A
CHROMIUM	N/A	N/A	N/A
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
TOTAL RISK	1.2E-04	9.3E-06	8.4E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-23
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN							
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	THYROID
4,4'-DDT	4.3E-03				4.3E-03				
CHLOROFORM	3.8E-02			3.8E-02	3.8E-02				
DIELDRIN	2.0E-02				2.0E-02		2.0E-02	2.0E-02	
ENDOSULFAN I	2.7E-04	2.7E-04		2.7E-04					
GAMMA-BHC (LINDANE)	1.8E-03			1.8E-03	1.8E-03				
HEPTACHLOR EPOXIDE	6.4E-02				6.4E-02				
ALUMINUM	2.7E+00								
ARSENIC	8.6E+00		8.6E+00						
BERYLLIUM	8.3E-02								
CADMIUM	1.9E+00			1.9E+00					
CHROMIUM	3.0E+01			3.0E+01					
COBALT	2.9E-02	2.9E-02							2.9E-02
COPPER	5.4E-02	5.4E-02		5.4E-02	5.4E-02				
IRON	2.3E+01				2.3E+01	2.3E+01			
LEAD	N/A	N/A					N/A		
NICKEL	2.7E-01						2.7E-01		
SILVER	1.3E-02		1.3E-02						
VANADIUM	1.0E+01								
	HI BY TARGET ORGAN	8.3E-02	8.6E+00	3.2E+01	2.3E+01	2.3E+01	2.9E-01	2.0E-02	2.9E-02

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-23
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER DERMAL CONTACT BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER DERMAL CONTACT - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	THYROID	INHALATION OF VOAS IN GW - ADULT
4,4'-DDT	7.9E-02				7.9E-02					N/A
CHLOROFORM	2.2E-03			2.2E-03	2.2E-03					N/A
DIELDRIN	2.6E-02				2.6E-02		2.6E-02	2.6E-02		N/A
ENDOSULFAN I	1.3E-04	1.3E-04		1.3E-04						N/A
GAMMA-BHC (LINDANE)	5.5E-04			5.5E-04	5.5E-04					N/A
HEPTACHLOR EPOXIDE	6.8E-02				6.8E-02					N/A
ALUMINUM	1.0E-01									N/A
ARSENIC	1.8E-02		1.8E-02							N/A
BERYLLIUM	1.6E-02									N/A
CADMIUM	3.7E-02			3.7E-02						N/A
CHROMIUM	3.0E+00		3.0E+00	3.0E+00						N/A
COBALT	1.1E-03	1.1E-03	1.1E-03						1.1E-03	N/A
COPPER	1.7E-04	1.7E-04		1.7E-04	1.7E-04					N/A
IRON	9.0E-01				9.0E-01	9.0E-01				N/A
LEAD	N/A	N/A					N/A			N/A
NICKEL	3.4E-03						3.4E-03			N/A
SILVER	1.2E-04		1.2E-04							N/A
VANADIUM	2.0E+00									N/A
	HI BY TARGET ORGAN	1.4E-03	3.0E+00	3.0E+00	1.1E+00	9.0E-01	3.0E-02	2.6E-02	1.1E-03	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-23a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN							
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	THYROID
4,4'-DDT	2.0E-03				2.0E-03				
CHLOROFORM	1.6E-02			1.6E-02	1.6E-02				
DIELDRIN	9.6E-03				9.6E-03		9.6E-03	9.6E-03	
ENDOSULFAN I	8.2E-05	8.2E-05		8.2E-05					
GAMMA-BHC (LINDANE)	8.6E-04			8.6E-04	8.6E-04				
HEPTACHLOR EPOXIDE	3.0E-02				3.0E-02				
ALUMINUM	1.2E+00								
ARSENIC	2.5E+00		2.5E+00						
BERYLLIUM	2.2E-02								
CADMIUM	4.3E-01			4.3E-01					
CHROMIUM	8.1E+00			8.1E+00					
COBALT	1.0E-02	1.0E-02							1.0E-02
COPPER	1.6E-02	1.6E-02		1.6E-02	1.6E-02				
IRON	6.4E+00				6.4E+00	6.4E+00			
LEAD	N/A	N/A					N/A		
NICKEL	8.8E-02						8.8E-02		
SILVER	3.9E-03		3.9E-03						
VANADIUM	2.8E+00								
	HI BY TARGET ORGAN	2.6E-02	2.5E+00	8.6E+00	6.5E+00	6.4E+00	9.8E-02	9.6E-03	1.0E-02

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-23a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 23
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER DERMAL CONTACT BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER DERMAL CONTACT - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	REPRO-DUCTIVE SYSTEM	THYROID	INHALATION OF VOAS IN GW - ADULT
4,4'-DDT	5.3E-02				5.3E-02					N/A
CHLOROFORM	1.3E-03			1.3E-03	1.3E-03					N/A
DIELDRIN	1.7E-02				1.7E-02		1.7E-02	1.7E-02		N/A
ENDOSULFAN I	5.8E-05	5.8E-05		5.8E-05						N/A
GAMMA-BHC (LINDANE)	3.7E-04			3.7E-04	3.7E-04					N/A
HEPTACHLOR EPOXIDE	4.5E-02				4.5E-02					N/A
ALUMINUM	7.0E-02									N/A
ARSENIC	7.5E-03		7.5E-03							N/A
BERYLLIUM	6.2E-03									N/A
CADMIUM	1.2E-02			1.2E-02						N/A
CHROMIUM	1.1E+00		1.1E+00	1.1E+00						N/A
COBALT	5.6E-04	5.6E-04	5.6E-04						5.6E-04	N/A
COPPER	7.6E-05	7.6E-05		7.6E-05	7.6E-05					N/A
IRON	3.6E-01				3.6E-01	3.6E-01				N/A
LEAD	N/A	N/A					N/A			N/A
NICKEL	1.6E-03						1.6E-03			N/A
SILVER	5.4E-05		5.4E-05							N/A
VANADIUM	7.8E-01									N/A
	HI BY TARGET ORGAN	7.0E-04	1.1E+00	1.1E+00	4.8E-01	3.6E-01	1.9E-02	1.7E-02	5.6E-04	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-24
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 23
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	1.3E-11	3.2E-12
4,4'-DDT	1.9E-11	4.8E-12
ALPHA-CHLORDANE	7.8E-12	1.9E-12
ANTHRACENE	N/A	N/A
BENZO(A)ANTHRACENE	4.7E-09	1.9E-09
BENZO(A)PYRENE	3.8E-08	5.1E-08
BENZO(B)FLUORANTHENE	5.2E-09	2.1E-09
BENZO(G,H,I)PERYLENE	N/A	N/A
BENZO(K)FLUORANTHENE	1.2E-10	4.8E-11
BIS(2-ETHYLHEXYL)PHTHALATE	4.2E-11	1.6E-11
CHRYSENE	5.0E-11	2.0E-11
DIBENZ(A,H)ANTHRACENE	4.3E-09	8.6E-09
DIETHYLPHTHALATE	1.1E-08	N/A
1,2,4-TRICHLOROBENZENE	3.8E-07	N/A
FLUORANTHENE	N/A	N/A
FLUORENE	N/A	N/A
GAMMA-CHLORDANE	5.4E-12	1.3E-12
INDENO(1,2,3-CD)PYRENE	1.6E-09	6.3E-10
PHENANTHRENE	N/A	N/A
PYRENE	N/A	N/A
ARSENIC	7.7E-08	3.2E-09
BARIUM	N/A	N/A
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MANGANESE	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	5.2E-07	6.7E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 23-25
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 23
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
4,4'-DDD	NA	NA
4,4'-DDT	1.3E-06	3.3E-07
ALPHA-CHLORDANE	1.2E-06	2.9E-07
ANTHRACENE	2.8E-08	1.1E-08
BENZO(A)ANTHRACENE	NA	NA
BENZO(A)PYRENE	NA	NA
BENZO(B)FLUORANTHENE	NA	NA
BENZO(G,H,I)PERYLENE	NA	NA
BENZO(K)FLUORANTHENE	NA	NA
BIS(2-ETHYLHEXYL)PHTHALATE	1.7E-06	6.9E-07
CHRYSENE	NA	NA
DIBENZ(A,H)ANTHRACENE	NA	NA
DIETHYLPHTHALATE	2.9E-08	1.1E-08
1,2,4-TRICHLOROBENZENE	9.6E-07	3.8E-07
FLUORANTHENE	2.3E-06	9.1E-07
FLUORENE	1.6E-07	6.3E-08
GAMMA-CHLORDANE	8.1E-07	2.0E-07
INDENO(1,2,3-CD)PYRENE	NA	NA
PHENANTHRENE	NA	NA
PYRENE	3.3E-06	1.3E-06
ARSENIC	2.0E-03	8.3E-05
BARIUM	3.1E-05	3.0E-05
CADMIUM	3.1E-04	2.4E-04
CHROMIUM	2.1E-03	4.1E-03
IRON	5.5E-03	4.4E-03
LEAD	NA	NA
MANGANESE	2.5E-04	3.4E-04
ZINC	3.0E-05	4.8E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-26
RME CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 23
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
BIS(2-ETHYLHEXYL)PHTHALAT	1.5E-10	3.7E-09
GAMMA-BHC (LINDANE)	9.7E-11	2.5E-10
ALUMINUM	N/A	N/A
BARIUM	N/A	N/A
CADMIUM	N/A	N/A
CHROMIUM	N/A	N/A
COBALT	N/A	N/A
COPPER	N/A	N/A
IRON	N/A	N/A
LEAD	N/A	N/A
MERCURY	N/A	N/A
VANADIUM	N/A	N/A
ZINC	N/A	N/A
TOTAL RISK	2.5E-10	3.9E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 23-27
RME NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE 23
SURFACE WATER
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE WATER INGESTION	SURFACE WATER DERMAL CONTACT
BIS(2-ETHYLHEXYL)PHTHALAT	6.4E-06	1.5E-04
GAMMA-BHC (LINDANE)	2.9E-06	7.4E-06
ALUMINUM	4.7E-04	4.4E-04
BARIUM	5.5E-04	6.4E-04
CADMIUM	2.6E-04	2.4E-04
CHROMIUM	7.5E-04	1.7E-03
COBALT	4.0E-06	3.8E-06
COPPER	5.1E-05	4.0E-06
IRON	1.4E-02	1.3E-02
LEAD	N/A	N/A
MERCURY	7.2E-05	4.8E-05
VANADIUM	3.4E-04	1.6E-03
ZINC	1.1E-04	2.0E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

RI. Lead was found at levels exceeding 400 mg/kg in soil samples taken during past investigations but not in samples taken during the 1995 RI.

The IEUBK Lead Model (v. 0.99) was used to characterize risks from lead in soil, dust, and water for future residential children (ages 0 through 6), who are considered to be the most sensitive receptor group at Site 19. The simulated range of blood-lead values that might occur in a population as a result of exposures to lead was compared to a guideline level of 10 ug/dL. Based on model results, 6.8 percent of residential children exposed under similar conditions might have blood-lead levels above 10 ug/dL. This slightly exceeds a protective guideline of 5 percent for the maximum proportion of individuals with blood levels above 10 ug/dL (EPA, 1994). The model inputs assumed were default parameter values, 9.8 mg/kg lead in site-related soils, and 50.1 ug/L lead in unfiltered groundwater. The IEUBK results may be overconservative because unfiltered samples were affected by high turbidity and filtered lead results were significantly lower. The IEUBK population histograms for default and Site 23 exposures are presented in Appendix I.

23.7.1.6 Amended Risk Assessment

The amended risk assessment recalculated the cancer and non-cancer risks at Site 23 for future residential and future industrial receptors assuming exposure to COPCs in groundwater and subsurface soil.

Comparison to Background: Groundwater

Barium, mercury, selenium, and thallium were eliminated from consideration as groundwater COPCs based on a comparison of average levels to twice the background level. Table 23-8 presents the comparison of COPCs to background concentrations. Zinc was eliminated based on comparison to background upper 95 percent UTLs.

Comparison to Background: Subsurface Soil

Lead and vanadium were eliminated from consideration as subsurface soil COPCs based on a comparison of average levels to twice the background level. However, since arsenic is a class A carcinogen, it could not be eliminated from consideration. Table 23-4 presents the comparison of COPCs to background concentrations. Beryllium was eliminated based on comparison to background upper 95 percent UTLs.

Consideration of Modified Dermal Absorption and Target Organ Grouping: Groundwater

As discussed in Section 2.4.6.2, groundwater cancer and noncancer risks were recalculated using a modified gastrointestinal absorption factor for one chemical. After these steps, the final RME cancer risks are still above the 1E-04 to 1E-06 target acceptable range for the future residential receptor (3.3E-04, via

groundwater ingestion) and are approximately 1E-04 for the future industrial receptor. Arsenic and beryllium (via ingestion) are the principal COPCs contributing to the groundwater RME cancer risks.

The revised HIs are greater than 1.0 for exposure to groundwater by future residential and future industrial receptors; therefore, these risks were grouped according to target organ. The resulting final RME HIs are greater than 1.0 in several cases. For groundwater ingestion by the future residential child, the target organs, corresponding RME HIs, and associated principal COPCs are as follows: kidney (32 - chromium and cadmium), liver (23 - iron), digestive system (23 - iron), and skin (8.6 - arsenic). For groundwater dermal contact by the future residential child, the target organs, corresponding RME HIs, and associated principal COPCs are as follows: kidney (3.0 - chromium), skin (3.0 - chromium), and liver (1.1 - iron). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0. As noted in the discussion of Observed Chemical Contaminant Trends, the estimated HQs may not be representative of dissolved phase metals contamination receptor impacts because only unfiltered sampling results were used to calculate HQs.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial employees exposed to groundwater in Tables 23-18 and 23-19, respectively. Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater in Tables 23-22 and 23-23, respectively.

Consideration of Modified Dermal Absorption and Target Organ Grouping: Subsurface Soil

Subsurface soil cancer and non-cancer risks were recalculated using modified soil-to-skin absorption factors for three chemicals and excluding dermal effects for other COPCs. After these steps, total RME cancer risks (from soil ingestion, dermal contact, and inhalation of dust) are still greater than 1E-04 for the future residential receptor and are approximately 1E-04 for the future industrial receptor. The principal COPCs that contributed to these risks are arsenic (ingestion - 82 percent of the risk for this pathway; dermal contact - 100 percent of the risk for this pathway), and various polyaromatic hydrocarbons (ingestion - approximately 18 percent of total carcinogenic risk for this pathway).

Revised HIs were greater than 1.0 for soil ingestion by residential receptors; therefore, these risks were grouped according to target organ. After this step, the sum of HIs (from soil ingestion, dermal contact, and inhalation of dust) exceeds 1.0 for one target organ - the skin. Arsenic (via soil ingestion and dermal contact) is the principal COPC contributing to subsurface soil non-cancer risks. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs for future residential receptors exposed to subsurface soil (assuming subsurface soils become future surface soils) are presented in Tables 23-20 and 23-21, respectively. Estimated RME carcinogenic risks and noncarcinogenic HQs for future industrial receptors exposed to subsurface soil are presented in Tables 23-16 and 23-17, respectively.

Application of Central Tendencies Guidance: Groundwater

Central tendency assumptions were applied to calculate groundwater cancer and non-cancer risks for future residential receptors and future industrial employees. Central tendency generates a lower risk estimate than RME because it assumes typical rather than upper range receptor behavior patterns related to the ingested dose. Based on this evaluation, the estimated total central tendency cancer risks are within the mid-range of the target acceptable risk range for the future industrial employee and slightly greater than 1E-04 for the future residential receptor. Ingestion exposures contributed the major portion of these cancer risks.

Central tendency noncarcinogenic HIs for groundwater were greater than 1.0 for the future industrial employee and the future residential child. For groundwater ingestion by the future residential child, the target organs, corresponding RME HIs, and associated principal COPCs are as follows: kidney (8.6 - chromium and cadmium), liver (6.5 - iron), digestive system (6.4 - iron), and skin (2.5 - arsenic). For groundwater dermal contact by the future residential child, chromium contributed to HIs of 1.1 for the target organs kidney and skin. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Central tendency carcinogenic risks and noncarcinogenic HQs are presented for future industrial employees exposed to groundwater in Tables 23-18a and 23-19a, respectively. Estimated central tendency carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to groundwater in Tables 23-22a and 23-23a, respectively.

Application of Central Tendencies Guidance: Subsurface Soil

Central tendency assumptions were applied to calculate subsurface soil cancer and non-cancer risks for future residential receptors and cancer risks for the future industrial employee. Based on this evaluation, the estimated total central tendency cancer risks for the residential receptor are approximately 1E-04, at the upper end of the target acceptable risk range, and within the mid-range of the target acceptable risk range for the future industrial employee. For subsurface soil ingestion by the future residential child, central tendency HIs were less than 1.0; the cutoff below which adverse noncarcinogenic effects are not anticipated.

Central tendency carcinogenic risks and noncarcinogenic HQs for future residential receptors exposed to subsurface soil (assuming subsurface soils become future surface soils) are presented in Tables 23-20a and 23-21a, respectively. Central tendency carcinogenic risks for future industrial receptors exposed to subsurface soil are presented in Table 23-16a.

23.7.2 Conclusions

Subsurface soil, sediment, groundwater, and surface water were sampled at Site 23. The potential receptors for this site were future industrial, residential, and recreational receptors.

The RME cancer risks associated with future industrial (subsurface soil and groundwater) and future residential (subsurface soil and groundwater) exposure scenarios exceeded 1E-04, the upper end of the target risk range. Arsenic (via ingestion of and dermal contact with groundwater and subsurface soil) was the major COPC that contributed to the cancer risks for these exposure scenarios. However, these RME estimates are probably overconservative because a central tendency calculation shows that cancer risks are more likely to be in the mid-range of the target acceptable range for the future industrial receptor (groundwater and subsurface soil), and approximately 1E-04, at the upper end of the target acceptable risk range, for the future residential receptor (groundwater or subsurface soil). In addition, filtered metals results, which are considered more representative of dissolved-phase concentrations, are considerably lower than the unfiltered concentration and would yield a commensurate reduction in the estimated risk.

RME estimates for noncarcinogenic HIs associated with future industrial (groundwater) and future residential (subsurface soil and groundwater) exposure scenarios exceeded 1.0; the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Chromium, cadmium, iron, and arsenic (chiefly via ingestion of groundwater) were the COPCs that exceeded 1.0 or contributed to the HI exceeding 1.0 for these exposure scenarios. In addition, central tendency risk estimates for residential and industrial exposure to groundwater yielded HIs greater than 1.0 for the target organs liver, kidney, skin, and digestive system. The RME estimates of noncancer risk from exposure to subsurface soil for the future residential child are probably overconservative because associated central tendency noncancer HIs are less than 1.0. In addition, filtered metals results, which are considered more representative of dissolved-phase concentrations, are considerably lower than the unfiltered concentration and would yield a commensurate reduction in the estimated risk.

Lead was detected at the site at levels greater than the EPA screening guidelines. Based on the results of the IEUBK Lead Model (v. 0.99), the maximum detected soil and groundwater concentrations might be expected to be associated with significant increases in blood-lead levels (i.e., above 10 ug/dL) in 6.8 percent of children from a population exposed under similar conditions. This slightly exceeds the EPA guideline of no more than 5 percent of the population exhibiting elevated blood-lead levels.

The amended risk assessment procedure did not result in the elimination of all cancer or non-cancer risks above guideline limits. Although several metals by groundwater ingestion remained with cancer risks greater than the target acceptable range and HIs above 1.0, the estimated risks may not be representative of dissolved phase metals contamination receptor impacts because only unfiltered sampling results were used to calculate risks.

Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 23 in Table 23-28 for subsurface soil, sediment, groundwater, and surface water. Table 23-28a presents the relevant central tendency risk estimates associated with potential receptors for subsurface soil and groundwater.

23.8 ECOLOGICAL RISK ASSESSMENT

23.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Site 23 is cut into a hillside. As a result, Building D-5 and remainder of the site is enclosed on three sides by a large, steep berm. The area around Building D-5 is characterized by a paved and graveled parking lot. Wooded upland areas are present to the west and east on top of the berm, and are dominated by pitch pine. A small wetland is located west of the site, above the berm, and is primarily dominated by beakrush (*Rhyncospora* sp.). A wetland dominated by *Phragmites* and sphagnum moss is located north and northeast of the berm. NJDEP Geographic Information System data initially indicated the presence of extensive wetlands east and southeast of the berm, but ground-truthing revealed no wetlands in these areas. In addition, some standing water is present in a drainageway inside the berm north, west, and southwest of Building D-5. Water may exit the site to the south after extreme storm events, but water tends to perch in the drainageway. Perched water in the drainageway is mainly runoff into the berm from the north and west. The drainageway southwest of Building D-5 connects to an eastward flowing ditch adjacent to the asphalt road. This ditch connects with a tributary of Hockhockson Brook approximately 200 feet east of the site, Therefore; Site 23 is located within the Hockhockson Brook watershed. The closest RI site to Site 23 is Site 22, which is located across the asphalt road to the south.

Ecological habitat is limited within the bermed area, the area inside the berm is small, and the site is surrounded by a chain-link fence. Therefore, receptor use of the site is expected to be minimal. The surrounding areas outside of the berm provide excellent wetland and terrestrial habitat. Surrounding habitats are expected to mainly attract terrestrial receptors since the wetlands are limited and do not support an extensive aquatic community. Most species of mammals and birds attracted to wooded upland and wetland areas probably utilize the adjacent habitats. No sensitive habitats, other than the wetlands, and no threatened or endangered species are present on or around the site.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathways from the site are overland runoff and infiltration of contaminants. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and surface soils, particularly to the ditch south of the site via the drainageway in the berm; the ditch south of the site connects with a tributary of Hockhockson Brook. The large berm prevents any off-site runoff to the north,

TABLE 23-28
SUMMARY OF ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.0E-04^	4.6E-04^	N/A	N/A	9.9E-02^	6.9E-01@	N/A	N/A
	Dermal Contact	N/A	8.4E-05^	2.8E-04^	N/A	N/A	5.3E-02^	4.3E-01^	N/A	N/A
	Inhalation of Fugitive Dust	N/A	7.3E-08^	4.5E-08^	N/A	N/A	1.9E-05^	2.0E-05^	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	5.2E-07	N/A	N/A	N/A	N/A	1.0E-02
	Dermal Contact	N/A	N/A	N/A	6.7E-08	N/A	N/A	N/A	N/A	9.2E-03
Groundwater	Ingestion	N/A	3.1E-04^	1.3E-03^	N/A	N/A	5.0E+00@	3.2E+01@	N/A	N/A
	Dermal Contact	N/A	4.5E-06^	1.1E-04^	N/A	N/A	2.0E-01^	3.0E+00@	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	1.5E-05^	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	2.5E-10	N/A	N/A	N/A	N/A	1.7E-02
	Dermal Contact	N/A	N/A	N/A	3.9E-09	N/A	N/A	N/A	N/A	1.8E-02
TOTAL		-	5.0E-04	2.2E-03	5.9E-07	-	5.4E+00	3.6E+01	-	5.4E-02

N/A = Not applicable because this media is not associated with this potential receptor
N/R = Central Tendency calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatile noncarcinogens were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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TABLE 23-28a
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	6.2E-06^	5.3E-05^	N/A	N/A	N/R	2.2E-01@	N/A	N/A
	Dermal Contact	N/A	9.1E-06^	5.7E-05^	N/A	N/A	N/R	2.8E-01^	N/A	N/A
	Inhalation of Fugitive Dust	N/A	9.9E-09^	1.0E-08^	N/A	N/A	N/R	1.4E-05^	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
Groundwater	Ingestion	N/A	2.1E-05^	1.2E-04^	N/A	N/A	1.7E+00@	8.6E+00@	N/A	N/A
	Dermal Contact	N/A	4.3E-07^	9.3E-06^	N/A	N/A	1.0E-01^	1.1E+00@	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	8.4E-07^	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
	Dermal Contact	N/A	N/A	N/A	N/R	N/A	N/A	N/A	N/A	N/R
TOTAL		-	3.7E-05	2.4E-04	-	-	1.8E+00	1.0E+01	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation is not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatile noncarcinogens were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Amended result is maximum HI for individual target organs.

east, and west. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a contaminant may be carried with the flow of groundwater to downgradient locations. Groundwater from the site may eventually discharge to surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. This is mainly of concern for the portion of the drainageway north of the site, since shallow groundwater flows to the north-northeast and wetlands outside the berm are several feet higher on grade.

Exposure Routes

Terrestrial receptors at Site 23 may be exposed to surface soil contaminants via incidental ingestion of soil or by ingestion of contaminated food items, although this is expected to be minimal since terrestrial habitat is limited within the bermed area. Terrestrial receptors may also come into contact with contaminants in Site 23 surface water by using it for drinking, although this pathway is generally insignificant for terrestrial receptors. Terrestrial vegetation may also be exposed to contaminants in soils at Site 23. However, since terrestrial habitat at the site is limited in extent and is of relatively poor quality, exposure routes of main concern are aquatic. Aquatic and semi-aquatic organisms, mainly semi-aquatic receptors, and terrestrial organisms that utilize the drainage area may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Semi-aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water, although the relatively small amount of surface water in the drainageway limits this pathway.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this site. In particular, contaminants detected in Site 23 surface water and sediments were considered preliminary COPCs for quantitative assessment. Also, constituents in surface soil, sediment, and groundwater samples taken as part of the 1993 SI, and 1995 RI groundwater and subsurface soil samples, were evaluated qualitatively.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

23.8.2 Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminants in surface water and sediments. Surface water and sediment ET values are presented in Tables 2-28 and 2-29, respectively.

23.8.3 Preliminary Exposure Assessment

Contaminant concentrations in environmental media used for this initial screening were obtained from data generated during previous RI activities. The maximum detected contaminant concentrations in surface water and sediment were used as conservative representative exposure point concentrations. Three surface water and five sediment samples were taken in drainageway adjacent to Building D-5 and in the drainageway south of the site. In addition, surface soil, groundwater, and sediment samples taken as part of the SI are discussed qualitatively in Section 23.8.5, as are groundwater and subsurface soil samples taken as part of the 1995 RI. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

23.8.4 Risk Characterization

In Site 23 surface water, the inorganics aluminum (HQ = 42.2), barium (HQ = 77.2), cadmium (HQ = 1.0), copper (HQ = 1.46), chromium (HQ = 2.94), lead (HQ = 4.12) and zinc (HQ = 2.57) exceeded ET values and were retained as final COPCs (Table 23-29). No organics exceeded ET values. For inorganics in sediments, cadmium, chromium, and lead equalled or slightly exceeded most conservative ET values, but did not exceed less conservative ET values (Table 23-30). Aluminum and vanadium were conservatively retained as final COPCs since no suitable ET value was available.

For organics in sediments, the compounds 4,4'-DDD, 4,4'-DDT, and some PAHs slightly exceeded most conservative ET values, but did not exceed less conservative ET values. The toxicological properties of final COPCs in surface water and sediment are summarized in Appendix M.

23.8.5 Summary and Conclusions

Habitats inside the berm that surrounds Site 23 on three sides are limited and of marginal ecological value. Excellent upland and wetland habitats are present outside of the berm. Therefore, receptor use is limited within the berm, but ecological receptors, mainly terrestrial organisms, are expected to use the areas outside of the berm. Runoff of contaminants to off-site habitats to the north, east, and west is prevented by the large berm. Off-site runoff may occur via the drainageway next to Building D-5 after extreme storm events, but water tends to perch near the building. The groundwater-to-surface water contaminant migration pathway is also possible, but mainly to the drainageway next to the building since wetlands

TABLE 23-29

SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - SITE 23

NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (μg/L)	Maximum Concentration (μg/L)	Ecotox Threshold (μg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	3/3	409	3670	87	42.2	Retained-HQ > 1
Barium	3/3	34	301	3.9	77.2	Retained-HQ > 1
Cadmium	1/3	0.18	1	1	1.0	Retained-HQ > 1
Chromium	2/3	2.6	29.4	10	2.94	Retained-HQ > 1
Cobalt	3/3	1.9	1.9	3	0.63	Eliminated-Does not exceed threshold
Copper	3/3	9.8	16.1	11	1.46	Retained-HQ > 1
Lead	1/3	4.4	10.3	2.5	4.12	Retained-HQ > 1
Manganese	3/3	55.5	36.1	80	0.45	Eliminated-Does not exceed threshold
Mercury	3/3	0.028	0.17	1.3	0.13	Eliminated-Does not exceed threshold
Vanadium	1/3	0.9	18.8	19	0.99	Eliminated-Does not exceed threshold
Zinc	1/3	29.4	253	100	2.53	Retained-HQ > 1
Organics						
Bis(2-ethylhexyl)phthalate	1/1	ND	1.0	32	0.03	Eliminated-Does not exceed threshold
Gamma-BHC (Lindane)	1/1	ND	0.0068	0.08	0.09	Eliminated-Does not exceed threshold

ND = None detected

TABLE 23-30
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 23
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)[1]	Maximum Concentration (mg/kg)	Ecotox Threshold[1] (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	5/5	3940	2660	NA		Retained-No suitable threshold available
Arsenic	5/5	6.2	4.7	8.2	0.57	Eliminated-Does not exceed threshold
Barium	5/5	10.6	16.7	40	0.42	Eliminated-Does not exceed threshold
Cadmium	2/5	ND	1.2	1.2/9.6	1.0/0.13	Retained-HQ > 1
Chromium	5/5	56	120	81/370	1.48/0.32	Retained-HQ > 1
Copper	5/5	13	6.7	34	0.20	Eliminated-Does not exceed threshold
Lead	5/5	34.3	72.5	47/218	1.54/0.33	Retained-HQ > 1
Manganese	5/5	9.2	9.95	460	0.02	Eliminated-Does not exceed threshold
Mercury	3/5	0.068	0.06	0.15	0.33	Eliminated-Does not exceed threshold
Nickel	4/5	6	4.5	21	0.21	Eliminated-Does not exceed threshold
Vanadium	5/5	42.7	20.8	NA		Retained-No suitable threshold available
Zinc	5/5	26.9	71.3	150	0.48	Eliminated-Does not exceed threshold
Organics[3]						
1,2,4-Trichlorobenzene	1/5	ND	75	9200	0.01	Eliminated-Does not exceed threshold
4,4'-DDD	3/5	21	4.85	1.6/46	3.03/0.11	Retained-HQ > 1
4,4'-DDT	1/5	19	6.75	1.6/46	4.22/0.15	Retained-HQ > 1
Alpha-Chlordane	2/5	ND	0.55	7	0.08	Eliminated-Does not exceed threshold
Anthracene	1/5	ND	65	330	0.20	Eliminated-Does not exceed threshold
Benzo(a)anthracene	2/5	560	590	330/1600	1.79/0.37	Retained-HQ > 1
Benzo(a)pyrene	2/5	590	480	430/1600	1.12/0.30	Retained-HQ > 1
Benzo(b)fluoranthene	2/5	490	895	330/1700	2.71/0.53	Retained-HQ > 1
Benzo(g,h,i)perylene	2/5	380	165	330	0.50	Eliminated-Does not exceed threshold
Benzo(k)fluoranthene	2/5	470	150	330	0.45	Eliminated-Does not exceed threshold
Bis(2-ethylhexyl)phthalate	5/5	ND	400	8.9E+08	4.5E-07	Eliminated-Does not exceed threshold
Chrysene	2/5	940	630	330/2800	1.91/0.23	Retained-HQ > 1
Dibenzo(a,h)anthracene	1/5	ND	54	330	0.16	Eliminated-Does not exceed threshold
Diethylphthalate	1/5	44	180	630	0.29	Eliminated-Does not exceed threshold
Fluoranthene	2/5	1800	1000	2900	0.34	Eliminated-Does not exceed threshold
Fluorene	1/5	190	50	540	0.09	Eliminated-Does not exceed threshold
Gamma-Chlordane	1/5	0.095	0.38	7	0.05	Eliminated-Does not exceed threshold
Indeno(1,2,3-cd)pyrene	2/5	310	200	330	0.61	Eliminated-Does not exceed threshold
Phenanthrene	2/5	1900	725	850	0.08	Eliminated-Does not exceed threshold
Pyrene	2/5	1900	770	660/2600	1.17/0.30	Retained-HQ > 1

ND = None detected
NA = No suitable threshold was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg.

outside the berm are several feet higher on grade. For these reasons, the main ecological concern at Site 23 is migration of contaminants via the drainageway into the tributary of Hockhockson Brook.

As part of the 1993 SI, surface soil samples were taken in the bermed area near Building D-5. Slightly elevated levels of some VOCs and metals, mainly cadmium, copper, chromium, lead, were detected in surface soils. Sediment samples were also taken in the berm as part of the SI, primarily in the drainageway in the bermed area. Low levels of some VOCs, PAHs, and 4,4-DDE were detected in sediment samples, and elevated levels of cadmium, copper, lead, and zinc were detected. In SI groundwater samples, low levels of some VOCs and some elevated levels of some metals, including copper, cadmium, and lead were detected.

Subsurface soil and groundwater samples were taken as part of the 1995 RI. In subsurface soils, most metals present were detected in concentrations similar to background, with one slightly elevated detection of chromium and vanadium. One sample contained elevated levels of several PAHs, and gamma-BHC and Bis(2-ethylhexylphthalate) were detected in low concentrations. Groundwater samples indicated the presence of some low levels of organics and elevated levels of some metals, including cadmium, chromium, lead, and zinc.

Surface water and sediment samples were taken in the berm and in the drainageway outside of the berm during the RI to investigate contaminant levels in these media near the building and potential off-site migration. These samples were used for quantitative assessment. In surface water, HQs were indicative of low potential risk for inorganics, with the exception of aluminum and barium, which had HQs indicative of moderate potential risk. Organics in surface water had HQs indicative of low potential risk. In sediments, all HQs were indicative of low potential risks for inorganics. Aluminum was conservatively retained as a final COPC since no suitable ET was available, but it was detected in concentrations lower than background, and barium did not exceed its ET value. No suitable sediment ET was available for vanadium, but it was also detected in low concentrations lower than background. HQ values for sediment organics were indicative of low potential risk. Some pesticides and several PAHs were detected, but a cumulative toxic effect is not likely given the relatively low concentrations detected.

In summary, both inorganic and organic contaminants were detected in elevated levels in groundwater and subsurface soils as part of 1995 RI activities, and some elevated levels of contaminants were present in surface soils and sediment samples taken as part of the 1993 SI. Nonetheless, potential risks to ecological receptors from contaminants detected in surface water and sediment samples taken as part of the 1995 RI were relatively low. HQ values for aluminum and barium were indicative of moderate potential risk in surface water, but were not of concern in sediment. The concentrations of aluminum and barium in the downstream surface water sample (23SW05) were low. Concentrations of contaminants in the downstream sediment sample (23SD05) were also low, suggesting limited off-site migration and negligible contaminant inputs into the Hockhockson Brook watershed. Contaminant concentrations in watershed sample WS14,

taken several thousand feet downstream in Hockhockson Brook, were also relatively low, and that area may receive potential contaminant inputs from several other sources. Most of the organics detected in site sediments, such as 4,4-DDT and PAHs, have strong affinities for the organic fraction in sediments, and do not readily migrate. Also, low flow in the drainageway would not facilitate bulk flow and migration of sediments, and the presence of suspended solids in groundwater samples suggests limited dissolved phase metals and limited subsequent mobility to surface water.

Since potential risks to ecological receptors at Site 23 appear to be low and off-site contaminant migration is minimal, further study or remediation based on ecological risk concerns at the site appear to be unnecessary.

Since high levels of several contaminants (mainly metals) were detected during the 1995 RI (in soil boring 23 SB 04) and in earlier sampling events in the area west and southwest near Building D-5, soil from the area could be excavated to eliminate any possible future contaminant migration into drainageway surface water and sediments via runoff and groundwater to surface water discharge.

23.9 EVALUATION AND RECOMMENDATIONS

23.9.1 Evaluation Summary

Metals in groundwater at levels above regulatory guidelines included aluminum, arsenic, beryllium, cadmium, chromium, iron. , manganese, lead, and thallium. However, the lowest sampling endpoint turbidity value of 457 NTU, indicates that the unfiltered groundwater sample results may not be representative of metals concentrations in the formation.

No organic compounds were found at concentrations above regulatory guidelines in groundwater.

Sampling confirmed past findings of elevated levels of metals, mainly lead and chromium in soils in the area west and southwest of Building D-5. The additional data collected can be used in a subsequent focused FS for soil removal..

The human health risk assessment was biased in that past investigation near-surface soil sample results, showing high levels of metals, were not included in the risk calculation. It was assumed that a removal action would be implemented to remove near-surface soil.

Ecological risk assessment concluded that since potential risks to ecological receptors at Site 23 appear to be low and off-site contaminant migration is minimal, further study or remediation based on ecological risk concerns at the site appear to be unnecessary.

High levels of several PAHs were detected during the 1995 RI in 23 SB 04. In earlier sampling events, shallow surface soil contaminants (mainly metals) were found near soil boring 23 SB 04 and generally in the area west and southwest near Building D-5. Removal of near-surface soil from the area would eliminate any possible future contaminant migration into drainageway surface water and sediments via runoff and groundwater to surface water discharge.

23.9.2 Recommendations

A focused FS for this site should consider removal of soils in area west and southwest of building D-5.

24.0 SITES 24 AND 25: CLOSED PISTOL RANGES

24.1 SITE BACKGROUND AND PHYSICAL SETTING

Sites 24 and 25 are closed pistol ranges that were once used for target practice. Due to the sites' similar nature, history, and close proximity, they are being considered together. During target practice at the sites, lead- and copper-jacketed bullets were fired into 70-foot-high impact berms (natural sand banks). Preserved wooden posts at the sites formed the firing platform. No drainage swales or wetlands are on or near the sites. (See Figure 24-1.)

24.2 PREVIOUS INVESTIGATIONS

24.2.1 Summary of Activities and Results

The 1983 IAS, consisting of interviews and visual inspection, concluded minimal impact. The site was not recommended for a confirmation study.

Four soil samples were collected from shallow soil borings from the berms behind the target areas during the 1993 SI field activities. The samples were collected from approximately 3 feet bgs. Lead slugs were removed from the material before the samples were sent for analysis. Soil samples were analyzed for lead, zinc, copper, chromium, and cadmium. Analysis indicated that lead was the primary metal of concern at the site.

24.2.2 Summary of Conclusions

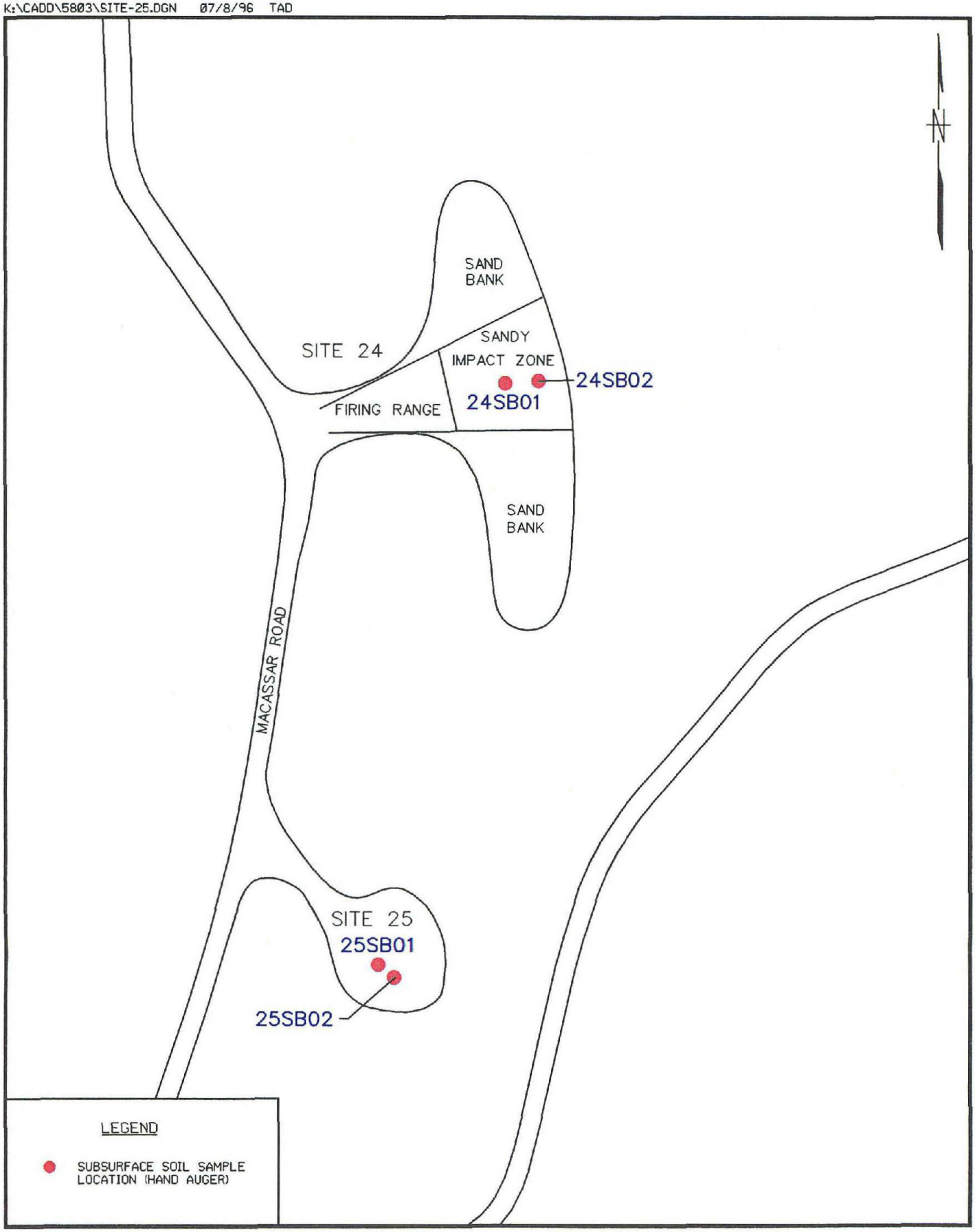
Elevated metals concentrations, principally lead and cadmium, were encountered in soils from the impact berm. The area of the impact berm was easily determined from the orientation of the shooting platform in relation to the target line.

24.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations and removal actions, follow-up remedial investigation activities were developed to meet the following objectives:

- Determine the extent of penetration and the density of projectiles in the impact areas.
- Perform ecological risk assessment.

K:\CADD\5803\SITE-25.DGN 07/8/96 TAD



SAMPLE LOCATIONS

SITE 24/25 - CLOSED PISTOL RANGES

0 100 200

SCALE IN FEET

FIGURE 24-1

Brown & Root Environmental

24.3 RI FIELD INVESTIGATIONS

In August 1995, B&R Environmental conducted the following field investigation activities at Sites 24 and 25:

- The total number of lead slugs (bullets) was counted, in 6-inch-depth intervals, at two locations at each site (Section 24.3.1).

- Subsurface soil samples from two borings at each site (Section 24.3.1) were sampled and analyzed.

24.3.1 Soil Borings and Subsurface Soil Sampling

Lead Slugs (Bullets) Count

From two locations within the impact berms (top and middle), at both sites, B&R Environmental installed hand-augered boreholes. The total number of lead slugs was counted at 6-inch-depth intervals to determine the amount of lead and other metals that may be present. Figure 24-1 shows sample locations. The retrieved soil samples, from the desired depth interval, were seived and the number of whole or partial slugs was determined. 24 SB 01, 24 SB 02, 25 SB 01, and 25 SB 02 were collected in August 1995. See Table 24-1 for slug count summary. Sample log sheets are presented in Appendix C.

Subsurface Soil Sampling

Subsurface soil samples were collected from each boring (from the top and middle of the impact berm), based on the depths at which lead slugs were observed. Two subsurface soil samples were collected from each hand-augered boring. One sample was collected from 2 to 2.5 feet below the last depth where slugs were observed, and one sample was collected from 3 feet below the previous sample's depth.

Nine subsurface soil samples, including one field duplicate (24 SB 01-05, 24 SB 01-08, Dup-18, 24 SB 02-03, 24 SB 02-06, 25 SB 01-05, 25 SB 01-08, 25 SB 02-03, and 25 SB 02-06), were collected in August 1995 to determine if lead contamination has migrated vertically in the soil (Figure 24-1). The samples were submitted to Lancaster Laboratories for TAL metals, moisture, and nitrite/nitrate analyses. Sample log sheets are presented in Appendix C. See Table 24-2 for subsurface soil sample summary.

A hand auger was used to bore down to the desired depth, and the soil sample was placed directly into the appropriate bottleware. The auger holes were backfilled with the removed cuttings. The auger was cleaned between sampling events.

Table 24-1
Sites 24 and 25 Slug Count Summary
NWS Earle Colts Neck, New Jersey

Soil Boring Number	Hand Auger Depth (inches)[1]	Number of Lead Slugs
24 SB 01	0 to 6	1
	6 to 12	2
	12 to 18	3
	18 to 24	1
	24 to 30	1
	30 to 36	0
	36 to 42	0
24 SB 02	0 to 6	2
	6 to 12	1
	12 to 18	0
25 SB 01	0 to 6	4
	6 to 12	8
	12 to 18	9
	18 to 24	2
	24 to 30	2
	30 to 36	1
	36 to 42	0
25 SB 02	0 to 6	1
	6 to 12	0
	12 to 18	0

(1) In inches below ground surface.

Table 24-2
Sites 24 and 25 Subsurface Soil Sampling Summary
NWS Earle Colts Neck, New Jersey

Sample Number	Hand Auger Depth (inches)[1]	Soil Description
24 SB01-05	60 to 72	Grayish-brown, medium-grained sand
24 SB01-08	96 to 108	Brown, coarse-grained sand
24 SB02-03	36 to 48	Tannish-gray, medium-grained sand
24 SB02-06	72 to 84	Gray, coarse-grained sand
25 SB01-05	60 to 72	Light brown, medium- to coarse-grained sand
25 SB01-08	96 to 108	Brownish-gray medium- to coarse-grained sand
25 SB02-03	36 to 48	Grayish-brown, medium-grained sand
25 SB02-06	72 to 84	Light brown, medium-grained sand

(1) In inches below ground surface

24.4 SITE CHARACTERISTICS

24.4.1 Geology

Regional mapping places Sites 24 and 25 in the outcrop area of the Cohansey Sand; upland colluvium and gravel, undivided, may be present at the sites. The upland colluvium and gravel, undivided, has a maximum thickness of 10 feet, the Cohansey Sand ranges between 0 and 30 feet in thickness, and the hand-auger borings at Sites 24 and 25 are no more than 9 feet deep. The sediments encountered in the hand-auger borings generally agree with the published descriptions of the upland colluvium and gravel, undivided, and the Cohansey Sand. In general, the borings encountered gray and brown medium- and coarse-grained sand and brown, medium- to coarse-grained sand.

24.4.2 Hydrogeology

Groundwater conditions beneath the site cannot be confirmed because no wells were installed at the site. However, groundwater in the Cohansey aquifer beneath Site 4, and presumably Sites 24 and 25, occurs under unconfined conditions. Site 4 is located about 1,300 feet south-southeast of the site. The direction of shallow groundwater flow in the aquifer beneath Site 4, as indicated by both the August and October groundwater contour maps for Site 4, is toward the east and east-southeast.

24.5 NATURE AND EXTENT OF CONTAMINATION - SITE 24

24.5.1 Subsurface Soils

Four site-related subsurface soil samples (24 SB 01-05, 24 SB 01-08, 24 SB 02-03, and 24 SB 02-06) were collected at Site 24 (Figure 24-1). Table 24-3 presents the occurrence and distribution of inorganic chemicals detected in site-related subsurface soil samples and compares them to background as presented in Section 31. Tables 24-3a and 24-3b present a comparison of detected compounds to ARARs and TBCs.

24.5.1.1 Inorganics

Concentrations of metals were generally similar or lower in the site-related subsurface soil samples than in background samples.

TABLE 24-3
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOILS AT SITE 24
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5370.00	4 / 4	102 - 911	472.75	NO	911
ARSENIC	8 / 8	1.35 - 14.4	13.29	2 / 4	1.6 - 1.8	1.02	NO	1.8
BARIUM	8 / 8	0.92 - 31	17.92	4 / 4	0.23 - 1.155	0.65	NO	1.155
BERYLLIUM	2 / 8	0.12 - 0.28	0.28	2 / 4	0.035 - 0.044	0.05	NO	0.044
CADMIUM	1 / 8	0.57	0.58	2 / 4	0.27 - 0.62	0.24	NO	0.62
CALCIUM	8 / 8	28.6 - 799	577.55	4 / 4	14.9 - 27.3	22.00	NO	27.3
CHROMIUM	8 / 8	4.7 - 59.5	54.73	4 / 4	0.36 - 4.9	2.32	NO	4.9
COPPER	8 / 8	0.97 - 8.6	8.66	3 / 4	0.39 - 3.4	1.30	NO	3.4
IRON	8 / 8	3745 - 62500	40871.25	4 / 4	238 - 7350	3144.25	NO	7350
LEAD	8 / 8	1.4 - 39.4	24.33	4 / 4	0.47 - 6	2.14	NO	5.19
MAGNESIUM	8 / 8	18.5 - 619	504.05	4 / 4	3.8 - 11.8	8.20	NO	11.8
MANGANESE	8 / 8	2.6 - 214	92.51	4 / 4	0.5 - 1.915	1.12	NO	1.915
MERCURY	8 / 8	0.03 - 0.17	0.13	3 / 4	0.0065 - 0.026	0.01	NO	0.026
NICKEL	4 / 8	1.8 - 7.2	4.75	1 / 4	0.22	0.26	NO	0.22
POTASSIUM	7 / 8	95 - 792	793.35	4 / 4	34.7 - 82.9	55.85	NO	82.9
SODIUM	8 / 8	17.5 - 94.8	79.35	4 / 4	19 - 329.05	98.61	YES	279.40
VANADIUM	8 / 8	11.05 - 64	64.71	4 / 4	0.56 - 2.3	1.67	NO	2.3
ZINC	6 / 8	1.1 - 50.7	31.35	3 / 4	1 - 3.9	4.61	NO	3.9

Note: Selected COPCs are indicated in boldface type.

TABLE 24-3a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 24

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	24SB01-05	24SB01-08	24SB01-08-DUP	24SB02-03	24SB02-06	---	ARARS & TBCs		
LOCATION:	24SB01	24SB01	24SB01	24SB02	24SB02	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI				
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**		**mg/kg**	**mg/kg**	**mg/kg**
aluminum	497	168 J	911	102	381		-	-	-
arsenic	1.8	0.68 U	1.6	0.66 U	0.70 U		20.0	20.0	-
barium	0.70	0.51	1.8	0.23	0.52		700	47000	-
beryllium	0.044	0.035	0.20 U	0.022 U	0.19 U		1.00	1.00	-
cadmium	0.27	0.079 U	0.56 U	0.076 U	0.62 J		1.00	100	-
calcium	14.9	23.5	22.9	22.6	27.3		-	-	-
chromium, total	4.9 J	1.0	4.7	0.36	1.2		-	500	-
copper	3.4	0.52	1.3	0.39	1.0 U		600	600	-
iron	7350	662 J	7830 J	238	743 J		-	-	-
lead	6.0	0.77	1.8	0.47	0.80		400	600	-
magnesium	3.8	6.0	13.2	7.6	11.8		-	-	-
manganese	0.50	0.33	3.5	0.57	1.5		-	-	-
mercury	0.026	0.024	0.0027 J	0.0065	0.0021 U		14.0	270	-
nickel	0.16 U	0.22	1.3 U	0.15 U	1.3 U		250	2400	-
potassium	57.4	77.1	88.7	48.4	34.7		-	-	-
sodium	19.0	643	15.1	22.4	24.0		-	-	-
vanadium	2.3	0.54	2.9	0.56	2.1		370	7100	-
zinc	3.9 J	4.8 R	1.4 J	24.3 R	1.0 J		1500	1500	-

TABLE 24-3a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 24
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

TABLE 24-3b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 24

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		24SB01-05	24SB01-08	24SB01-08-DUP	24SB02-03	24SB02-06	ARARS & TBCs		
LOCATION:		24SB01	24SB01	24SB01	24SB02	24SB02	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS									
moisture	%	7.0	7.2	7.8	4.5	5.7	-	-	-
nitrate nitrogen	mg/kg	1.0 U	0.26 J	0.28 J	0.26 J	0.33 J	-	-	-

TABLE 24-3b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 24
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

. - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

24.5.1.2 Miscellaneous Parameters

Miscellaneous parameter analyses for four subsurface soil samples at Site 24 consisted of moisture and nitrates. Percent moisture and percent nitrate nitrogen ranged from 4.5 to 7.8% and 0.26 to 0.33 mg/L, respectively.

24.5.2 Subsurface Soils - Site 25

Four site-related subsurface soil samples (25 SB 01-05, 25 SB 01-08, 25 SB 02-03, and 25 SB 02-06) were collected at Site 25 (Figure 24-1). Table 24-4 presents the occurrence and distribution of inorganic chemicals detected in Site 25 background and site-related subsurface soil samples. Tables 24-4a and 24-4b present a comparison of detected compounds to ARARs and TBCs.

24.5.2.1 Inorganics

Antimony was detected at a trace level (0.56 mg/kg to 0.79 mg/kg) in two site-related subsurface soil samples but was not found in background subsurface soil samples. Concentrations of the remaining metals were generally similar or lower in the site-related subsurface soil samples than the concentrations observed in background samples.

24.5.2.2 Miscellaneous Parameters

Miscellaneous parameter analyses of four subsurface soil samples at Site 25 consisted of moisture and nitrates. Percent moisutre ranged from 4.4 to 8.5%. Nitrate nitrogen was detected below background in 25 SB 01-05.

24.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 24 and Site 25 are described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 24.6.1. Persistence of detected chemicals in the environment is discussed in Section 24.6.2. Section 24.6.3 presents a brief discussion of contaminant trends.

24.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at the Site 24 and Site 25 do not demonstrate elevated levels of metals at either site. The physical transport data for the detected contaminants are presented in Table 2-10.

TABLE 24-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOILS AT SITE 25
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5370.00	4 / 4	116 - 540	343.75	NO	540
ANTIMONY	NOT DETECTED	-	-	2 / 4	0.56 - 0.79	0.48	YES	0.79
ARSENIC	8 / 8	1.35 - 14.4	13.29	1 / 4	1.2	0.56	NO	1.06
BARIUM	8 / 8	0.92 - 31	17.92	4 / 4	0.24 - 1.6	0.73	NO	1.6
BERYLLIUM	2 / 8	0.12 - 0.28	0.28	2 / 4	0.025 - 0.05	0.02	NO	0.05
CALCIUM	8 / 8	28.6 - 799	577.55	4 / 4	21.8 - 26.2	23.30	NO	25.88
CHROMIUM	8 / 8	4.7 - 59.5	54.73	4 / 4	0.41 - 1.5	0.99	NO	1.5
COPPER	8 / 8	0.97 - 8.6	8.66	4 / 4	0.41 - 4.5	1.76	NO	4.5
IRON	8 / 8	3745 - 62500	40871.25	4 / 4	74.4 - 2580	1049.10	NO	2580
LEAD	8 / 8	1.4 - 39.4	24.33	4 / 4	1 - 39.7	13.30	NO	39.7
MAGNESIUM	8 / 8	18.5 - 619	504.05	4 / 4	4.3 - 6.7	6.00	NO	6.7
MANGANESE	8 / 8	2.6 - 214	92.51	4 / 4	1.7 - 5.7	2.95	NO	5.7
MERCURY	8 / 8	0.03 - 0.17	0.13	4 / 4	0.011 - 0.023	0.02	NO	0.023
NICKEL	4 / 8	1.8 - 7.2	4.75	2 / 4	0.28 - 0.3	0.19	NO	0.3
POTASSIUM	7 / 8	95 - 792	793.35	2 / 4	43.8 - 113	47.11	NO	113
SODIUM	8 / 8	17.5 - 94.8	79.35	4 / 4	19.4 - 772	379.10	YES	772
VANADIUM	8 / 8	11.05 - 64	64.71	4 / 4	0.26 - 2.7	1.27	NO	2.7
ZINC	6 / 8	1.1 - 50.7	31.35	2 / 4	1.2 - 3.4	3.09	NO	3.4

Note: Selected COPCs are indicated in boldface type.

TABLE 24-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 25

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	25SB01-05	25SB01-08	25SB02-03	25SB02-06	---	---	ARARS & TBCs		
LOCATION:	25SB01	25SB01	25SB02	25SB02	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**			**mg/kg**	**mg/kg**	**mg/kg**
aluminum	472	540	247	116			-	-	-
antimony	0.79	0.59 U	0.56	0.56 U			14.0	340	-
arsenic	0.67 U	1.2	0.69 U	0.68 U			20.0	20.0	-
barium	0.65	1.6	0.41	0.24			700	47000	-
beryllium	0.022 U	0.050	0.025	0.023 U			1.00	1.00	-
calcium	22.9	21.8	26.2	22.3			-	-	-
chromium, total	1.5	1.4	0.41	0.64			-	500	-
copper	4.5	1.6	0.53	0.41			600	600	-
iron	1300	2580	74.4	242			-	-	-
lead	39.7	11.1	1.0	1.4			400	600	-
magnesium	6.5	6.5	6.7	4.3			-	-	-
manganese	5.7	2.0	2.4	1.7			-	-	-
mercury	0.013	0.023	0.011	0.015			14.0	270	-
nickel	0.30	0.16 U	0.28	0.16 U			250	2400	-
potassium	31.4 U	113	43.8	31.9 U			-	-	-
sodium	699	26.0	19.4	772			-	-	-
vanadium	1.8	2.7	0.26	0.30			370	7100	-
zinc	3.4 J	9.3 R	6.2 R	1.2 J			1500	1500	-

TABLE 24-4a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 25
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

TABLE 24-4b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 25

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		25SB01-05	25SB01-08	25SB02-03	25SB02-06	---	ARARS & TBCs		
LOCATION:		25SB01	25SB01	25SB02	25SB02	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI				
MISCELLANEOUS									
moisture	%	4.9	8.5	7.6	4.4		-	-	-
nitrate nitrogen	mg/kg	0.32 J	1.0 U	1.0 U	1.0 U		-	-	-

TABLE 24-4b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 25
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

The inorganic compounds have a strong tendency to adsorb onto soil/sediment particles, a factor that greatly reduces their mobility. Many metals are water insoluble; however, some soluble species of metals, such as antimony, have increased mobility.

24.6.2 Contaminant Persistence

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment. Metals present in soil tend to remain in a sorbed form.

24.6.3 Observed Chemical Contaminant Trends

One shallow soil boring sample from the SI (1993) contained lead at 113 mg/kg. However, this sample had been obtained from the slug impact area, at a depth of 3 feet bgs, where slugs and shrapnel could have been present.

Inorganic constituents in subsurface soil were not detected at concentrations greater than background levels in Site 24. The trace level of antimony found Site 25 is near the instrument detection limit and should not be construed as significantly greater than background. No pattern of elevated metals contamination was observed in subsurface soil at either site.

24.6.4 Conclusions

The pistol range areas at Site 24 and Site 25 include impact berms (natural sand banks) where lead slugs and copper-jacketed bullets were fired. Historical analytical data from the SI (1993) revealed lead and copper in the vicinity of 100 mg/kg. In the current investigation, results from subsurface soils collected beneath the lowest level of slug penetration did not reveal evidence of lead or copper contamination greater than the concentration ranges associated with background samples. Levels of other metals were also not greater than the ranges observed in background samples.

24.7 BASELINE RISK ASSESSMENT

This section of the RI report presents the results of the baseline risk assessment for Sites 24/25. The risk assessment was performed using the approach outlined in Section 2.4. Tables 24-5 through 24-6 provide the selected COPCs and representative concentrations of inorganics in site-related subsurface soil for Sites 24 and 25, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

24.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential and industrial receptors).

24.7.1.1 Future Industrial Employee - Site 24

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 24 are 9.5E-06 (ingestion), 5.2E-06 (dermal contact), and 4.8E-09 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk

is within the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or formulate ARARs. The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 99 percent of the cancer risk for this pathway; dermal contact, 60 percent of the cancer risk for this pathway) and beryllium (dermal contact, 40 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soils) at Site 24 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soil at Site 24 in Tables 24-7 and 24-8, respectively.

TABLE 24-5
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 24 (mg/kg)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ARSENIC	1.8	NONPARAMETRIC
BERYLLIUM	0.044	NONPARAMETRIC
CADMIUM	0.62	NONPARAMETRIC
CHROMIUM	4.9	NONPARAMETRIC
LEAD	5.19	NORMAL

TABLE 24-6
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL -SITE 25 (mg/kg)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ANTIMONY	0.79	NONPARAMETRIC
ARSENIC	1.06	NORMAL
BERYLLIUM	0.05	NONPARAMETRIC
CHROMIUM	1.5	NONPARAMETRIC
LEAD	39.7	NONPARAMETRIC

TABLE 24-7
CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 24
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ARSENIC	9.4E-06	3.1E-06	2.1E-09
BERYLLIUM	6.6E-08	2.1E-06	1.7E-11
CADMIUM	N/A	N/A	5.1E-11
CHROMIUM	N/A	N/A	2.7E-09
LEAD	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	9.5E-06	5.2E-06	4.8E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 24-8
NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 24
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ARSENIC	5.9E-03	1.9E-03	1.1E-06
BERYLLIUM	8.6E-06	2.7E-04	1.6E-09
CADMIUM	1.2E-03	7.6E-03	6.2E-07
CHROMIUM	9.6E-04	1.5E-02	1.8E-07
LEAD	N/A	N/A	N/A
ZINC	1.3E-05	1.6E-05	2.4E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

24.7.1.2 Future Residential Receptor - Site 24

The estimated total cancer risks for the future lifetime resident assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 24 are 4.3E-05 (ingestion), 1.7E-05 (dermal contact), and 3.0E-09 (inhalation of COPCs in fugitive dust). The subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 60 percent of the cancer risk for this pathway) and beryllium (dermal contact, 40 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the future child resident assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soils) at Site 24 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to surface soil at Site 24 in Tables 24-9 and 24-10, respectively.

24.7.1.3 Future Industrial Employee - Site 25

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 25 are 5.6E-06 (ingestion), 4.2E-06 (dermal contact), and 2.1E-09 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 44 percent of the cancer risk for this pathway) and beryllium (dermal contact, 56 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soils) at Site 25 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soil at Site 25 in Tables 24-11 and 24-12, respectively.

TABLE 24-9
CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 24
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
ARSENIC	4.2E-05	1.0E-05	1.3E-09
BERYLLIUM	3.0E-07	6.8E-06	1.0E-11
CADMIUM	N/A	N/A	3.1E-11
CHROMIUM	N/A	N/A	1.6E-09
LEAD	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	4.3E-05	1.7E-05	3.0E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 24-10
NONCARCINOGENIC HQS, FUTURE RESIDENTIAL CHILD RECEPTORS - SITE 24
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
ARSENIC	7.7E-02	1.6E-02	1.1E-06
BERYLLIUM	1.1E-04	2.2E-03	1.7E-09
CADMIUM	1.6E-02	6.2E-02	6.5E-07
CHROMIUM	1.3E-02	1.2E-01	1.9E-07
LEAD	N/A	N/A	N/A
ZINC	1.7E-04	1.3E-04	2.5E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 24-11
CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 25
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ANTIMONY	N/A	N/A	N/A
ARSENIC	5.6E-06	1.8E-06	1.2E-09
BERYLLIUM	7.5E-08	2.3E-06	1.9E-11
CHROMIUM	N/A	N/A	8.2E-10
LEAD	N/A	N/A	N/A
TOTAL RISK	5.6E-06	4.2E-06	2.1E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

TABLE 24-12
NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 25
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
ANTIMONY	1.9E-03	1.2E-02	3.6E-07
ARSENIC	3.5E-03	1.1E-03	6.4E-07
BERYLLIUM	9.8E-06	3.1E-04	1.8E-09
CHROMIUM	2.9E-04	4.6E-03	5.4E-08
LEAD	N/A	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

24.7.1.4 Future Residential Receptor - Site 25

The estimated total cancer risks for the future lifetime resident assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 25 are 2.5E-05 (ingestion), 1.4E-05 (dermal contact), and 1.3E-09 (inhalation of COPCs in fugitive dust). The subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 98 percent of the cancer risk for this pathway; and dermal contact, 44 percent of the cancer risk for this pathway) and beryllium (dermal contact, 56 percent of the cancer risk for this pathway).

The estimated individual noncarcinogenic HQs for the future child resident assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soils) at Site 25 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to surface soil at Site 25 in Tables 24-13 and 24-14, respectively.

24.7.1.5 Lead Results - Site 24

Lead was not found above the EPA level of concern (400 mg/kg) in soil samples taken during RI or previous sampling.

The IEUBK Lead Model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 24 exposures are presented in Appendix I.

24.7.1.6 Lead Results - Site 25

Lead was not found above the EPA level of concern (400 mg/kg) in soil samples taken during RI or previous sampling.

The IEUBK Lead Model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 25 exposures are presented in Appendix I.

TABLE 24-13
CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 25
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COCS IN FUGITIVE DUST - LIFETIME
ANTIMONY	N/A	N/A	N/A
ARSENIC	2.5E-05	6.0E-06	7.6E-10
BERYLLIUM	3.4E-07	7.8E-06	1.2E-11
CHROMIUM	N/A	N/A	5.0E-10
LEAD	N/A	N/A	N/A
TOTAL RISK	2.5E-05	1.4E-05	1.3E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

TABLE 24-14
NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 25
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
ANTIMONY	2.5E-02	9.9E-02	3.8E-07
ARSENIC	4.5E-02	9.3E-03	6.8E-07
BERYLLIUM	1.3E-04	2.5E-03	1.9E-09
CHROMIUM	3.8E-03	3.7E-02	5.7E-08
LEAD	N/A	N/A	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

24.7.2 Conclusions

24.7.2.1 Conclusions - Site 24

Subsurface soil was sampled at Site 24. The potential receptors for this site were future industrial and residential receptors. The cancer risk associated with the future residential (subsurface soil) exposure scenario was approximately 6E-05, near the upper end of the target risk range. Arsenic (via ingestion of and dermal contact with subsurface soil) and beryllium (via dermal contact with subsurface soil) were the major COPCs that contributed to the cancer risk for this exposure scenario. The noncarcinogenic HQs associated with the future industrial and future residential (subsurface soil) exposure scenarios were below 1.0; the cutoff point below which adverse effects are not expected to occur. Lead concentrations at the site were detected at concentrations that are not expected to be associated with significant increases in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99). Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 24 in Table 24-15 for subsurface soil.

24.7.2.2 Conclusions - Site 25

Subsurface soil was sampled at Site 25. The potential receptors for this site were future industrial and residential receptors. The cancer risk associated with the future residential (subsurface soil) exposure scenario was approximately 3E-05, near the middle of the target risk range. Arsenic (via ingestion of and dermal contact with subsurface soil) and beryllium (via dermal contact with subsurface soil) were the major COPCs that contributed to the cancer risk for this exposure scenario. The noncarcinogenic HIs associated with the future industrial and residential (subsurface soil) exposure scenario were below 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Lead concentrations at the site were detected at concentrations that are not expected to be associated with significant increases in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99). Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 25 in Table 24-16 for subsurface soil.

24.8 ECOLOGICAL RISK ASSESSMENT

24.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Sites 24 and 25, the closed pistol ranges, are located near the top of a high, sandy ridge. The two sites are borrow pits dug into the side of the hill. Most of the surface area inside the firing ranges consists of exposed soil with some scattered grassy areas. Upland areas surround the sites, and are dominated by

TABLE 24-15
SUMMARY OF ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 24
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident Child	Future Resident Adult	Future Recreational Child
Surface Soil	Incidential Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidential Ingestion	N/A	9.5E-06	4.3E-05	N/A	N/A	8.1E-03	1.1E-01	N/A	N/A
	Dermal Contact	N/A	5.2E-06	1.7E-05	N/A	N/A	2.5E-02	2.0E-01	N/A	N/A
	Inhalation of Fugitive Dust	N/A	4.8E-09	3.0E-09	N/A	N/A	1.9E-06	2.0E-06	N/A	N/A
Sediment	Incidential Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/S	N/A
Surface Water	Incidential Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	1.5E-05	6.0E-05	-	-	3.3E-02	3.1E-01	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

TABLE 24-16
SUMMARY OF ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 25
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	5.6E-06	2.5E-05	N/A	N/A	5.7E-03	7.4E-02	N/A	N/A
	Dermal Contact	N/A	4.2E-06	1.4E-05	N/A	N/A	1.8E-02	1.5E-01	N/A	N/A
	Inhalation of Fugitive Dust	N/A	2.1E-09	1.3E-09	N/A	N/A	1.1E-06	1.1E-06	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/S	N/S	N/A	N/A	N/S	N/A	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	9.8E-06	3.9E-05	-	-	2.4E-02	2.2E-01	-	-

N/A = Exposure Route not applicable for receptor
N/S = Not Samples
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

pitch pine and chestnut oak, with an understory of *Vaccinium* sp. Soils are excessively drained Evesboro sands. NJDEP Geographical Information System data initially identified a small wetland between the two sites. However, ground-truthing revealed that no wetland was present; no wetland plants, hydric soils, or wetland hydrology was found. In addition, no drainage swales or other surface waters are present on the sites. Hence, no aquatic, and only minimal terrestrial habitat is present on these two sites. Upland areas surrounding Sites 24 and 25 provide excellent terrestrial habitat. The sites are located in the Hockhockson Brook Watershed. Sites 4, 14, 22, and 23 are located in the same general area of the base as Sites 24 and 25, also within the Hockhockson Brook Watershed. No sensitive habitats or threatened or endangered species are present on or around the sites.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathways from Sites 24 and 25 are overland runoff, and to a lesser extent, infiltration of contaminants. Precipitation runoff at Sites 24 and 25 may carry constituents to off-site surface soils, and to off-site wetland surface water and sediments. However, this migration pathway is limited by the berms partially surrounding the sites, and the confinement of most contaminants to subsurface soil. A site walk-through revealed no wetlands, and no overland drainage systems are present. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a chemical may be carried with the flow of groundwater to downgradient locations. Groundwater from the sites may eventually discharge to surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. Nonetheless, this migration route is expected to be minimal since no surface water or wetlands are present near the sites.

Exposure Routes

Direct exposure to contaminants in surface soil for terrestrial ecological receptors, both plant and animal, is possible, but is expected to be minimal since only minimal terrestrial habitat is present on site soils, and since most contaminants are confined to subsurface soils. Since no surface water or wetlands exist on or near the sites, no aquatic exposure routes are applicable at Sites 24 and 25.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1993 SI and 1995 RI activities for the sites. In particular, contaminants in soil samples taken from the impact berms were evaluated.

24.8.2 Summary and Conclusions

The areas inside the firing ranges are primarily exposed soil with little vegetation, precluding the existence of significant ecological habitat. Excellent upland habitats are present surrounding the sites, and a wide variety of terrestrial wildlife is expected to use these areas. However, runoff of contaminants to off-site

habitats is partially limited by berms surrounding the sites, and no drainageways from the site are present. In addition, groundwater contaminant discharge to surface water is not likely since no surface waters are present near Sites 24 and 25.

SI soil samples from the impact berms contained low levels of some metals, including cadmium, chromium, lead, copper, and zinc. The results of RI subsurface soil sampling indicate the presence of some inorganic contaminants, but concentrations were similar to background concentrations. Contaminant levels in samples taken below the deepest slug penetration were below levels of regulatory concern, suggesting no migration to groundwater. There are no significant contaminant migration pathways to the upland areas that surround the sites, and no migration pathways into the Hockhockson Brook Watershed. Quantitative ecological risk assessment was not applicable at Sites 24 and 25 since any risk numbers would be mitigated by the factors discussed above. Hence, potential risks to ecological receptors appear insignificant and the site was excluded from quantitative ecological risk

24.9 EVALUATION AND RECOMMENDATIONS

24.9.1 Evaluation Summary

The result of the human health risk assessment indicates that the sites represent no risk beyond background.

There is no evidence that any site-related material of any kind is migrating from site.

Significant metals debris from projectiles (bullets) was found in the impact area and the amount of debris by depth has been determined for potential future removal action.

24.9.2 Recommendations

A simple removal action to remove the metals debris from soil in the impact area would be consistent with Navy policy regarding abandonment of current firing ranges. Extension of this policy to these two former firing ranges would entail sifting out metals debris from soil and disposal or recycling of the metals.

25.0 SITE 26: EXPLOSIVE "D" WASHOUT AREA

25.1 SITE BACKGROUND AND PHYSICAL SETTING

The explosive "D" washout area is located behind Building GB-1. For 1 year in the late 1960s, the site was used for the removal and recovery of ammonium picrate (known as explosive "D") from artillery shells. The ammonium picrate was removed from the shells by washing with hot water. The explosive was water soluble, and the resulting solution flowed into a settling tank. Overflow from this settling tank flowed into an unlined percolation pit. Upon cooling, the explosive precipitated, and the precipitate was collected for reuse or disposal. According to the IAS report (Hart, 1983), as much as 20,000 pounds of ammonium picrate could have been lost to surface water due to heavy rainfall before the percolation pit was cleaned.

The site, which is approximately 200 by 200 feet in size, is situated at the intersection of Macassar and Midway Roads. Two railway lines adjacent to the site run toward the northeast. The ground surface at the site is relatively flat, approximately 150 feet above MSL. The percolation pit is located in the center of the site and measures approximately 30 feet in diameter and 10 feet in depth. A tile-lined open pipe runs from Building GB-1 to the percolation pit. A septic system north of the western end of Building GB-1, thought to consist of a grease trap and a cesspool-type leach tank, was used for sanitary waste disposal. The general direction of groundwater flow is to the southwest based on measured groundwater levels. Figure 25-1 is a map of the site.

25.2 PREVIOUS INVESTIGATIONS

25.2.1 Summary of Activities and Results

The 1983 IAS consisting of interviews and site observations, concluded minimal probable impact based on the presumption that material lost would have been lost as a direct discharges to surface water, and would no longer be present. The site was not recommended for a confirmation study.

During the 1993 SI, three monitoring wells were installed. Groundwater samples were analyzed for picric acid and pH. Picric acid was not detected, and pH was within expected levels. During the 1993 RI/FS, four soil samples were collected from the settling basin. Lead was detected at elevated levels in three samples. All other metals were within normal background ranges. Picric acid was detected in one sample. No other explosive compounds were detected.

One monitoring well was installed near the percolation pit. Groundwater samples from all SI and RI/FS wells were collected and analyzed for TCL/TAL analytes, explosive compounds, pesticides/PCBs, VOCs,

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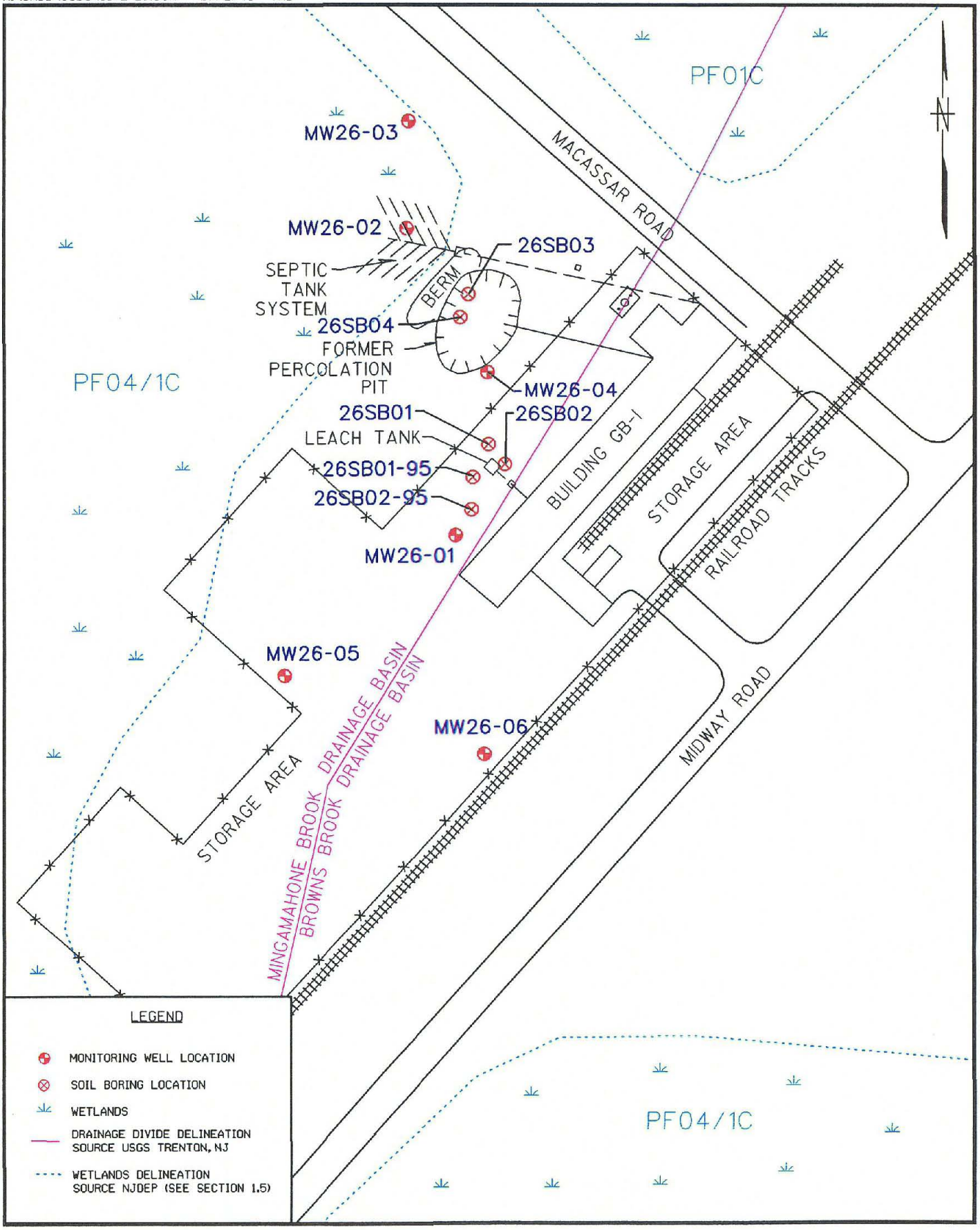

SAMPLE LOCATIONS

SITE 26 - EXPLOSIVE "D" WASHOUT AREA

FIGURE 25-1

0 80 160

SCALE IN FEET

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and drinking water metals. TCE was detected at MW26-01 at elevated levels (660 ug/L). Other VOCs, such as dichloroethanes, related to TCE as impurities or breakdown products, were also present. The source of TCE may be associated with the septic system of Building GB-1. Low concentrations of several explosive compounds were detected in wells MW26-01 and MW26-04.

25.2.2 Summary of Conclusions

Elevated levels of metals were found in groundwater samples. Lead was found at elevated levels in soil samples. No picric acid was found to be a concern, but one monitoring well (MW26-01) installed during the SI to investigate potential picric acid impacts, was found in the RI/FS to contain elevated levels of TCE and related chlorinated compounds. Low levels of explosive compounds were also found in groundwater.

25.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations actions, follow-up remedial investigation activities were developed to meet the following objectives:

- Determine the extent of impact to groundwater.
- Perform risk analysis to determine if further action is required.
- Determine potential impacts from grease trap/septic tank and leaching pit on subsurface soils.

25.3 RI FIELD INVESTIGATIONS

Between June and October 1995, B&R Environmental conducted the following field investigation activities at Site 26:

- Soil gas survey and analysis at 68 locations (Section 25.3.1)
- Sampling and analysis of subsurface soil samples from four soil borings (Section 25.3.2)
- Drilling and installation of two shallow permanent monitoring wells (Section 25.3.3)
- Sampling and analysis of groundwater from the wells (Section 25.3.3)
- Measurement of static-water levels in the wells (Section 25.3.3)

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the soil gas grid corners, soil boring locations, selected existing monitoring wells, and the newly installed wells. Surveying notes are provided in Appendix F.

NJDEP Geographic Information System data initially indicated the presence of wetlands where the wooded upland areas are located north and west of the site. However, ground-truthing of site revealed that no wetlands are present in the area. Soils in this area contain no evidence of saturation, no wetland hydrology is present, and no streams or watercourses exist near the site. The closest wetlands are located approximately 300 yards to the northwest.

25.3.1 Soil Gas Survey

B&R Environmental performed a soil gas survey in June 1995 to determine if the source of the TCE contamination is present behind Building GB-1 or in the percolation pit and to determine locations for soil borings and monitoring wells.

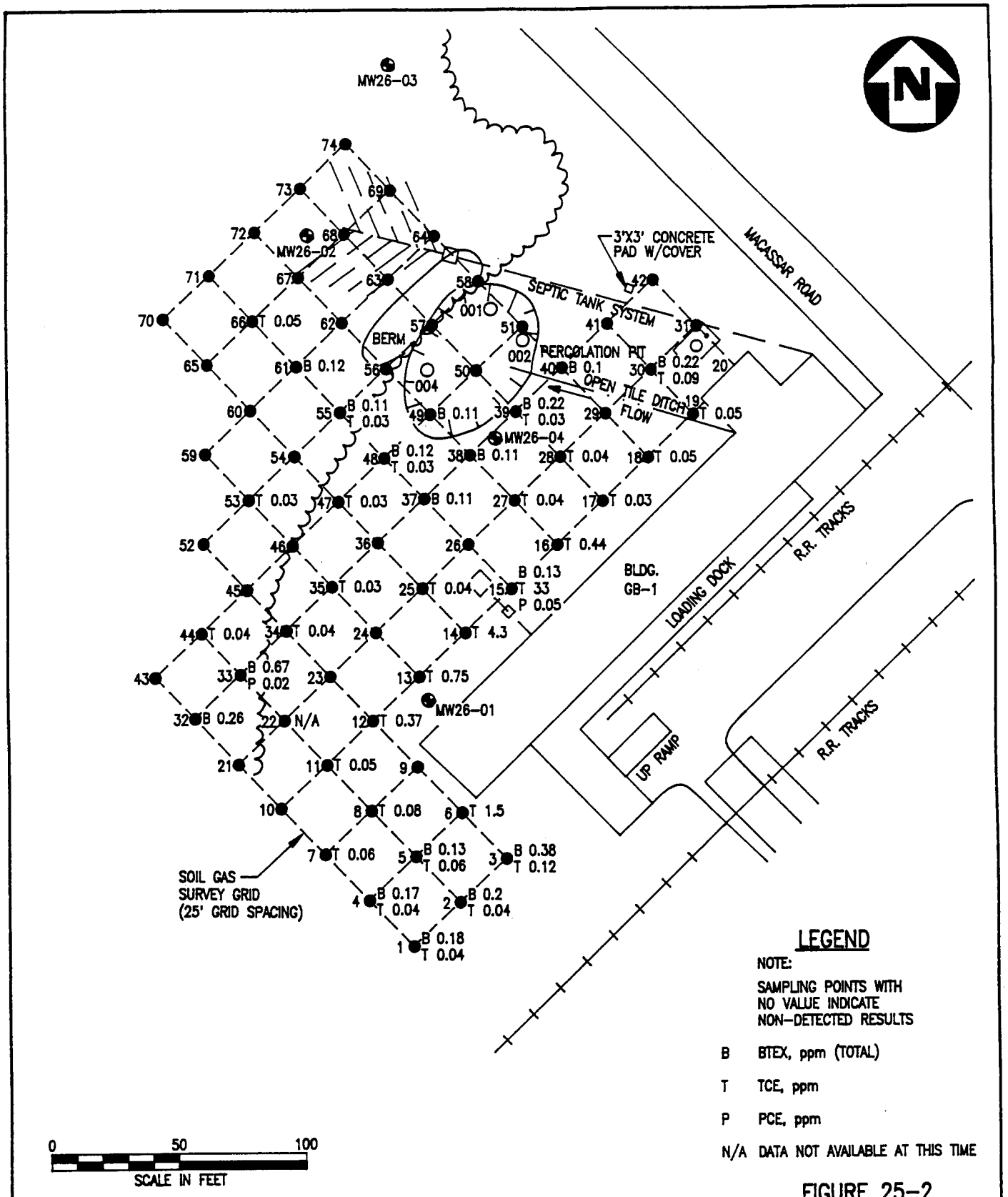
Seventy-five soil gas samples, including seven field duplicates, were collected from 68 soil gas points (26 SG 01 through 26 SG 19; 26 SG 21 through 26 SG 40; 26 SG 43 through 26 SG 69; 26 SG 73 and 26 SG 74). The soil gas points were placed with a uniform grid spacing of 25 feet and were located southwest and northwest of Building GB-1. Figure 25-2 is a map of soil gas locations. Soil gas points 20, 41, 42, 70, 71, and 72 were inaccessible and a soil gas sample was not collected at these locations.

The samples were representative of potential soil or groundwater conditions near the soil/water interface. The soil gas samples were collected near the soil/water interface at depths between 7 and 8 feet bgs at approximately 1 foot above the water table.

The soil gas samples were analyzed in an on-site Photovac 10 S plus field GC laboratory for BTEX, TCE, and PCE analyses (for full results see Appendix B). Table 25-1 contains soil gas analytical results. Figure 25-2 presents positive analytical results at sampling points. The results of soil gas analysis were used for screening purposes and therefore have not been validated by EPA guidelines.

In general, the soil gas results seemed to indicate a potential source area of TCE, possibly centered near MW26-01.

Based on the soil gas results and other previous site data, it was decided to place one planned monitoring well southwest of MW26-01. An additional (unplanned) monitoring well was added to investigate the shallow groundwater south of MW26-01.



LEGEND

NOTE:

SAMPLING POINTS WITH NO VALUE INDICATE NON-DETECTED RESULTS

B BTEX, ppm (TOTAL)

T TCE, ppm

P PCE, ppm

N/A DATA NOT AVAILABLE AT THIS TIME

FIGURE 25-2

SOIL GAS SAMPLE LOCATIONS
SITE 26 - EXPLOSIVE "D" WASHOUT AREA
NWS EARLE, COLTS NECK, NEW JERSEY

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TABLE 25-1
SITE 26 - EXPLOSIVE "D" WASHOUT AREA
NWS EARLE, COLTS NECK, NJ
SOIL GAS RESULTS (NOT VALIDATED)
SAMPLES COLLECTED 6/1/95 TO 6/3/95

Sample I.D.	Depth of Sample, Feet	Total BTEX PPM	TCE PPM	PCE PPM
26 SG 01	7	0.18	0.04	ND
26 SG 02	7	0.2	0.04	ND
26 SG 03	8	0.38	0.12	ND
26 SG 04	7	0.17	0.04	ND
26 SG 05	7	0.13	0.06	ND
26 SG 06	8	ND	1.5	ND
26 SG 07	7	ND	0.06	ND
26 SG 08	8	ND	0.08	ND
26 SG 09	8	ND	ND	ND
26 SG 10	8	ND	ND	ND
26 SG 11	8	ND	0.05	ND
26 SG 12	8	ND	0.37	ND
26 SG 13	8	ND	0.75	ND
26 SG 14	8	ND	4.3	ND
26 SG 15	8	0.13	33	0.05
26 SG 16	8	ND	0.44	ND
26 SG 17	8	ND	0.03	ND
26 SG 18	8	ND	0.05	ND
26 SG 19	8	ND	0.05	ND
26 SG 21	8	ND	ND	ND
26 SG 22	8	ND	ND	ND
26 SG 23	7	ND	ND	ND
26 SG 24	8	ND	ND	ND
26 SG 25	8	ND	0.04	ND
26 SG 26	8	ND	ND	ND
26 SG 27	8	ND	0.04	ND
26 SG 28	8	ND	0.04	ND
26 SG 29	8	ND	ND	ND
26 SG 30	8	0.22	0.09	ND
26 SG 31	8	ND	ND	ND
26 SG 32	8	0.26	ND	ND
26 SG 33	8	0.67	ND	0.02
26 SG 34	8	ND	0.04	ND
26 SG 35	8	ND	0.03	ND
26 SG 36	8	ND	ND	ND
26 SG 37	8	0.11	ND	ND
26 SG 38	8	0.11	ND	ND
26 SG 39	8	0.22	0.03	ND
26 SG 40	7	0.1	ND	ND
26 SG 43	8	ND	ND	ND
26 SG 44	8	ND	0.04	ND
26 SG 45	8	ND	ND	ND
26 SG 46	8	ND	ND	ND
26 SG 47	8	ND	0.03	ND
26 SG 48	8	0.12	0.03	ND
26 SG 49	8	0.11	ND	ND
26 SG 50	6	ND	ND	ND
26 SG 51	7	ND	ND	ND
26 SG 52	8	ND	ND	ND
26 SG 53	8	ND	0.03	ND
26 SG 54	8	ND	ND	ND
26 SG 55	8	0.11	0.03	ND
26 SG 56	8	ND	ND	ND
26 SG 57	8	ND	ND	ND
26 SG 58	8	ND	ND	ND
26 SG 59	8	ND	ND	ND
26 SG 60	8	ND	ND	ND
26 SG 61	8	0.12	ND	ND
26 SG 62	8	ND	ND	ND
26 SG 63	8	ND	ND	ND
26 SG 64	8	ND	ND	ND
26 SG 65	8	ND	ND	ND
26 SG 66	8	ND	0.05	ND
26 SG 67	8	ND	ND	ND
26 SG 68	8	ND	ND	ND
26 SG 69	8	ND	ND	ND
26 SG 73	8	ND	ND	ND
26 SG 74	8	ND	ND	ND

25.3.2 Soil Borings and Subsurface Soil Sampling

Four soil borings (26 SB 01 through 26 SB 04) were drilled in June 1995 to determine the effect of the leaching tank, grease trap, and percolation pit on the site's soils. Figure 25-1 shows sample locations. 26 SB 01 and 26 SB 02 were installed near the leaching tank and grease trap and 26 SB 03 and 26 SB 04 were installed where the percolation pit was located. The borings ranged in depth from 8 to 10 feet bgs. Saturated conditions were encountered in the borings from 7 to 9 feet below grade. Subsurface soil samples were collected continuously to the water table using a 3-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. Soil boring log sheets were prepared for each boring to evaluate subsurface lithologies (see Appendix C).

One subsurface soil sample each was collected from borings 26 SB 01 and 26 SB 02. These samples were collected from the depth interval that showed the highest HNu reading or evidence of contamination based upon visual and olfactory observations. Less than background HNu readings were screened in 26 SB 01, with slightly dark stains observed at the 4 to 6 feet interval. A 15 ppm reading with a sweet chemical odor was noted at 26 SB 02. Two subsurface soil samples each were collected from borings 26 SB 03 and 26 SB 04 based on the following: One sample was collected from the depth interval that showed the highest level of contamination based on visual observations or Hnu readings, and one sample was collected from the soil/water interface. HNu readings were less than background with no stains or odors observed in either boring. All the subsurface soil samples were submitted to Lancaster Laboratories for TCL VOC and TAL metals analyses and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix D. Soil boring characteristics and sample information are summarized in Table 25-2.

Two additional soil borings (26 SBDEC95 01 and 26 SBDEC95 02) were drilled in December 1995 to further investigate subsurface soil conditions in the vicinity of the leaching tank and grease trap. 26 SBDEC95 01 and 26 SBDEC95 02 were installed southwest of the leach tank and grease trap. The borings ranged in depth from 10 to 12 feet bgs. Saturated conditions were encountered in the borings to 10 feet below grade. Subsurface soil samples were collected continuously to the water table using 3-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. Solvent odors and a maximum HNu reading of 150 ppm were noted between the 8 to 10 feet interval in 26-SBDEC95-01. HNu readings were less than 10 ppm action level throughout 26 SBDEC95 02 with no stains or odors observed. Soil boring log sheets were prepared for each boring to evaluate subsurface lithologies (see Appendix C).

Table 25-2
Site 26 Soil Boring Characteristics Summary
NWS Earle Colts Neck, New Jersey

Soil Boring Number	Total Depth[1] (feet)	Ground Surface Elevation[2]	Laboratory Sample Number	Laboratory Sample Depth Interval[1] (feet)	Analytical Parameters[3]
26 SB 01	10	146.50	26 SB01-02	2 to 4	TCL VOC, TAL metals, and explosives
26 SB 02	10	146.70	26 SB02-04	4 to 6	TCL VOC, TAL metals, and explosives
26 SB 03	8	144.40	26 SB03-04	4 to 6	TCL VOC, TAL metals, and explosives
			26 SB03-06	6 to 8	
26 SB 04	8	144.20	26 SB04-02	2 to 4	TCL VOC, TAL metals, and explosives
			26 SB04-06	6 to 8	
26 SBDEC95 01	10	146.80	26 SBDEC95-01	8 to 10	TCL VOC
26 SBDEC95 02	12	146.40	26 SBDEC95-02	10 to 12	TCL VOC

(1) In feet below grade
(2) In feet above mean sea level
(3) TCL VOC - Target Compound List Volatile Organic Compound; TAL metals - Target Analyte List

One subsurface soil sample each was collected from borings 26 SBDEC95 01 and 26 SBDEC95 02. These samples were collected from the depth interval that showed the highest HNu reading or evidence of contamination based upon vidual and olfactory observations. Sample 26 SBDEC95 01 was collected from the depth interval that showed the highest level of contamination based on HNu readings. Sample 26 SBDEC95 02 was collected from the soil/water interface. All the subsurface soil samples were submitted to Lancaster Laboratories for TCL VOC analyses. Sample logsheets are presented in Appendix D.

25.3.3 Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

B&R Environmental added two shallow permanent monitoring wells (MW26-05 and MW26-06) to the existing four monitoring wells located at the site in July 1995 (Figure 25-1). The wells were installed to further evaluate the effect of the leach tank on groundwater at the site. MW26-05 had a total depth of 19 feet, and water was encountered at approximately 12 feet below grade during drilling. MW26-06 had a total depth of 16 feet, and water was encountered at approximately 7.5 feet below grade during drilling.

The borings were drilled to approximately 8 feet below the water table and completed as cased wells, screened across the water table.

Subsurface soil samples were collected continuously to the water table using a 2-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining or odors) and for lithologic description. HNu readings were 0 ppm throughout the MW26-05 and MW26-06 borings with no stains or odors observed. A soil boring log sheet was prepared for the boring to evaluate subsurface lithologies (see Appendix C).

The wells were constructed with 2-inch-diameter, flush jointed and threaded, Schedule 40 PVC well casing and 2-inch-diameter, Schedule 40, 0.10-foot slotted well screen fitted with a PVC bottom cap. Ten-foot screens were installed in the wells. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 2 feet above the top of screen. A 2-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height of approximately 1 foot below the ground surface. The wells were completed with a 2-foot-high stick-up and a 4- by 4- foot concrete pad keyed 1

foot into the well annulus surrounding the stick-up at ground level. The monitoring well construction sheets are in Appendix C. See Table 25-3 for the monitoring well characteristics summary.

The wells were developed 5 days after installation. Groundwater temperature, pH, conductivity, and turbidity were monitored during development. Approximately 60 gallons of water were removed from MW26-05 and approximately 90 gallons of water were removed from MW26-06.

Static-Water-Level Measurements

In order to define groundwater flow directions and horizontal and vertical groundwater gradients, B&R Environmental collected two rounds of static-water-level measurements. The first round of water-level measurements was collected on August 7, 1995, the second on October 17 and 18, 1995. Static-water levels were measured from the top of PVC riser using an electronic water-level indicator (M-scope or an interface probe) and recorded to the nearest 0.01 foot. The water-table elevation ranged from approximately 135.31 to 136.07 feet above MSL during the first round of measurements and from approximately 133.54 to 134.42 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 25-4.

Groundwater Sampling

Groundwater samples were obtained from the two newly installed monitoring wells (MW26-05 and MW26-06) and the four existing wells (MW26-01 through MW26-04) (Figure 25-1). The samples were analyzed to determine the groundwater quality and to provide data for use in the risk assessment and evaluation of remedial action alternatives.

B&R Environmental sampled MW26-01 through MW26-04 in July 1995 and MW26-05 and MW26-06 in August 1995. Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Prior to sampling, B&R Environmental purged the wells using the micro-purge protocol to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure little or no drawdown in water levels occurred throughout the purge and sample process.

Six groundwater samples (26 GW 01 through 26 GW 06) were collected and submitted to Lancaster Laboratory for TCL VOC and TAL metals analyses and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix D.

Table 25-3
Site 26 - Monitoring Well Characteristics Summary
NWS Earle, Colts Neck, New Jersey

Monitoring Well Number	Total Depth[1] (feet)	Ground Surface Elevation[2]			Diameter (inches)	Screened Interval Depth[1] (feet)	Filter Pack Interval Depth[1] (feet)	Date Installed
		Top of Concrete Pad	Top of PVC Riser	Top of Standpipe				
MW26-01	24	NS	148.76	NS	4	9 - 24	7 - 24	1/29/86
MW26-02	22	NS	148.51	NS	4	7 - 22	5 - 22	1/27/86
MW26-03	22	NS	149.35	NS	4	7 - 22	5 - 22	1/28/86
MW26-04	15	147.90	149.96	150.09	4	5 - 15	3 - 15.3[3]	1/15/91
MW26-05	19	149.68	148.68	150.23	2	9 - 19	7 - 19	7/6/95
MW26-06	16	144.94	146.82	147.38	2	6 - 16	4 - 16	7/6/95

Note: All wells were constructed with Schedule 40 polyvinyl chloride (PVC) well casing.

(1) In feet below grade. Reading obtained during monitoring well installation. See Table 25-4 for more accurate measurements.
(2) In feet above mean sea level.
(3) Filter pack extends beneath screened interval.
(NS) Not surveyed.

TABLE 25-4
SITE 26 STATIC WATER-LEVEL MEASUREMENT SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY

Monitoring Well Number	August 7, 1995			October 17 and 18, 1995		
	Depth to Water Table(1) (feet)	Top of PVC Riser(2)	Elevation of Water Table(2)	Depth to Water Table(1) (feet)	Top of PVC Riser(2)	Elevation of Water Table(2)
MW26-01	13.10	148.76	135.66	14.83	148.76	133.93
MW26-02	12.73	148.51	135.78	14.39	148.51	134.12
MW26-03	13.35	149.35	136.00	14.97	149.35	134.38
MW26-04	13.89	149.96	136.07	15.54	149.96	134.42
MW26-05	14.37	149.68	135.31	16.14*	149.68	133.54
MW26-06	11.33	146.82	135.49	13.09*	146.82	133.73

(1) In feet below top of riser.
(2) In feet above mean sea level.
* Water-level measurement collected on October 18, 1995.

25.4 SITE CHARACTERISTICS

25.4.1 Geology

Regional mapping places Site 26 in the outcrop area of the Kirkwood Formation; upland gravel may be present at the site. The upland gravel has a maximum thickness of 10 feet, the Kirkwood Formation ranges between 60 to 100 feet in thickness, and the soil borings are no more than 24 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the upland gravel and the Kirkwood Formation. In general, the borings encountered light yellowish-brown sand and gravel (probably representative of the upland gravel) and brownish-yellow, brown and gray, fine- to medium-grained and medium- to coarse-grained sand (probably representative of the Kirkwood Formation).

Based upon the boring log descriptions, wells MW26-02, MW26-03, MW26-05, and MW26-06 penetrated the upland gravel and the Kirkwood Formation, and wells MW26-01 and MW26-04 penetrated the Kirkwood Formation.

25.4.2 Hydrogeology

Groundwater in the Kirkwood aquifer beneath the site occurs under unconfined conditions. Static-water-level measurements and water-table elevations are summarized in Table 25-4. Groundwater elevations for August 1995 and October 1995 are contoured on Figures 25-3 and 25-4, respectively. The direction of shallow groundwater flow in the aquifer, as indicated by both the August and October groundwater contour maps, is toward the southwest. There does not appear to be a significant seasonal variation in groundwater flow direction.

Based on boring log descriptions, the wells are screened in the Kirkwood Formation. The hydraulic conductivities calculated for MW26-01, MW26-03, and MW26-04 are 3.85×10^{-4} cm/sec (1.09 ft/day), 1.92×10^{-3} cm/sec (5.44 ft/day), and 7.09×10^{-4} cm/sec (2.01 ft/day), respectively.

25.5 NATURE AND EXTENT OF CONTAMINATION

25.5.1 Subsurface Soils

Six site-related subsurface soil samples (26 SB 01-02, 26 SB 02-04, 26 SB 03-06, 26 SB 04-02, and 26 SB 04-06) were collected at Site 26 (Figure 25-1). Tables 25-5 and 25-6 present the occurrence and distribution of inorganic and organic chemicals detected in site-related subsurface soil samples and

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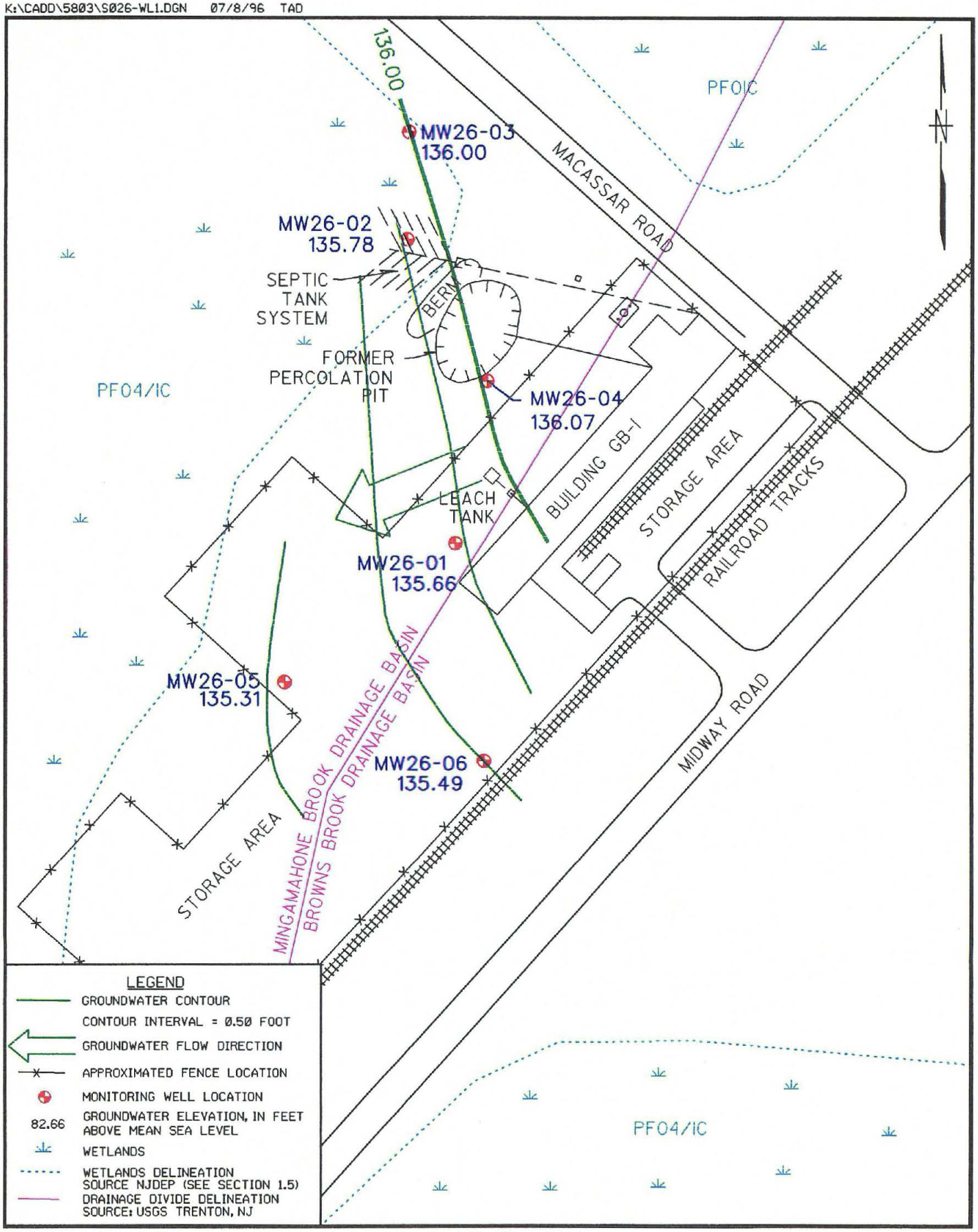

GROUNDWATER CONTOUR MAP AUGUST 7, 1995

SITE 26 - EXPLOSIVE "D" WASHOUT AREA

FIGURE 25-3

0 80 160

SCALE IN FEET

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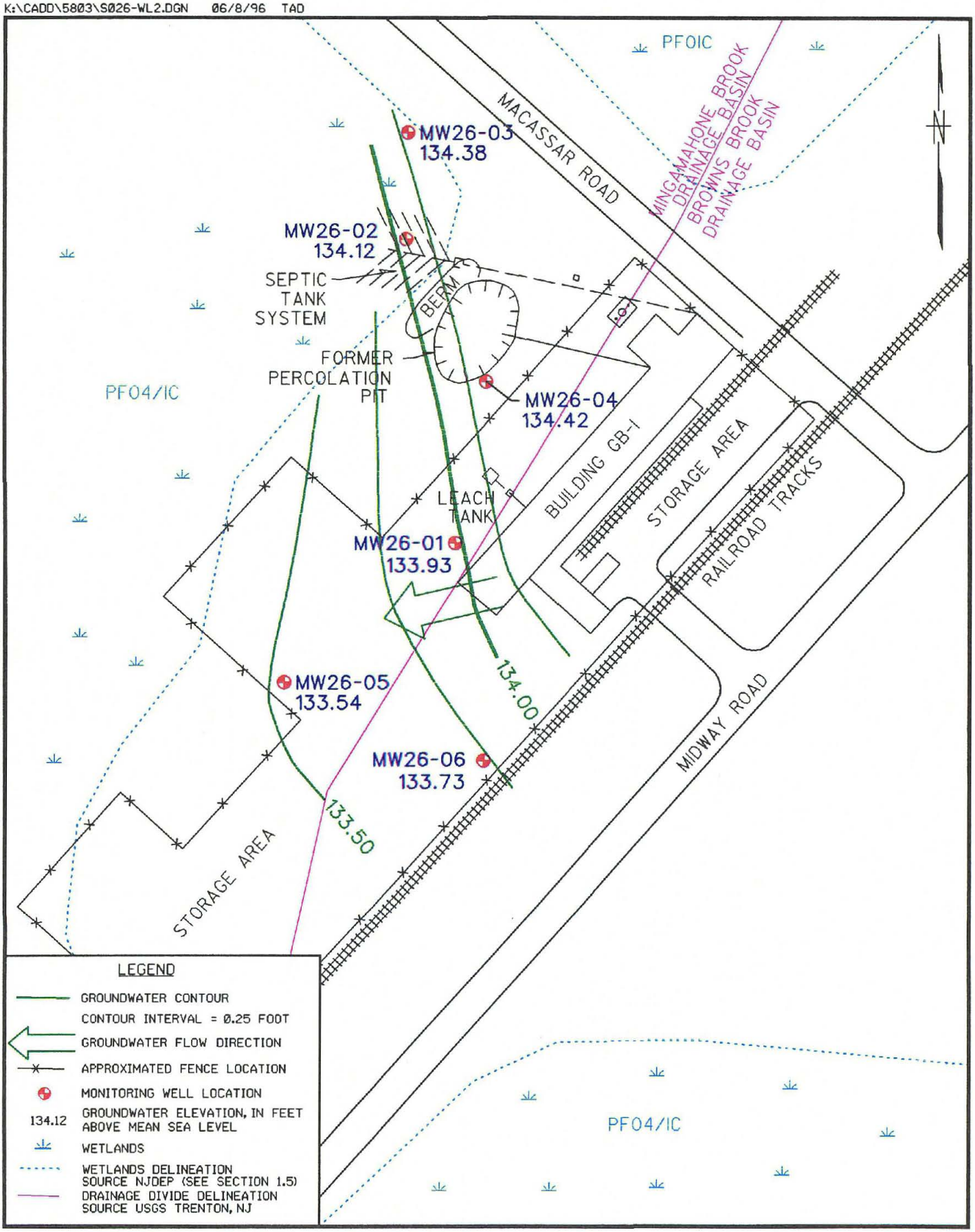

GROUNDWATER CONTOUR MAP OCTOBER 17, 1995

SITE 26 - EXPLOSIVE "D" WASHOUT AREA

FIGURE 25-4

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TABLE 25-5
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOILS AT SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	8 / 8	675 - 5310	5370.00	6 / 6	557 - 3350	1655.83	NO	3350
ANTIMONY	NOT DETECTED	-	-	2 / 6	0.61 - 0.66	0.40	YES	0.55
ARSENIC	8 / 8	1.35 - 14.4	13.29	4 / 6	0.59 - 3.1	1.32	NO	3.1
BARIUM	8 / 8	0.92 - 31	17.92	6 / 6	1.1 - 213	37.38	YES	108.16
BERYLLIUM	2 / 8	0.12 - 0.28	0.28	6 / 6	0.13 - 0.25	0.16	NO	0.20
CADMIUM	1 / 8	0.57	0.58	6 / 6	0.04 - 1.2	0.40	NO	0.80
CALCIUM	8 / 8	28.6 - 799	577.55	6 / 6	28.7 - 169	88.92	NO	169
CHROMIUM	8 / 8	4.7 - 59.5	54.73	6 / 6	2.2 - 7.8	4.83	NO	7.8
COPPER	8 / 8	0.97 - 8.6	8.66	5 / 6	0.52 - 2.3	1.00	NO	2.3
IRON	8 / 8	3745 - 62500	40871.25	6 / 6	961 - 6550	3220.17	NO	6550
LEAD	8 / 8	1.4 - 39.4	24.33	6 / 6	0.55 - 2.3	1.36	NO	2.3
MAGNESIUM	8 / 8	18.5 - 619	504.05	6 / 6	17.3 - 59	41.37	NO	59
MANGANESE	8 / 8	2.6 - 214	92.51	6 / 6	0.97 - 1.9	1.36	NO	1.74
MERCURY	8 / 8	0.03 - 0.17	0.13	1 / 6	0.064	0.01	NO	0.03
NICKEL	4 / 8	1.8 - 7.2	4.75	6 / 6	0.24 - 0.78	0.42	NO	0.68
POTASSIUM	7 / 8	95 - 792	793.35	5 / 6	77.7 - 185	114.75	NO	185
SILVER	2 / 8	0.37 - 0.67	0.51	4 / 6	0.64 - 2.4	0.91	YES	2.4
SODIUM	8 / 8	17.5 - 94.8	79.35	6 / 6	98.6 - 160	130.43	YES	157.27
THALLIUM	4 / 8	0.7 - 1.9	1.38	3 / 6	0.7 - 0.92	0.59	NO	0.92
VANADIUM	8 / 8	11.05 - 64	64.71	6 / 6	1.2 - 8.1	4.27	NO	8.1
ZINC	6 / 8	1.1 - 50.7	31.35	4 / 6	1.6 - 89.3	17.89	NO	46.93

Note: Selected COPCs are indicated in boldface type.

TABLE 25-6
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,2-DICHLOROETHENE (TOTAL)	NOT DETECTED	-	-	2 / 8	3 - 140	53.99
METHYLENE CHLORIDE	NOT DETECTED	-	-	1 / 8	2 - 2	2
TRICHLOROETHENE	NOT DETECTED	-	-	2 / 8	2 - 74	30.03

compares them to background as presented in Section 31. Tables 25-5a and 25-5b presents a comparison of detected compounds to ARARs and TBCs. Figure 25-5 shows sample locations and cncentrations of compounds which exceed ARARs and TBCs.

25.5.1.1 Inorganics

Concentrations of most metals in site-related subsurface soil samples were within the same ranges as background samples. Antimony was detected at low levels, near the instrument detection limit, in two site-related subsurface soil samples but was not found in background samples. Barium was detected in one site-related sample, 26 SB 02-04, at levels greater than the concentration range associated with background samples.

25.5.1.2 Organics

Explosives and volatile organics were analyzed for but not detected in the first round of subsurface soil samples at Site 26.

In the two soil borings taken in December of 1995 to further investigate TCE near the Leach Tank (26SB01-95 and 26SB02-95), TCE (2.0J ug/kg and 74.0 mg/kg respectively), and 1,2-dichloroethane (3.0 ug/kg and 140 ug/kg respectively) were found at concentrations above regulatory levels. Table 25-5a presents data and compares it to ARARs and TBCs ~~and TBCs.~~

25.5.2 Groundwater

Six site-related groundwater samples (26 GW 01 through 26 GW 06) were collected at Site 26 (Figure 25-1). Four designated background groundwater samples (BG GW 01 through BG GW 04) were collected (Figures 30-1 and 30-2). Tables 25-7 and 25-8 present the occurrence and distribution of inorganic and organic chemicals detected in site-related groundwater samples. Table 25-7a presents a comparison of detected compounds to ARARs and TBCs. Figure 25-5 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

25.5.2.1 Inorganics

Concentrations of most metals in site-related groundwater samples were within ranges similar to as background samples. Zinc was detected in four site-related groundwater samples (26 GW 01 through 26 GW 03 and 26 GW 05) at levels greater than the concentration range associated with background

TABLE 25-5a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26SB01-02	26SB02-04	26SB03-04	26SB03-06	26SB04-02	26SB04-06	ARARS & TBCs		
LOCATION:	26SB01	26SB02	26SB03	26SB03	26SB04	26SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	3350	668	1780	557	2300	1280	-	-	-
antimony	0.56 U	0.55 U	0.55 U	0.66	0.61	0.59 U	14.0	340	-
arsenic	1.0 J	0.59 J	3.1 J	0.56 UJ	2.7 J	0.59 UJ	20.0	20.0	-
barium	3.4 J	213 J	2.3 J	1.1 J	2.2 J	2.3 J	700	47000	-
beryllium	0.13	0.25	0.16	0.13	0.16	0.14	1.00	1.00	-
cadmium	0.040	0.068	1.2 E	0.077	0.81	0.20	1.00	100	-
calcium	163	169	63.7	28.7	76.2	32.9	-	-	-
chromium, total	6.4	2.7	7.8	2.2	6.6	3.3	-	500	-
copper	0.59	1.6	2.3	0.088 U	0.94	0.52	600	600	-
iron	3270 J	2240 J	6550 J	961 J	4560 J	1740 J	-	-	-
lead	2.3 J	1.7 J	1.4 J	0.55 J	1.2 J	1.0 J	400	600	-
magnesium	59.0	31.1	52.9	17.3	58.2	29.7	-	-	-
manganese	1.9 J	1.2 J	1.6 J	1.1 J	1.0 J	1.4 J	-	-	-
mercury	0.064 J	0.0070 U	0.0072 U	0.0073 U	0.0068 U	0.0077 U	14.0	270	-
nickel	0.78	0.24	0.50	0.38	0.32	0.29	250	2400	-
potassium	95.2	77.7	185	55.2 U	185	118	-	-	-
silver	0.14 U	0.14 U	2.4	1.0	1.3	0.64	110	4100	-
sodium	160	146	103	144	98.6	131	-	-	-
thallium	0.67 U	0.92 J	0.87 J	0.70 J	0.68 U	0.71 U	2.00	2.00	-
vanadium	5.7	2.5	8.1	1.2	6.2	1.9	370	7100	-
zinc	3.1 J	89.3 J	12.8 J	0.50 UJ	1.6 J	0.52 UJ	1500	1500	-
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	12.0 U	79000	1000000	1000
methylene chloride	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	11.0 UJ	12.0 UJ	49000	210000	1000
trichloroethene	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	12.0 U	23000	54000	1000

TABLE 25-5a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26SBDEC95-01	26SBDEC95-02	---	---	---	---	ARARS & TBCs		
LOCATION:	26SBDEC95-01	26SBDEC95-02	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.							
INORGANICS	**mg/kg**	**mg/kg**					**mg/kg**	**mg/kg**	**mg/kg**
aluminum	n/a	n/a					-	-	-
antimony	n/a	n/a					14.0	340	-
arsenic	n/a	n/a					20.0	20.0	-
barium	n/a	n/a					700	47000	-
beryllium	n/a	n/a					1.00	1.00	-
cadmium	n/a	n/a					1.00	100	-
calcium	n/a	n/a					-	-	-
chromium, total	n/a	n/a					-	500	-
copper	n/a	n/a					600	600	-
iron	n/a	n/a					-	-	-
lead	n/a	n/a					400	600	-
magnesium	n/a	n/a					-	-	-
manganese	n/a	n/a					-	-	-
mercury	n/a	n/a					14.0	270	-
nickel	n/a	n/a					250	2400	-
potassium	n/a	n/a					-	-	-
silver	n/a	n/a					110	4100	-
sodium	n/a	n/a					-	-	-
thallium	n/a	n/a					2.00	2.00	-
vanadium	n/a	n/a					370	7100	-
zinc	n/a	n/a					1500	1500	-
VOLATILES	**ug/kg**	**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
1,2-dichloroethene (total)	3.0 J	140					79000	1000000	1000
methylene chloride	11.0 U	2.0 J					49000	210000	1000
trichloroethene	2.0 J	74.0					23000	54000	1000

TABLE 24-5a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

TABLE 25-5b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26SB01-02	26SB02-04	26SB03-04	26SB03-06	26SB04-02	26SB04-06	ARARS & TBCs		
LOCATION:	26SB01	26SB02	26SB03	26SB03	26SB04	26SB04	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
MISCELLANEOUS	%	%	%	%	%	%	%	%	%
moisture	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

TABLE 25-5b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26SBDEC95-01	26SBDEC95-02	---	---	---	---	ARARS & TBCs		
LOCATION:	26SBDEC95-01	26SBDEC95-02	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.							
MISCELLANEOUS	%	%					%	%	%
moisture	12.8	19.5					-	-	-

TABLE 25-5b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

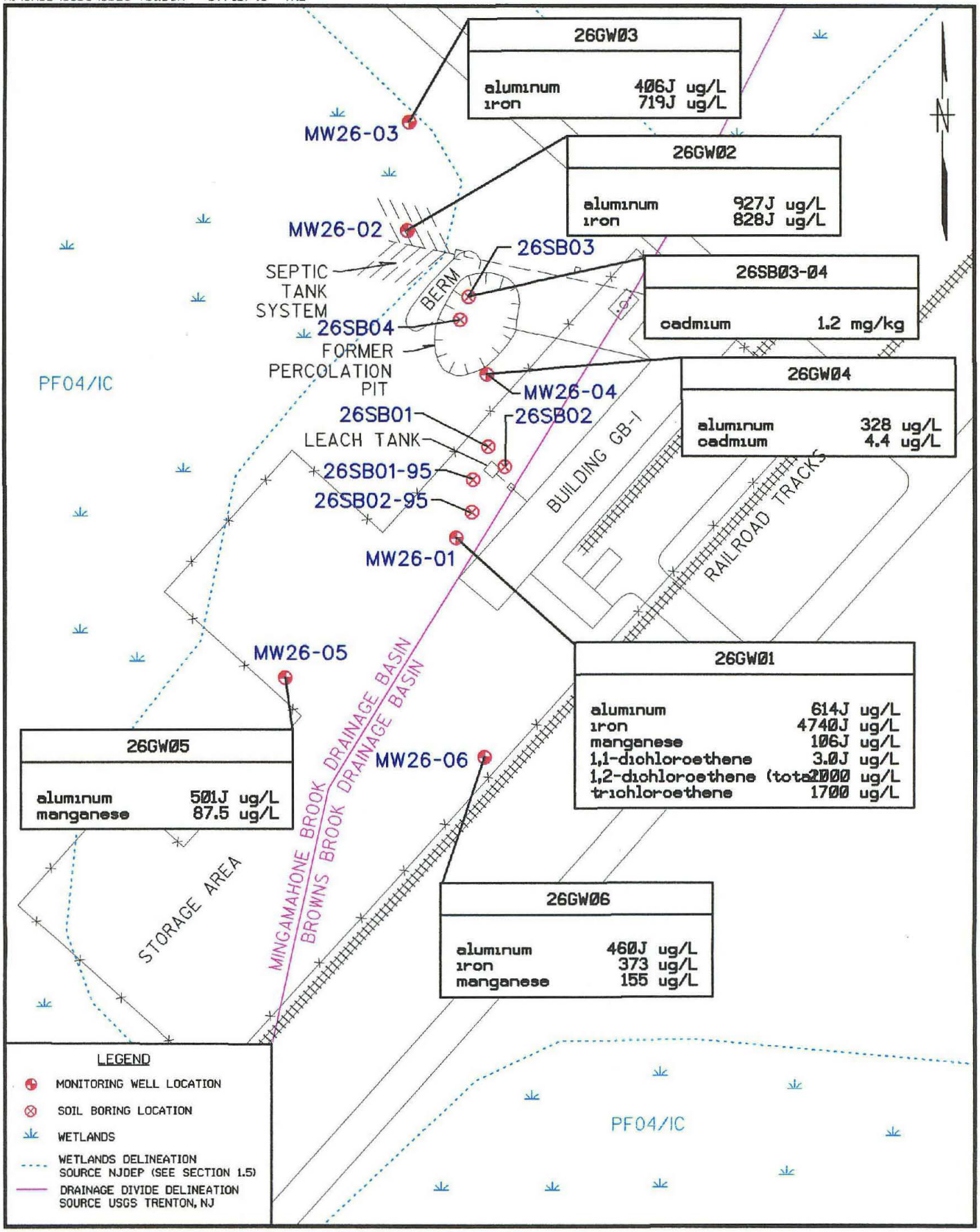
E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

K:\CADD\5803\S026-T01.DGN 07/10/96 TAD



CONCENTRATIONS ABOVE SCREENING LEVLES

SITE 26 - EXPLOSIVE "D" WASHOUT AREA

FIGURE 25-5

0 80 160

SCALE IN FEET

Brown & Root Environmental

TABLE 25-7
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	REPRESENTATIVE CONCENTRATION
ALUMINUM	11 / 11	287 - 7870	5097.82	6 / 6	328 - 927	539.33	NO	792.03
BARIUM	11 / 11	2.6 - 518	229.60	6 / 6	13.2 - 518	267.78	YES	465.70
CADMIUM*	5 / 11	0.6 - 1.9	1.21	4 / 6	0.42 - 4.4	1.04	NO	2.40
CALCIUM	11 / 11	506 - 17200	8306.55	6 / 6	3540 - 17800	8440.00	YES	17800
CHROMIUM	NOT DETECTED	-	-	3 / 6	1.2 - 1.4	0.89	YES	1.40
COBALT	6 / 11	0.7 - 10.1	4.06	5 / 6	0.92 - 5.8	2.69	NO	5.80
COPPER*	9 / 11	0.79 - 13.5	6.53	6 / 6	0.81 - 13.8	6.22	NO	13.80
IRON*	11 / 11	153 - 7690	4197.09	6 / 6	90.8 - 4740	1172.47	NO	2627.87
LEAD*	3 / 11	2.1 - 3	2.44	1 / 6	2.6	1.06	NO	1.92
MAGNESIUM	11 / 11	273 - 27400	8449.64	6 / 6	636 - 2170	1415.50	NO	2170
MANGANESE	11 / 11	3.3 - 65	46.18	6 / 6	3.3 - 155	62.23	YES	155.00
MERCURY*	11 / 11	0.005 - 0.12	0.12	6 / 6	0.012 - 0.11	0.05	NO	0.11
NICKEL	10 / 11	0.81 - 25.5	11.98	2 / 6	0.81 - 1	0.55	NO	0.94
POTASSIUM	11 / 11	350 - 3245	2810.55	6 / 6	362 - 3640	1385.17	NO	3640
SILVER	NOT DETECTED	-	-	1 / 6	3.3	0.94	YES	3.06
SODIUM	11 / 11	1850 - 11650	8449.09	6 / 6	2360 - 12500	4875.00	NO	8019.92
VANADIUM	10 / 11	0.69 - 42.25	16.48	3 / 6	0.81 - 1.6	0.71	NO	1.60
ZINC*	6 / 9	3.7 - 348	178.61	5 / 6	100 - 326	202.69	YES	326

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 25-8
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,1-DICHLOROETHENE	NOT DETECTED	-	-	1 / 6	3	3
1,2-DICHLOROETHENE (TOTAL)	NOT DETECTED	-	-	1 / 6	2000	2000
CHLOROFORM	NOT DETECTED	-	-	1 / 6	1	1
TETRACHLOROETHENE	NOT DETECTED	-	-	1 / 6	1	1
TRICHLOROETHENE	NOT DETECTED	-	-	2 / 6	1 - 1700	856.35

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TABLE 25-7a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 26

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	26GW01	26GW02	26GW03	26GW04	26GW05	26GW06	ARARS & TBCs		
LOCATION:	26GW01	26GW02	26GW03	26GW04	26GW05	26GW06	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI			
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	614 E J	927 E J	406 E J	328 E	501 E J	460 E J	-	-	200
barium	518	464	475	13.2	89.6	46.9	2000	2000 a	2000
cadmium	0.52	0.42	0.38 U	4.4 E	0.52	0.38 U	5.00	5.00 e	4.00
calcium	17800	3540	7010	4600	6590	11100	-	-	-
chromium, total	1.3	1.2	1.4	1.0 U	1.0 U	1.0 U	100 *	100 a	100
cobalt	2.9	0.92	0.60 U	1.2	5.0	5.8	-	-	-
copper	8.7	13.8	9.2	4.0	0.82	0.81	1300	-	1000
iron	4740 E J	828 E J	719 E J	90.8	284	373 E	-	-	300
lead	2.6	1.5 U	1.5 U	1.5 UJ	1.5 U	1.5 U	15.0	-	10.0
magnesium	2170	636	2120	724	923	1920	-	-	-
manganese	106 E J	10.6	3.3	11.0	87.5 E	155 E	-	-	50.0
mercury	0.012	0.021	0.014	0.11 J	0.080	0.083	2.00	2.00 b	2.00
nickel	0.75 U	1.0	0.81	0.75 U	0.75 U	0.75 U	100	100 a	100
potassium	3640	1100	362	569	1350	1290	-	-	-
silver	0.94 U	0.94 U	0.94 U	3.3	0.94 U	0.94 U	-	100 a	-
sodium	4580	3250	2650	3910	2360	12500	-	-	50000
vanadium	1.6	1.0	0.81	0.61 U	0.61 U	0.61 U	-	-	-
zinc	326	326	280	8.3 R	180	100	-	2000 a	5000
VOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
1,1-dichloroethene	3.0 E J	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	7.00	7.00 a	2.00
1,2-dichloroethene (total)	2000 E	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	70.0 a	70.0 a	10.0
chloroform	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	1.0 J	100	100 e	6.00
tetrachloroethene	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	1.0 J	5.00	1000 e	1.00
trichloroethene	1700 E	10.0 U	10.0 U	10.0 U	10.0 U	1.0 J	5.00	-	1.00

TABLE 25-7a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

samples. Barium was found at elevated levels in samples 26 GW 01 through 26 GW 03 and cadmium and silver were detected in sample 26 GW 04 at levels greater than background ranges.

25.5.2.2 Organics

TCE (1 ug/L to 1,700 ug/L) was detected in two groundwater samples collected at Site 26. 1,1-DCE (3 ug/L), 1,2-DCE (2,000 ug/L), chloroform (1 ug/L), and PCE (1 ug/L) were each detected in one groundwater sample collected at Site 26. Sample 26 GW 01 contained the highest levels of TCE, 1,1-DCE, and 1,2-DCE. This monitoring well is located near a leach tank along the northwestern end of Building GB-1. Trace levels of TCE, PCE, and chloroform were also detected in 26 GW 06, which is located approximately 90 feet south of the southwestern corner of Building GB-1. Explosives were analyzed for but not detected in groundwater samples collected at Site 26.

25.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 26 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 25.6.1. Persistence of detected chemicals in the environment is discussed in Section 25.6.2. Section 25.6.3 presents a brief discussion of contaminant trends.

25.6.1 Detected Chemicals and Transport Potential

Analytical results for groundwater sampled at Site 26 indicate significant levels of TCE and associated degradation products in one monitoring well and trace levels of TCE, PCE, and chloroform in another well. Barium was detected in one subsurface soil sample at a level greater than the range with associated background samples. Zinc was detected in four site-related groundwater samples at similar levels that are greater than the concentration range associated with background samples. Barium was found at similarly elevated levels in three groundwater samples, and cadmium and silver were detected in sample 26 GW 04 at low levels that are greater than background. The physical transport data for the detected contaminants are presented in Table 2-10. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

The organic compounds detected in the groundwater are volatile and characteristically mobile in the environment (either through soil gas migration or groundwater transport). The detected chlorinated VOCs all possess specific gravities greater than 1, which indicates that a product source will tend to sink to the bottom of an aquifer rather than float on the water table.

The inorganic compounds have a strong tendency to adsorb onto soil/sediment particles, a factor that greatly reduces their mobility.

25.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment.

1,1-DCE and 1,2-DCE are associated with degradation of PCE and TCE (Cline and Viste, 1983) and may further degrade to vinyl chloride. Concentrations of the parent compounds (TCE and PCE) may diminish over time, depending upon the presence of contaminated source materials that could continue to leach new product into groundwater.

25.6.3 Observed Chemical Contaminant Trends

TCE, PCE, and several of their degradation by-products were detected in the groundwater and in subsurface soil. The levels detected at the location of maximum concentrations (MW26-01) and the lack of any pattern of significant concentrations in other nearby monitoring wells suggest that well MW26-01 is in close proximity to the area where TCE or PCE was originally released. The similar levels of TCE and 1,2-DCE suggest that the release occurred a number of years ago. This monitoring well exhibited similar concentrations during a 1993 sampling investigation. The fact that a sample from the well to the south (MW26-06) contained concentrations three orders of magnitude less and that a downgradient well sample (MW26-05) contained no chlorinated ethenes suggest a preferential downward vertical migration consistent with the relatively small hydrological gradient in this area.

The levels of zinc detected in four groundwater samples and barium in three groundwater samples from wells west and north of Building GB-1 do not demonstrate a clear pattern of impact related to any known site-specific source. Similarly, no relationship was identified between historical site activities and the low

levels of cadmium and silver that were detected in the monitoring well nearest the former picric acid percolation pit. It should be noted that picric acid and other explosive compounds were not found in samples collected near this pit or elsewhere in Site 26 groundwater and subsurface soil samples.

Antimony was detected at low levels, near the instrument detection limit, in two site-related subsurface soil samples but was not found in background samples. Barium was detected in one subsurface soil sample collected in the former percolation pit. Neither of these metals are apparently associated with former site activities. TCE and 1,2-DCE were found in subsurface soil near the building's grease traps and leach pit.

25.6.4 Conclusions

TCE, PCE, and related chlorinated aliphatics at Site 26 have impacted the groundwater. Based upon the information gathered during this investigation, the source area appears to be in the vicinity of the southeastern corner of Building GB-1, possibly the septic system leach tank near well MW26-01. Lateral contaminant migration in shallow groundwater appears limited (at least in the horizontal plane) since only trace levels of VOCs appeared in a nearby well to the south and no VOCs were detected in the well located approximately downgradient (southwest) of MW26-05. Since TCE and related chlorinated aliphatics are heavier than water, downward vertical migration of contamination is suspected to have occurred. Vertical migration seems likely based on the current conceptual model, consisting of an assumed concentrated source at or near the septic tank, a nearly flat groundwater surface, and permeable soils which are not expected to hamper downward migration. However, there is the possibility, considering local geology, that an intervening aquatard layer(s) could affect the anticipated mostly downward migration pattern.

Picric acid, an explosive that was previously associated with artillery shell washout processing at Site 26, was not detected in any groundwater or subsurface soil samples collected during this investigation. A 1993 sampling investigation revealed one soil sample within the settling basin that contained picric acid. This compound is not expected to persist in the environment due to its high water solubility and potential for biodegradation. Elevated levels of lead in the soils from the settling basin were detected in the 1993 investigation but were not confirmed in subsurface samples collected in the current investigation.

25.7 BASELINE RISK ASSESSMENT

This section of the RI report presents the results of the baseline risk assessment for Site 26. The risk assessment was performed using the approach outlined in Section 2.4. Tables 25-9 through 25-10 provide the selected COPCs and representative concentrations of inorganics and organics in site-related subsurface soil, and groundwater, respectively. COPCs and representative concentrations were selected

TABLE 25-9
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 26 (mg/kg)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ANTIMONY	0.55	NORMAL
ARSENIC	3.1	NONPARAMETRIC
BARIUM	108.16	NORMAL
BERYLLIUM	0.20	NORMAL
CADMIUM	0.80	NORMAL
CHROMIUM	7.8	NONPARAMETRIC
LEAD	2.3	NONPARAMETRIC
SILVER	2.4	NONPARAMETRIC
ZINC	46.93	NORMAL
1,2-DICHLOROETHENE (TOTAL)*	53.99	NORMAL
METHYLENE CHLORIDE*	2	NORMAL
TRICHLOROETHENE*	30.03	NORMAL

* Organic chemicals are in (ug/kg)

TABLE 25-10
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
GROUNDWATER - SITE 26 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
BARIUM	465.70	NORMAL
CADMIUM	2.40	NORMAL
COPPER	13.8	NONPARAMETRIC
IRON	2627.87	NORMAL
LEAD	1.92	LOGNORMAL
MERCURY	0.11	NONPARAMETRIC
SILVER	3.06	LOGNORMAL
ZINC	326	LOGNORMAL
1,1-DICHLOROETHENE	3	LOGNORMAL
1,2-DICHLOROETHENE (TOTAL)	2000	LOGNORMAL
CHLOROFORM	1	LOGNORMAL
TETRACHLOROETHENE	1	LOGNORMAL
TRICHLOROETHENE	856.35	NORMAL

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as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The result of the conservative baseline risk assessment was greater than a value of 1.0 for non-cancer risk and greater than 1E-04 for cancer risk; therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. Section 25.7.1.4 discusses the modifications made to the conservative preliminary baseline risk assessment.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation procedures are identified for a site.

25.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential and industrial receptors).

25.7.1.1 Future Industrial Employee

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 26 are 1.7E-05 (ingestion), 1.5E-05 (dermal contact), and 8.0E-09 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate standards and criteria (ARARs). The principal COPCs contributing to the subsurface soil cancer risk are arsenic (ingestion, 99 percent of the cancer risk for this pathway; and dermal contact, 36 percent of the cancer risk for this pathway) and beryllium (dermal contact, 63 percent of the cancer risk for this pathway).

The estimated RME noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soil) at Site 26 are less than 1.0 for the ingestion, dermal contact and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soil at Site 26 in Tables 25-11 and 25-12, respectively.

The estimated total RME cancer risks for the future industrial employee for exposure to COPCs in groundwater at Site 26 are within the mid-range of the 1E-04 to 1E-06 target acceptable risk range. (Ingestion exposures contributed the significant portion of risks.)

The conservative preliminary baseline risk assessment yielded an estimated noncarcinogenic HI with a value greater than 1.0 for the future industrial employee assuming exposure to COPCs in groundwater at Site 26. (Ingestion exposures contributed the significant portion of risk.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for industrial exposure to groundwater are discussed in Section 25.7.1.4 and presented in Tables 25-13, 25-14, and 25-14a.

25.7.1.2 Future Residential Receptor

The estimated total RME HIs for the future residential child for exposure to COPCs in subsurface soil at Site 26 are below 1.0; the cutoff below which adverse effects are not expected.

For the future residential receptor, the conservative preliminary baseline risk assessment yielded estimated total cancer risks greater than 1E-04 (groundwater) and approximately 1E-04 (subsurface soil). For the future residential child, HIs were greater than 1.0 (groundwater). Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. The amended carcinogenic and noncarcinogenic risks for residential receptors are discussed in Section 25.7.1.4 and presented for subsurface soil in Tables 25-15, 25-15a, and 25-16, respectively. Estimated carcinogenic risks and noncarcinogenic HQs for future residential receptors exposed to groundwater are presented in Tables 25-17, 25-17a, 25-18, and 25-18a, respectively.

TABLE 25-11
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 26
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
METHYLENE CHLORIDE	5.2E-12	1.6E-11	1.0E-15
TRICHLOROETHENE	1.2E-10	3.6E-10	2.4E-14
ANTIMONY	N/A	N/A	N/A
ARSENIC	1.6E-05	5.3E-06	3.6E-09
BARIUM	N/A	N/A	N/A
BERYLLIUM	3.0E-07	9.3E-06	5.5E-11
CADMIUM	N/A	N/A	6.5E-11
CHROMIUM	N/A	N/A	4.2E-09
LEAD	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	1.7E-05	1.5E-05	8.0E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-12
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 26
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
1,2-DICHLOROETHENE (TOTA	5.9E-06	1.8E-05	1.1E-09
METHYLENE CHLORIDE	3.3E-08	1.0E-07	6.1E-12
TRICHLOROETHENE	4.9E-06	1.5E-05	9.1E-10
ANTIMONY	1.3E-03	8.4E-03	2.5E-07
ARSENIC	1.0E-02	3.3E-03	1.9E-06
BARIUM	1.5E-03	1.2E-02	2.8E-05
BERYLLIUM	3.9E-05	1.2E-03	7.2E-09
CADMIUM	1.6E-03	9.8E-03	8.0E-07
CHROMIUM	1.5E-03	2.4E-02	2.8E-07
LEAD	N/A	N/A	N/A
SILVER	4.7E-04	7.3E-04	8.7E-08
ZINC	1.5E-04	1.9E-04	2.8E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-13
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	6.3E-06	9.4E-08
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
CHLOROFORM	2.1E-08	2.1E-10
TETRACHLOROETHENE	1.8E-07	1.3E-08
TRICHLOROETHENE	3.3E-05	1.0E-06
BARIUM	N/A	N/A
SILVER	N/A	N/A
TOTAL RISK	3.9E-05	1.1E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-14
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	3.3E-03			3.3E-03	3.3E-03					4.9E-05
1,2-DICHLOROETHENE (TOTAL)	2.2E+00	2.2E+00			2.2E+00					2.0E-02
CHLOROFORM	9.8E-04			9.8E-04	9.8E-04					9.6E-06
TETRACHLOROETHENE	9.8E-04				9.8E-04					7.1E-05
TRICHLOROETHENE	1.4E+00	1.4E+00					1.4E+00			4.2E-02
BARIUM	6.5E-02	6.5E-02				6.5E-02		6.5E-02	6.5E-02	6.7E-04
SILVER	6.0E-03		6.0E-03							1.2E-05
HI BY TARGET ORG		3.6E+00	6.0E-03	4.2E-03	2.2E+00	6.5E-02	1.4E+00	6.5E-02	6.5E-02	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-14a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	GROUNDWATER DERMAL CONTACT
1,1-DICHLOROETHENE	3.1E-03			3.1E-03	3.1E-03					6.6E-05
1,2-DICHLOROETHENE (TOTAL)	2.3E-01	2.3E-01			2.3E-01					3.0E-03
CHLOROFORM	6.0E-04			6.0E-04	6.0E-04					8.4E-06
TETRACHLOROETHENE	6.0E-04				6.0E-04					6.3E-05
TRICHLOROETHENE	8.6E-01	8.6E-01					8.6E-01			3.7E-02
BARIUM	4.0E-02	4.0E-02				4.0E-02		4.0E-02	4.0E-02	5.8E-04
SILVER	3.7E-03		3.7E-03							1.1E-05
	HI BY TARGET ORG	1.1E+00	3.7E-03	3.7E-03	2.3E-01	4.0E-02	8.6E-01	4.0E-02	4.0E-02	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-15
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 26
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
METHYLENE CHLORIDE	2.3E-11	5.4E-11	6.2E-16
TRICHLOROETHENE	5.2E-10	1.2E-09	1.5E-14
ANTIMONY	N/A	N/A	N/A
ARSENIC	7.3E-05	1.8E-05	2.2E-09
BARIUM	N/A	N/A	N/A
BERYLLIUM	1.3E-06	3.1E-05	3.4E-11
CADMIUM	N/A	N/A	4.0E-11
CHROMIUM	N/A	N/A	2.6E-09
LEAD	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	7.4E-05	4.9E-05	4.9E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-15a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 26
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
METHYLENE CHLORIDE	3.8E-12	N/A	1.9E-16
TRICHLOROETHENE	8.3E-11	N/A	4.5E-15
ANTIMONY	N/A	N/A	N/A
ARSENIC	5.0E-06	7.1E-06	2.9E-10
BARIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	5.0E-06	7.1E-06	2.9E-10

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-16
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL CHILD RECEPTORS - SITE 26
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
1,2-DICHLOROETHENE (TOT	7.7E-05	1.5E-04	1.1E-09
METHYLENE CHLORIDE	4.3E-07	8.3E-07	6.5E-12
TRICHLOROETHENE	6.4E-05	1.3E-04	9.6E-10
ANTIMONY	1.8E-02	6.9E-02	2.6E-07
ARSENIC	1.3E-01	2.7E-02	2.0E-06
BARIUM	2.0E-02	9.7E-02	2.9E-05
BERYLLIUM	5.1E-04	9.9E-03	7.6E-09
CADMIUM	2.0E-02	8.0E-02	8.4E-07
CHROMIUM	2.0E-02	1.9E-01	3.0E-07
LEAD	N/A	N/A	N/A
SILVER	6.1E-03	6.0E-03	9.2E-08
ZINC	2.0E-03	1.6E-03	3.0E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-17
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
1,1-DICHLOROETHENE	2.7E-05	3.0E-06	8.8E-06
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
CHLOROFORM	9.1E-08	6.6E-09	1.2E-06
TETRACHLOROETHENE	7.7E-07	4.2E-07	2.7E-08
TRICHLOROETHENE	1.4E-04	3.2E-05	7.5E-05
BARIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	1.7E-04	3.5E-05	8.5E-05

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-17a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
1,1-DICHLOROETHENE	6.0E-06	7.4E-07	7.8E-07
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
CHLOROFORM	1.3E-08	1.1E-09	6.7E-08
TETRACHLOROETHENE	1.1E-07	6.7E-08	1.6E-09
TRICHLOROETHENE	2.0E-05	5.0E-06	4.3E-06
BARIUM	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
TOTAL RISK	2.6E-05	5.8E-06	5.1E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-18
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN							
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM
1,1-DICHLOROETHENE	2.1E-02			2.1E-02	2.1E-02				
1,2-DICHLOROETHENE (TOTAL)	1.4E+01	1.4E+01			1.4E+01				
CHLOROFORM	6.4E-03			6.4E-03	6.4E-03				
TETRACHLOROETHENE	6.4E-03				6.4E-03				
TRICHLOROETHENE	9.1E+00	9.1E+00					9.1E+00		
BARIUM	4.3E-01	4.3E-01				4.3E-01		4.3E-01	4.3E-01
SILVER	3.9E-02		3.9E-02						
	HI BY TARGET ORGAN	2.4E+01	3.9E-02	2.8E-02	1.4E+01	4.3E-01	9.1E+00	4.3E-01	4.3E-01

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-18
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER DERMAL CONTACT BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER DERMAL CONTACT - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	INHALATION OF VOAS IN GW - ADULT
1,1-DICHLOROETHENE	1.9E-03			1.9E-03	1.9E-03					N/A
1,2-DICHLOROETHENE (TOTAL)	7.8E-01	7.8E-01			7.8E-01					N/A
CHLOROFORM	3.7E-04			3.7E-04	3.7E-04					N/A
TETRACHLOROETHENE	2.7E-03				2.7E-03					N/A
TRICHLOROETHENE	1.6E+00	1.6E+00					1.6E+00			N/A
BARIUM	2.1E-02	2.1E-02				2.1E-02		2.1E-02	2.1E-02	N/A
SILVER	3.8E-04		3.8E-04							N/A
HI BY TARGET ORGAN		2.4E+00	3.8E-04	2.2E-03	7.8E-01	2.1E-02	1.6E+00	2.1E-02	2.1E-02	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-18a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER INGESTION BY TARGET ORGAN							
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM
1,1-DICHLOROETHENE	1.6E-02			1.6E-02	1.6E-02				
1,2-DICHLOROETHENE (TOTAL)	1.1E+00	1.1E+00			1.1E+00				
CHLOROFORM	3.0E-03			3.0E-03	3.0E-03				
TETRACHLOROETHENE	3.0E-03				3.0E-03				
TRICHLOROETHENE	4.3E+00	4.3E+00					4.3E+00		
BARIUM	2.0E-01	2.0E-01				2.0E-01		2.0E-01	2.0E-01
SILVER	1.8E-02		1.8E-02						
	HI BY TARGET ORGAN	5.6E+00	1.8E-02	1.9E-02	1.1E+00	2.0E-01	4.3E+00	2.0E-01	2.0E-01

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 25-18a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 26
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GROUNDWATER DERMAL CONTACT BY TARGET ORGAN								
SUBSTANCE	GROUNDWATER DERMAL CONTACT - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	KIDNEY	LIVER	DIGESTIVE SYSTEM	CENTRAL NERVOUS SYSTEM	SKELETAL MUSCLE	REPRO-DUCTIVE SYSTEM	INHALATION OF VOAS IN GW - ADULT
1,1-DICHLOROETHENE	1.9E-03			1.9E-03	1.9E-03					N/A
1,2-DICHLOROETHENE (TOTAL)	8.8E-02	8.8E-02			8.8E-02					N/A
CHLOROFORM	2.4E-04			2.4E-04	2.4E-04					N/A
TETRACHLOROETHENE	1.8E-03				1.8E-03					N/A
TRICHLOROETHENE	1.1E+00	1.1E+00					1.1E+00			N/A
BARIUM	1.4E-02	1.4E-02				1.4E-02		1.4E-02	1.4E-02	N/A
SILVER	2.6E-04		2.6E-04							N/A
	HI BY TARGET ORGAN	1.2E+00	2.6E-04	2.2E-03	9.2E-02	1.4E-02	1.1E+00	1.4E-02	1.4E-02	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

25.7.1.3 Lead Results

Lead was not found above the EPA level of concern (400 mg/kg) in soil samples taken during the RI. Lead was not found at concentrations greater than the EPA action level (15 ug/L) in groundwater samples taken during the RI, but was found at levels in excess of the action level in previous groundwater sampling.

The IEUBK Lead Model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 26 exposures are presented in Appendix I.

25.7.1.4 Amended Risk Assessment

The amended risk assessment recalculated the cancer and non-cancer risks at Site 26 for future residential and future industrial receptors assuming exposure to COPCs in groundwater and for future residential receptors assuming exposure to COPCs in subsurface soil.

Comparison to Background: Groundwater

Cadmium, copper, iron, lead, and mercury were eliminated from consideration as groundwater COPCs based on a comparison of average levels to twice the background level. Table 25-7 presents the comparison of COPCs to background concentrations. Zinc was eliminated based on comparison to background upper 95 percent UTLs.

After the above steps, groundwater cancer and non-cancer risks were recalculated. The final RME cancer risks are still above the 1E-04 to 1E-06 target acceptable range for the future residential receptor (1.7E-04, via groundwater ingestion). The cancer risk associated with the future industrial (groundwater) exposure scenario is within the mid-range of the target acceptable risk range. TCE and 1,1-dichloroethene (via ingestion and inhalation during showering) are the principal COPCs contributing to the groundwater RME cancer risks.

Estimated RME carcinogenic risks are presented for future industrial employees exposed to groundwater in Table 25-13. Estimated RME carcinogenic risks are presented for future residential receptors exposed to groundwater in Table 25-17.

Comparison to Background: Subsurface Soil

Beryllium, cadmium, chromium, lead, and zinc were eliminated from consideration as subsurface soil

COPCs based on a comparison of average levels to twice the background level. However, since arsenic is a class A carcinogen, it could not be eliminated from consideration. Table 25-5 presents the comparison of COPCs to background concentrations. No other metals could be eliminated based on comparison to background upper 95 percent UTLs.

Consideration of Target Organ Grouping: Groundwater

The revised HIs are greater than 1.0 for exposure to groundwater by future residential and future industrial receptors; therefore, these risks were grouped according to target organ. The resulting final RME HIs are greater than 1.0 for both receptors. For groundwater ingestion by the future residential child, the target organs, corresponding RME HIs, and associated principal COPCs are as follows: cardiovascular system (24 - 1,2-dichloroethene, TCE), liver (14 - 1,2-dichloroethene), and central nervous system (9.1 - TCE). For groundwater dermal contact by the future residential child, the target organs, corresponding RME HIs, and associated principal COPCs are as follows: cardiovascular system (2.4 - 1,2-dichloroethene, TCE), and central nervous system (1.6 - TCE). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated RME noncarcinogenic HQs are presented for future industrial employees exposed to groundwater in Table 25-14. Estimated RME noncarcinogenic HQs are presented for future residential receptors exposed to groundwater in Table 25-18.

Consideration of Modified Dermal Absorption and Target Organ Grouping: Subsurface Soil

Subsurface soil cancer and non-cancer risks were recalculated for future residential receptors using modified soil-to-skin absorption factors for three chemicals and excluding dermal effects for other COPCs. After these steps, total RME cancer risks (from soil ingestion, dermal contact, and inhalation of dust) are approximately 1E-04, at the upper end of the target acceptable range. Arsenic (via soil ingestion and dermal contact) is the principal COPC that contributed to these risks. The resulting final RME HIs are less than 1.0 for each affected organ for the future residential child. Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soil in Tables 25-15 and 25-16, respectively.

Application of Central Tendencies Guidance: Groundwater

Central tendency assumptions were applied to calculate groundwater cancer and non-cancer risks for future residential receptors and non-cancer risks for the future industrial employee. Central tendency generates a lower risk estimate than RME because it assumes typical rather than upper range receptor

behavior patterns related to the ingested dose. Based on this evaluation, the estimated total central tendency cancer risks are within the mid-range of the target acceptable risk range. Ingestion and inhalation exposures contributed the major portion of these cancer risks.

Central tendency noncarcinogenic HIs for groundwater were greater than 1.0 for the future industrial employee and the future residential child. For groundwater ingestion by the future residential child, the target organs, corresponding RME HIs, and associated principal COPCs are as follows: cardiovascular system (5.6 - 1,2-dichloroethene, TCE), liver (1.1 - 1,2-dichloroethene), and central nervous system (4.3 - TCE). For groundwater dermal contact by the future residential child, the target organs, corresponding RME HIs, and associated principal COPCs are as follows: cardiovascular system (1.2 - TCE), and central nervous system (1.1 - TCE). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated central tendency noncarcinogenic HQs for future industrial employees exposed to groundwater are presented in Table 25-14a. Central tendency carcinogenic risks and noncarcinogenic HQs for future residential receptors exposed to groundwater are presented in Tables 25-17a and 25-18a, respectively.

Application of Central Tendencies Guidance: Subsurface Soil

Central tendency assumptions were applied to calculate subsurface soil cancer risks for future residential receptors. Based on this evaluation, the estimated total central tendency cancer risks for the residential receptor are within the mid-range of the target acceptable risk range for the future residential receptor. Arsenic (via ingestion of and dermal contact with soil) was the principal COPC contributing to these risks.

Central tendency carcinogenic risks for future residential receptors exposed to subsurface soil (assuming subsurface soils become future surface soils) are presented in Table 25-15a.

25.7.2 Conclusions

Subsurface soil and groundwater were sampled at Site 26. The potential receptors for this site were future industrial and residential receptors.

The RME cancer risks associated with future residential (subsurface soil and groundwater) exposure scenarios exceeded 1E-04, the upper end of the target risk range. However, these RME estimates are probably overconservative because a central tendency calculation shows that cancer risks are more likely to be within the mid-range of the target acceptable risk range. TCE and 1,1-dichloroethene (via

groundwater ingestion and inhalation during showering) and arsenic (via ingestion of and dermal contact with soil) are the principal COPCs that contributed to the cancer risks for these exposure scenarios.

RME estimates for noncarcinogenic HIs associated with future industrial and future residential (groundwater) exposure scenarios exceeded 1.0; the cutoff point below which adverse noncarcinogenic effects are not expected to occur. TCE and 1,2-dichloroethene were the COPCs that exceeded 1.0 or contributed to the HI exceeding 1.0 for these exposure scenarios. In addition, central tendency risk estimates for residential and industrial exposure to groundwater yielded HIs greater than 1.0; affected target organs include liver, cardiovascular system, and central nervous system.

Lead concentrations detected at the site during this RI were below the EPA guidelines and are not expected to be associated with a significant increase in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site 26 in Table 25-19 for subsurface soil and groundwater. Table 25-19a presents the relevant central tendency risk estimates associated with potential receptors for subsurface soil and groundwater.

25.8 ECOLOGICAL RISK ASSESSMENT

25.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Site 26 comprises a relatively small area approximately 200 feet by 200 feet located behind Building GB-1. The area immediately northwest and southwest of Building GB-1 consists of pavement and a gravel and dirt storage area with flat topography. The surrounding area is a turfgrass lawn. The site is bordered to the north by Macassar Road. A depression, the percolation pit described in Section 25.1, is located in the center of the site, about 75 feet behind the building, and measures approximately 30 feet in diameter and 10 feet deep. In addition, a leaching tank/grease trap is located next to the northwest side of Building GB-01. A septic system is situated about 100 feet north of the western edge of the building. The septic system is surrounded by wooded upland areas. The upland areas are dominated by pitch pine, blackjack oak, blueberry, and *Clethra* sp. NJDEP Geographic Information System data initially indicated the presence of wetlands where the wooded upland areas are located. However, ground-truthing of site revealed that no wetlands are present in the area. Soils in this area contain no evidence of saturation, no wetland hydrology is present, and no streams or watercourses exist near the site. The closest wetlands

TABLE 25-19
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.7E-05	7.3E-05^	N/A	N/A	1.7E-02	1.8E-01^	N/A	N/A
	Dermal Contact	N/A	1.5E-05	5.3E-05^	N/A	N/A	5.9E-02	8.2E-02^	N/A	N/A
	Inhalation of Fugitive Dust	N/A	8.0E-09	2.2E-09^	N/A	N/A	3.1E-05	3.2E-05^	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	3.9E-05^	1.7E-04^	N/A	N/A	3.6E+00@	2.4E+01@	N/A	N/A
	Dermal Contact	N/A	1.1E-06^	3.5E-05^	N/A	N/A	6.4E-02^	2.4E+00@	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	8.5E-05^	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	TOTAL	-	7.2E-05	4.1E-04	-	-	3.7E+00	2.7E+01	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatile noncarcinogens were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value for amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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TABLE 25-19a
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 26
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	5.0E-06^	N/A	N/A	N/R	N/R	N/A	N/A
	Dermal Contact	N/A	N/R	7.1E-06^	N/A	N/A	N/R	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/R	2.9E-10^	N/A	N/A	N/R	N/R	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	N/R	2.6E-05^	N/A	N/A	1.1E+00@	5.6E+00@	N/A	N/A
	Dermal Contact	N/A	N/R	5.8E-06^	N/A	N/A	4.1E-02^	1.2E+00@	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	5.1E-06^	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	TOTAL	-	-	4.9E-05	-	-	1.1E+00	6.8E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation is not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatile noncarcinogens were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value for amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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are located approximately 300 yards to the northwest. The East Branch of Mingamahone Brook is located approximately 300 yards southwest of Site 26, and the site is in the Mingamahone Brook Watershed.

In general, the turfgrass areas behind Building GB-01 provide minimal wildlife habitat, while the upland areas provide excellent habitat for terrestrial ecological receptors. The border of the wooded area at the site provides an "edge effect" that may attract a wide variety of terrestrial species. Gamebirds found on the installation, including bobwhite quail and ruffed grouse, and mammals such as white-tailed deer, cottontail rabbit, and several species of rodents, are attracted to edge areas. Nonetheless, it should be reiterated that the site is relatively small and consists of developed areas and turfgrass, and therefore, receptor use would not be extensive. The site represents only a small part of the home ranges for most terrestrial mammals and birds that may utilize the area. Ecological receptor use of the percolation pit area is expected to be minimal. No threatened or endangered species are known to occur on or around Site 26, and no sensitive habitats, including wetlands, are present.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The potential contaminant source to the environment at Site 26 is the percolation pit, and to a much lesser extent, the leaching tank and grease trap next to the building. In general, the major potential release pathways from the percolation pit area and the leaching tank/grease trap at Site 26 are overland runoff and infiltration of contaminants. Precipitation runoff as a possible migration pathway was investigated since it could carry constituents to wetland surface waters and sediments that were indicated by NJDEP wetland delineations as being nearby. However, ground-truthing found no wetlands in the area, precluding the potential for runoff-related impacts to wetlands. Potential runoff of contaminants to surface soils in the upland areas was also evaluated. Surface drainage in the grassy areas is toward the percolation pit, which is several feet deep. As such, water percolates through the pit soils, and does not collect and overflow the edge of the pit. Also, the leaching tank/grease trap area is rather small and precipitation tends to settle, rather than run off, in this area. The upland areas are also a few feet higher on grade than the area next to the building.

Infiltration, primarily from precipitation, was also investigated as a potential contaminant migration pathway. Upon infiltrating the soil column and reaching the water table, a chemical may be carried with the flow of groundwater to downgradient locations. Groundwater from the site could eventually discharge to surface water with contaminants subsequently deposited in sediment where they may accumulate in the tissues of aquatic organisms. Potential surface water receiving bodies are in the Mingamohone Watershed. No TCE related compounds were detected in the Mingmahone Watershed surface water or sediment samples.

Exposure Routes

Terrestrial receptors associated with Site 26 may be exposed to surface soil contaminants via incidental ingestion of soil in the depression or leaching tank/grease trap areas, though this is expected to be minimal given the small size of the site. Ecological habitat is also limited on the grassy areas near the percolation pit and leaching tank/grease trap areas. Terrestrial receptors may also come into contact with contaminants at Site 26 by using standing water for drinking, but this is unlikely since surface water at and near the site is limited.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were all contaminants detected in 1993 RI/FS investigations at the site, and all contaminants detected during current RI activities for this site by B&RE. In particular, contaminants detected in percolation pit and leaching tank/grease trap area sediments and surface soils were investigated.

25.8.2 Summary and Conclusions

Site 26 is relatively small and consists of turfgrass or developed areas, providing little ecological habitat. Wooded uplands are present northwest of the site. These upland areas provide excellent habitat for a wide variety of terrestrial organisms. No wetlands, other sensitive habitats, or threatened or endangered species of any kind exist in the vicinity of Site 26.

No significant contaminant migration pathways to the upland habitats exist at the site. Overland runoff of contaminants from the percolation pit is unlikely since water percolates through and is not expected to overflow the edges of the pit. Water in the leaching tank/grease trap area is not expected to migrate via overland runoff to the upland areas since water tends to settle in this area, and the wooded areas are a few feet higher on grade than the area next to Building GB-01. Groundwater discharge of contaminants to surface water is also insignificant since no wetlands or other surface waters are present near the site. Groundwater contaminants are not expected to migrate several hundred yards to the nearest substantial surface waters.

As part of previous RI activities, four sediment samples and four surface soil samples were taken from the percolation pit area at depths of 0 to 0.5 feet, and groundwater was sampled. Based on the nature of the suspected contaminants, mainly ammonium picrate, the surface soil samples were analyzed for explosive compounds and nitrate/nitrate and the sediment samples were analyzed for TAL inorganics. The study concluded that all metals concentrations in the these samples were in the normal range of background,

with the exception of lead, which ranged from 100 to 300 mg/kg. The Effects Range-Low (ER-L) and Effects Range-Medium (ER-M) screening values for lead are 47 and 218 mg/kg, respectively. Picric acid was detected in one sample at a relatively low concentration, and no other explosives were detected. Some organics, including TCE, were detected in groundwater. As a result, the previous RI/FS investigation concluded that contaminant impacts to pit soils and groundwater were measurable but not extensive.

As part of recent RI activities, soil borings were taken in the percolation pit and in the leaching tank/grease trap areas behind Building GB-1. These samples served to determine the impact of the percolation pit and leaching tank/grease trap on site soils. Concentrations of most inorganics in soil were at or below background levels, including lead in sediments, with the exception of slightly elevated levels of cadmium and antimony in the percolation pit, and barium in the leaching tank/grease trap area. VOCs and explosives were analyzed for in soil borings but were not detected (except for the two soil borings taken in the vicinity of the Leach Tank in December 1995). Furthermore, inorganic contaminant concentrations were low in groundwater at Site 26. The organics TCE and DCE were found in groundwater at the site.

Site 26 is relatively small, as are the contaminated areas of ecological interest, namely the percolation pit and leaching tank/grease trap area. Ecological receptor use of these areas is minimal since most of it is developed or covered with turfgrass, although terrestrial wildlife are expected to inhabit the nearby wooded upland areas. Overland migration of contaminants from these areas is precluded by several factors, and infiltration and subsequent groundwater to surface water migration of contaminants is not applicable at the site. Moreover, the contaminants and their concentrations at the site are relatively low, with the exception of a few slightly elevated inorganics. Lead was elevated in 1993 percolation pit soil samples, but the maximum detection in 1995 RI samples was an order of magnitude lower. Again, contaminants are not expected to migrate to upland habitats. Contaminant contributions to the Mingamahone Brook Watershed also appear to be negligible. Quantitative ecological risk assessment at this site was not applicable since any risk numbers would be mitigated by the factors discussed above. For these reasons, further study or remediation at the site based on ecological risk concerns does not appear necessary.

25.9 EVALUATION AND RECOMMENDATIONS

25.9.1 Evaluation Summary

Concentrations of metals found in site sub surface soils were generally in the range of background and below ARAR action levels.

Aluminum, iron, cadmium and manganese were found in groundwater at concentrations greater than the NJDEP GWQS.

Results of human health risk assessment concluded that all calculated risks were above guideline limits for future resident ingestion of groundwater containing TCE and 1,2-DCE.

Ecological risk assessment concluded that since contaminants and their concentrations at the site are relatively low the site does not appear to be impacting ecological receptors. No wetlands or other surface waters are present near the site. Groundwater contaminants are not expected to migrate several hundred yards to the nearest wetlands to the northwest, or substantial surface water body to the southwest. .

TCE, 1,2-DCE, and associated degradation products were found at high concentrations, above levels of regulatory concern, in soil boring samples taken from the area of the septic leach pit. In the near vicinity, groundwater samples from MW26-01 have shown correspondingly high concentrations of the same chlorinated solvent compounds.

25.9.2 Recommendations

A plan should be developed to further investigate the fate of the TCE plume based on information available, and may include installation of deeper and "nested" monitoring wells.

In order to delineate groundwater contamination and the extent of the concentrated source of the TCE solvent plume, additional monitoring wells and soil sampling will be necessary.

26.0 SITE 27: PROJECTILE REFURBISHING AREA

26.1 SITE BACKGROUND AND PHYSICAL SETTINGS

Site 27 includes Building E-14 and a small storage locker is located off Oran Road. Projectiles are refurbished at the site by shot-blasting, repainting, and restenciling. Oil-contaminated rags, paint chips, and spent sandblasting shot were disposed behind the facility (IAS, 1983). A small portion of the site surface (approximately 80 square feet) near the southeast corner of Building E-14 was covered by a red paint sludge.

A railroad siding and small drainage depression exist on the east side of the site behind the building. Overland runoff drains towards the southeast to the shallow depression immediately downslope approximately 15 feet in from the paint sludge area. Surface water infiltration occurs within the drainage depression. The east branch of Mingamahone Brook is located approximately 1200 to 1500 ft east-southeast of the site.

26.2 PREVIOUS INVESTIGATIONS

26.2.1 Summary of Activities and Results

The 1983 IAS consisting of interviews, concluded that the approximately eighty cubic feet of paint chips and blast shot posed no significant threat to the environment or public health because the material was considered relatively inert. The site was not recommended for a confirmation study.

The 1993 SI field activities included collection of ten soil samples and eight sediment samples. Two soil samples (at 0 to 0.5 ft bgs and 0.5 to 1.5 ft bgs) were collected at five different locations concentrated in the area of observed soil staining behind Building E-14. Shallow soils encountered within the zone were disturbed in places and composed of red brown gravelly sand with some slag, sand blasting material, and paint chips. Analysis of soil samples detected elevated concentrations of metals, PCBs, and semivolatiles.

The eight sediment samples were collected within the drainage ditch between the railroad tracks located behind Building E-14 and one sediment sample was collected to the east of the main railroad track in a dry drainage depression. Low concentrations of metals and pesticides and trace levels of SVOCs were detected in several sediment samples.

26.2.2 Summary of Conclusions

Site 27 was found to have a small area where shot blast and paint chip wastes were dumped (Figure 26-2). Cadmium and mercury were found in samples at levels of concern. PCBs were found at low levels. Other organics, phenanthrene, pyrene, methylene chloride, acetone, and toluene, were detected at low concentrations, below levels of concern.

26.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations, follow-up remedial investigation activities were developed to meet the following objectives:

- Determine vertical extent of soil contamination.
- Compare data to background levels and risk based criteria.
- Using all data collected to date, determine whether wetlands, or surface water has been impacted.

26.3 REMEDIAL INVESTIGATION SAMPLING ACTIVITIES

In December 1995, B&R Environmental conducted the following field investigation activities at Site 27:

- Sampling and analysis of subsurface soil samples from two soil borings (Section 26.3.1)
- Sampling and analysis of subsurface soil samples from one had-augured boring (Section 26.3.21)

The field team conducted a survey to establish the horizontal locations and vertical elevations of the soil boring locations. Surveying notes are provided in Appendix F.

26.3.1 Soil Borings and Subsurface Soil Sampling

B&R Environmental installed 2 soil borings (27 SB 01 and 27 SB 02) to determine the vertical extent of contamination below the previous sampled depths of 0.5 foot and 1.5 feet. RI sample locations are shown in Figure 26-1. Both borings were drilled to a total depth of 12 feet bgs using hollow-stem auger drilling techniques and 4.25 inch I.D. augers. Saturated conditions were encountered in the borings from 10 to 12 feet bgs. Subsurface soil samples were collected continuously from the ground surface to the water table by driving a 3-inch O.D. by 24-inch-long split-barrel sampler. A light brown, silty, fine-grained sand with subround pebbles was encountered in both borings. The samples were screened with an HNu and

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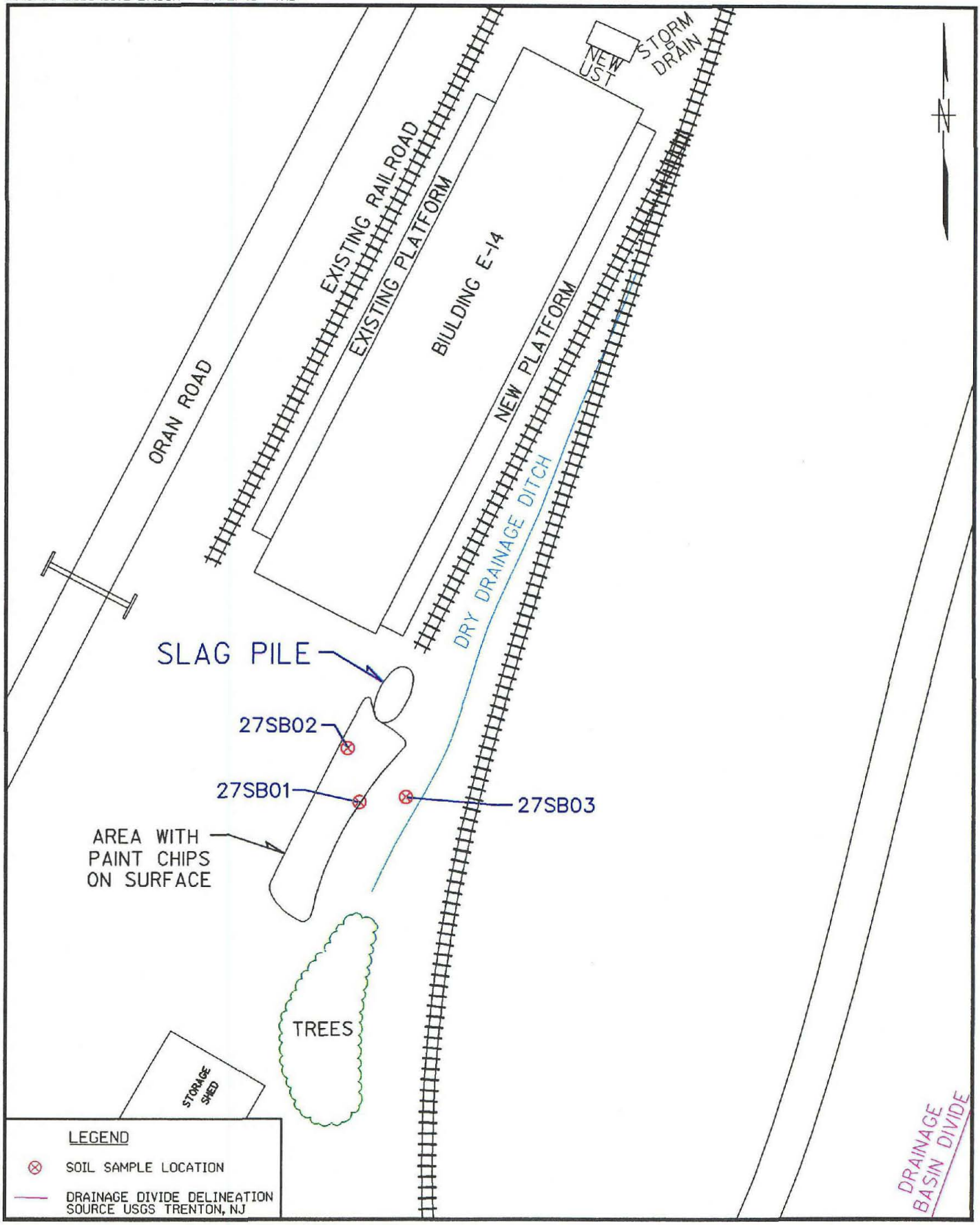


SAMPLE LOCATIONS

SITE 27 - PROJECTILE REFURBISHING

FIGURE 26-1

0 50 100

SCALE IN FEET

Brown & Root Environmental

visually inspected for evidence of contamination (e.g. staining and odors) and for lithologic description. HNu readings were 0 ppm throughout either boring with no stains or odors observed. Blue/green paint chips existed in the surface area around 27 SB 01.

A total of 6 subsurface soil samples were collected from both borings at three depth intervals (1 to 2 feet bgs, 3 to 4 feet bgs, and 10 to 12 feet bgs) and submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TAL metals, and TCL pesticides/PCBs.

26.3.2 Subsurface Soil Sampling (Hand Augering)

Drilling rig access problems at soil boring location 27 SB 03 prevented the field team from drilling a borehole. The borehole was hand-augered below the previous sampled depths of 0.5 foot to 1.5 feet to a total depth of 7 feet bgs. Saturated conditions were encountered in the borehole from 6 to 7 feet bgs. A total of 3 subsurface soil samples were collected from three depth intervals (0 to 2 feet bgs, 3 to 4 feet bgs, and 6-7 feet bgs). The samples were screened with a HNu and visually inspected for evidence of contamination and for lithologic description. Sample 27 SB 03-01 consisted of dark brown, silty, fine-to medium- grained sand with some pebbles. Sample 27-SB 03-03 consisted of orange brown, silty, fine-to medium-grained sand. Sample 27 SB 03-06 consisted of orange-grayish brown, silty clayey, fine-grained sand. Sample log sheets are presented in Appendix D. The samples were placed directly into the appropriate bottleware using a stainless steel trowel. The auger holes were backfilled with the removed cuttings and the hand auger was decontaminated. The samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, and TAL metals.

The Navy requested three additional hand auger borings to probe the area surrounding the observed solidified paint sludge on the surface. The boreholes were hand-augered to approximately 2 to 3 feet bgs. No evidence of paint chips or other contamination was observed.

26.4 SITE CHARACTERISTICS

26.4.1 Geology

Regional mapping places site 27 within the outcrop area of the Kirkwood Formation. The Kirkwood Formation ranges between 60 and 100 feet in thickness and the soil borings are no more than 12 feet deep. The lithology of the sediments encountered in the on-site soil borings generally agrees with the published description of the Kirkwood Formation. The borings encountered light brown, pebbly, fine-grained sand with varying amounts of clay and silt.

26.4.2 Hydrogeology

Groundwater conditions beneath the site cannot be confirmed because no wells were installed at the site. However, groundwater in the Kirkwood Formation beneath sites 3 and 26, and presumably site 27, occurs under unconfined conditions. Site 3 is located about 3,200 feet south-southeast and site 26 is located about 3,000 feet north of the site. The direction of shallow groundwater flow in the aquifer beneath site 3, as indicated by the August groundwater contour map for site 3, is toward the southeast. The direction of groundwater flow in the aquifer beneath site 26, as indicated by both the August and October groundwater contour maps for site 26, is toward the southwest.

26.5 NATURE AND EXTENT OF CONTAMINATION

26.5.1 Subsurface Soils

Nine subsurface soil samples were collected at Site 27 (Figure 26-1). Tables 26-1 and 26-2 present the occurrence and distribution of inorganic and organic chemicals in site-related samples and compare them to background values as presented in Section 31. Tables 26-1a and 26-1b present a comparison of detected compounds to ARARs and TBCs. Figure 26-2 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

26.5.1.1 Inorganics

Concentrations of several metals in site-related subsurface soil samples were similar to the ranges associated with background samples. Although site-related concentrations of arsenic were detected below the background concentration range, it is an EPA-designated carcinogenic inorganic chemical and therefore included as a COPC.

Aluminum, barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc were found at concentrations above background. The highest concentrations above background were detected in samples collected at a depth of one foot.

Cadmium was detected above New Jersey state standards.

26.5.1.2 Organics

Because most organic chemicals on the TCL are not naturally occurring, compounds with concentration levels below background and below state standards are included as COPCs. Site-related subsurface samples exhibited low levels of PCBs, eleven pesticides, bis(2-ethylexyl)phthalate, and naphthalene.

TABLE 26-1
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SUBSURFACE SOIL AT SITE 27
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM*	8 / 8	675 - 5310	5370.00	9 / 9	1370 - 7530	3598.89	NO	5718.97
ANTIMONY	NOT DETECTED	-	-	1 / 9	3	1.47	YES	1.82
ARSENIC	8 / 8	1.35 - 14.4	13.29	8 / 9	0.73 - 3.9	1.58	NO	3.49
BARIUM	8 / 8	0.92 - 31	17.92	9 / 9	4.2 - 109	25.04	YES	45.07
BERYLLIUM*	2 / 8	0.12 - 0.28	0.28	6 / 9	0.096 - 0.42	0.16	NO	0.42
CADMIUM	1 / 8	0.57	0.58	6 / 9	0.67 - 52.4	6.99	YES	17.57
CALCIUM	8 / 8	28.6 - 799	577.55	9 / 9	46.3 - 572	243.59	NO	351.54
CHROMIUM*	8 / 8	4.7 - 59.5	54.73	9 / 9	5.8 - 191	48.10	NO	91.15
COBALT*	4 / 8	0.75 - 5	2.77	5 / 9	0.89 - 4.1	1.21	NO	1.94
COPPER	8 / 8	0.97 - 8.6	8.66	9 / 9	1.7 - 150	25.50	YES	55.34
IRON*	8 / 8	3745 - 62500	40871.25	9 / 9	2750 - 11800	6333.33	NO	9168.25
LEAD	8 / 8	1.4 - 39.4	24.33	9 / 9	2.9 - 369	63.97	YES	137.72
MAGNESIUM	8 / 8	18.5 - 619	504.05	9 / 9	162 - 1090	419.22	NO	602.25
MANGANESE*	8 / 8	2.6 - 214	92.51	9 / 9	18 - 104	36.93	NO	53.75
MERCURY*	8 / 8	0.03 - 0.17	0.13	9 / 9	0.029 - 0.12	0.05	NO	0.06
NICKEL*	4 / 8	1.8 - 7.2	4.75	9 / 9	0.91 - 10.6	3.49	NO	5.33
POTASSIUM	7 / 8	95 - 792	793.35	9 / 9	113 - 392	215.67	NO	299.90
SELENIUM*	2 / 8	0.57 - 0.93	0.79	2 / 9	0.74	0.39	NO	0.51
SILVER	2 / 8	0.37 - 0.67	0.51	1 / 9	15	1.86	YES	4.91
SODIUM	8 / 8	17.5 - 94.8	79.35	9 / 9	11.8 - 48	28.10	NO	41.05
VANADIUM*	8 / 8	11.05 - 64	64.71	9 / 9	7.2 - 18.6	10.84	NO	13.58
ZINC	6 / 8	1.1 - 50.7	31.35	9 / 9	5.2 - 323	110.53	YES	199.55

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 26-2
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 27
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	NOT DETECTED	-	-	4 / 9	0.28 - 33	11.98
4,4'-DDE	2 / 8	16 - 330	121.91	4 / 9	1.8 - 16	8.81
4,4'-DDT	2 / 8	43 - 420	157.34	5 / 8	1.5 - 47	19.61
ALPHA-CHLORDANE	NOT DETECTED	-	-	5 / 9	0.2 - 3.2	1.81
AROCLOR-1254	NOT DETECTED	-	-	3 / 9	30 - 150	69.10
AROCLOR-1260	NOT DETECTED	-	-	5 / 9	12 - 300	115.39
BIS(2-ETHYLHEXYL)PHTHALATE	NOT DETECTED	-	-	2 / 9	840 - 5600	1969.54
DI-N-BUTYLPHTHALATE	2 / 8	45 - 48	48	1 / 9	58	58
DIELDRIN	1 / 8	0.49	0.49	1 / 9	1.6	1.6
ENDRIN ALDEHYDE	NOT DETECTED	-	-	1 / 9	15	6.01
HEPTACHLOR	NOT DETECTED	-	-	1 / 9	0.27	0.27
NAPHTHALENE	NOT DETECTED	-	-	1 / 9	89	89

TABLE 26-1a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 27

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	27SB01-01	27SB01-03	27SB01-10	27SB02-01	27SB02-03	27SB02-10	ARARS & TBCs		
LOCATION:	27SB01	27SB01	27SB01	27SB02	27SB02	27SB02	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	5090	1690	7530	3680	3350	2500	-	-	-
antimony	2.5 U	2.4 U	2.7 U	2.5 U	2.5 U	2.6 U	14.0	340	-
arsenic	2.8	1.1	0.73	1.8	1.6	0.61 U	20.0	20.0	-
barium	21.5	4.2	23.1	19.7	5.3	11.0	700	47000	-
beryllium	0.10	0.078 U	0.42	0.083 U	0.081 U	0.13	1.00	1.00	-
cadmium	2.1 E J	0.67 J	0.62 U	4.0 E J	0.57 U	0.61 U	1.00	100	-
calcium	156	46.3	179	502	232	176	-	-	-
chromium, total	191	18.8	10.4	26.7	9.3	5.8	-	500	-
cobalt	1.4	0.80 U	1.6	0.85 U	0.83 U	0.89 U	-	-	-
copper	11.6	3.0	4.2	39.9	1.7	4.5	600	600	-
iron	10100	3850	6250	7320	5300	2750	-	-	-
lead	105 J	9.9 J	4.6 J	46.4 J	2.9	4.6 J	400	600	-
magnesium	424	162	1090	341	216	364	-	-	-
manganese	18.4 J	18.0 J	45.6 J	31.3 J	19.1 J	20.7 J	-	-	-
mercury	0.044	0.029	0.033	0.053	0.037	0.033	14.0	270	-
nickel	3.0	0.91	5.0	3.4	1.8	1.0	250	2400	-
potassium	280	186	392	176	121	113	-	-	-
selenium	0.74	0.53 U	0.60 U	0.57 U	0.55 U	0.59 U	63.0	3100	-
silver	0.62 U	15.0	0.67 U	0.63 U	0.62 U	0.66 U	110	4100	-
sodium	19.6	18.8	34.2	19.2	11.8	33.2	-	-	-
vanadium	18.6 J	7.2	12.2 J	12.5 J	10.1	7.3	370	7100	-
zinc	323	14.0	16.7	258	5.2	18.5	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
bis(2-ethylhexyl)phthalate	840	340 U	380 U	360 U	350 U	380 U	49000	210000	100000
di-n-butylphthalate	350 U	340 U	380 U	360 U	350 U	380 U	5700000	10000000	100000
naphthalene	89.0 J	340 U	380 U	360 U	350 U	380 U	230000	4200000	100000

TABLE 26-1a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 27

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	27SB01-01		27SB01-03		27SB01-10		27SB02-01		27SB02-03		27SB02-10		ARARS & TBCs		
LOCATION:	27SB01		27SB01		27SB01		27SB02		27SB02		27SB02		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.				
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	33.0		3.4	U	3.8	U	3.6	U	3.5	U	6.7		3000	12000	50000
4,4'-DDE	15.0	J	3.4	U	3.8	U	4.3		3.5	U	1.8	J	2000	9000	50000
4,4'-DDT	1.7	NJ	0.67	R	3.8	U	14.0	J	3.5	U	3.7	U	2000	9000	500000
Aroclor-1254	35.0	U	30.0	J	38.0	U	79.0		35.0	U	150		490	2000	50000
Aroclor-1260	35.0	U	12.0	J	38.0	U	94.0		35.0	U	37.0	U	490	2000	50000
alpha-BHC	1.8	U	1.8	U	2.0	U	1.9	U	1.8	U	0.14	R	-	-	-
alpha-chlordane	1.8	U	0.26	NJ	2.0	U	0.80	J	1.8	U	2.5	J	-	-	-
dieldrin	3.5	U	3.4	U	3.8	U	3.6	U	3.5	U	3.7	U	42.0	180	50000
endrin aldehyde	3.5	U	3.4	U	3.8	U	3.6	U	3.5	U	3.8	U	-	-	-
gamma-BHC (Lindane)	1.8	U	1.8	U	2.0	U	1.9	U	1.8	U	1.9	U	520	2200	50000
gamma-chlordane	1.8	U	1.8	U	2.0	U	0.33	R	1.8	U	0.41	R	-	-	-
heptachlor	1.8	U	1.8	U	0.27	J	1.9	U	1.8	U	1.9	U	150	650	50000
heptachlor epoxide	1.8	U	1.8	U	2.0	U	1.9	U	1.8	U	0.45	R	-	-	-

TABLE 26-1a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 27

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	27SB03-01	27SB03-03	27SB03-06	---	---	---	ARARS & TBCs		
LOCATION:	27SB03	27SB03	27SB03	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.						
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**				**mg/kg**	**mg/kg**	**mg/kg**
aluminum	1370	2660	4520				-	-	-
antimony	3.0	2.5 U	2.7 U				14.0	340	-
arsenic	3.9	1.2	0.79				20.0	20.0	-
barium	109	10.0	21.6				700	47000	-
beryllium	0.16	0.18	0.32				1.00	1.00	-
cadmium	52.4 E	1.5 E	1.3 E				1.00	100	-
calcium	572	168	161				-	-	-
chromium, total	146	10.4	14.5				-	500	-
cobalt	4.1	0.89	1.2				-	-	-
copper	150 J	4.8	9.8 J				600	600	-
iron	11800	4660	4970				-	-	-
lead	369	11.9	21.4				400	600	-
magnesium	180	323	673				-	-	-
manganese	104	37.2	38.1				-	-	-
mercury	0.12	0.030	0.033				14.0	270	-
nickel	10.6	2.2	3.5				250	2400	-
potassium	149	278	246				-	-	-
selenium	0.74 J	0.56 UJ	0.60 UJ				63.0	3100	-
silver	0.072 U	0.068 U	0.074 U				110	4100	-
sodium	48.0	23.3	44.8				-	-	-
vanadium	8.4	8.8	12.5				370	7100	-
zinc	320 J	16.1 J	23.3 J				1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**	**ug/kg**	**ug/kg**
bis(2-ethylhexyl)phthalate	5600	350 U	430 U				49000	210000	100000
di-n-butylphthalate	58.0 J	350 U	380 U				5700000	10000000	100000
naphthalene	370 U	350 U	380 U				230000	4200000	100000

TABLE 26-1a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 27

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	27SB03-01		27SB03-03		27SB03-06		---	---	---	ARARS & TBCs		
LOCATION:	27SB03		27SB03		27SB03		---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.							
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	3.7	U	0.34	J	0.28	J				3000	12000	50000
4,4'-DDE	16.0		3.6	U	3.9	U				2000	9000	50000
4,4'-DDT	47.0		1.5	J	1.5	J				2000	9000	500000
Aroclor-1254	37.0	U	35.0	U	38.0	U				490	2000	50000
Aroclor-1260	300		15.0	J	16.0	J				490	2000	50000
alpha-BHC	1.9	U	1.8	U	2.0	U				-	-	-
alpha-chlordane	3.2		1.8	U	0.20	J				-	-	-
dieldrin	1.6	NJ	3.5	U	3.8	U				42.0	180	50000
endrin aldehyde	15.0	J	3.6	U	3.9	U				-	-	-
gamma-BHC (Lindane)	0.22	R	1.8	U	2.0	U				520	2200	50000
gamma-chlordane	1.4	R	1.8	U	2.0	U				-	-	-
heptachlor	1.9	U	1.8	U	2.0	U				150	650	50000
heptachlor epoxide	0.17	R	1.8	U	2.0	U				-	-	-

TABLE 26-1a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 27
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- No standard is available for this chemical in this classification.

TABLE 26-1b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 27

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	27SB01-01	27SB01-03	27SB01-10	27SB02-01	27SB02-03	ARARS & TBCs		
LOCATION:	27SB01	27SB01	27SB01	27SB02	27SB02	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.			
MISCELLANEOUS								
moisture %	6.0	3.3	14.1	9.1	6.7	-	-	-
pH	5.6	5.2	5.7	7.7	7.7	-	-	-

TABLE 26-1b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 27

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	27SB02-10	27SB03-01	27SB03-03	27SB03-06	---	ARARS & TBCs		
LOCATION:	27SB02	27SB03	27SB03	27SB03	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.				
MISCELLANEOUS								
moisture %	12.1	11.2	6.4	14.2		-	-	-
pH	7.1	6.6	7.0	5.7		-	-	-

TABLE 26-1b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 27
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

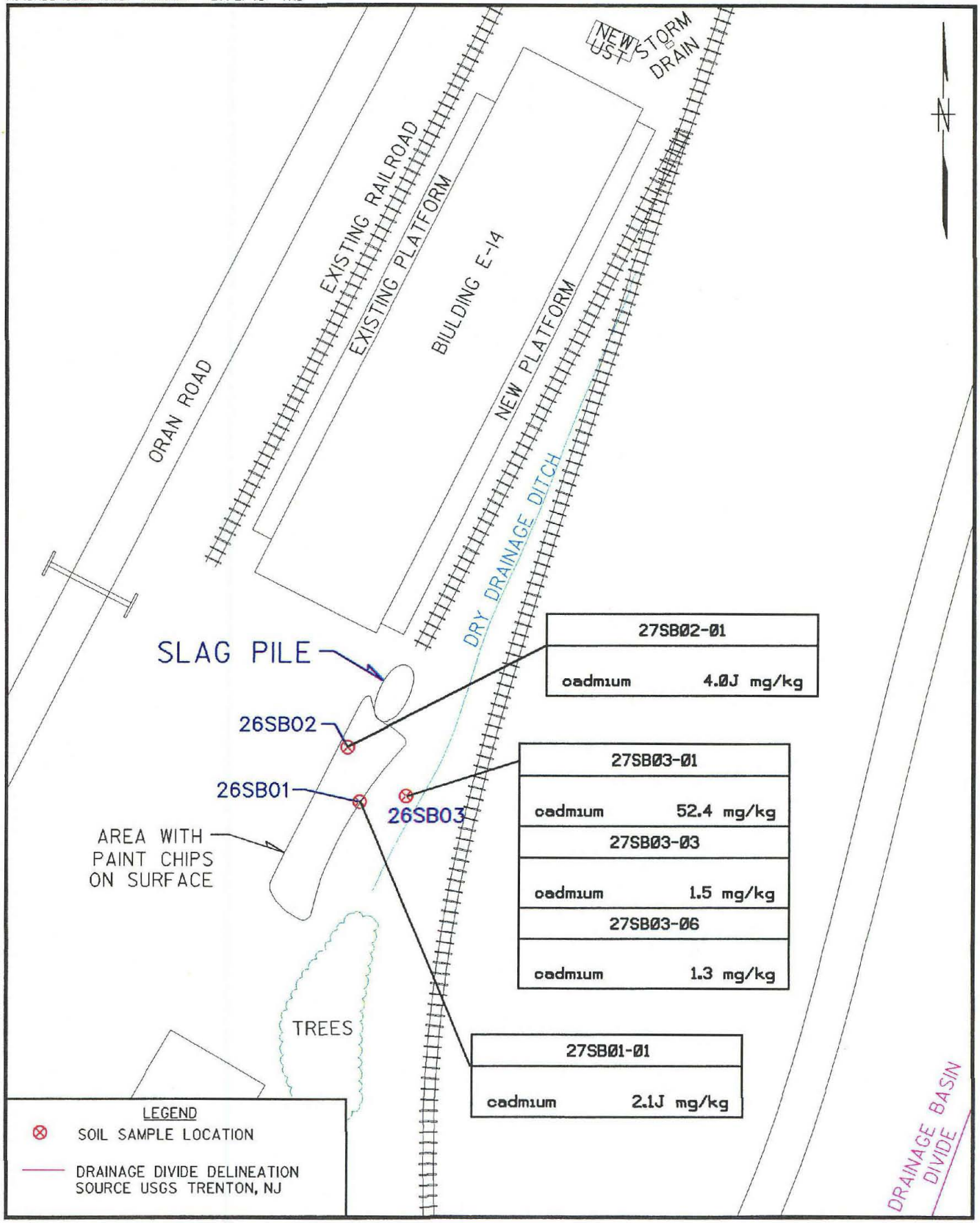
E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- *No standard is available for this chemical in this classification.*

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

K:\CADD\5803\S027-T01.DGN 07/2/96 TAD



CONCENTRATIONS ABOVE SCREENING LEVELS

SITE 27 - PROJECTILE REFURBISHING

FIGURE 26-2

0 50 100

SCALE IN FEET

Brown & Root Environmental

Two PCB aroclors, naphthalene, bis(2-ethylhexyl) phthalate and four pesticides were not detected in background samples found at the site.

One semivolatile (di-n-butylphthalate) and one pesticide (dieldrin) were not detected above state standards but were detected above levels found in background samples. Di-n-butylphthalate was detected at 58 ug/kg in sample 27 SB 03-01. Dieldrin was also detected in sample 27 SB 03-01 at a concentration of 1.6 ug/kg.

There were no organic chemicals detected above state standards.

26.5.1.3 Miscellaneous Parameters

The nine subsurface samples collected were analyzed for moisture (3.3 percent to 14.2 percent) and pH (5.16 to 7.68). Four samples (27 SB0201, 27 SB02-03, and 27 SB03-03) contained pH levels above the subsurface soil background range.

26.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 27 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 26.6.1. Persistence of detected chemicals in the environment is discussed in Section 26.6.2. Section 26.6.3 presents a brief discussion of contaminant trends.

26.6.1 Detected Chemicals and Transport Potential

Analytical results for the subsurface soils sampled at Site 27 indicate levels greater than background for the metals antimony, cadmium, chromium, copper, lead, and zinc in one or more shallow subsurface soils, and silver in one subsurface soil collected at the 3-foot depth. Organic chemicals detected at Site 27 include a low level of naphthalene in one shallow subsurface soil, phthalates in two shallow subsurface soils, and PCBs at low concentrations in several shallow and intermediate-depth soils and in one subsurface soil collected at the 10-foot depth. All of these contaminants, except for bis(2-ethylhexyl)phthalate, were previously identified in shallow soils collected from the same areas or in sediments collected from a nearby drainage ditch during a 1993 sampling investigation. All of the above chemicals can be related to historical site activities. In addition to chemicals related to site history, several pesticides were detected at trace levels in subsurface soils. The detected pesticides did not exceed state standards and do not appear to be related to projectile refurbishing, shot blasting, repainting, or disposal of oil contaminated rags, paint chips, and spent sandblasting shot. The physical transport data for the detected contaminants are presented in Table 2-10. Additional discussion with respect to chemical and

physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

Many metals are adsorbed onto soil and sediment easily but may also exist in dissolved or suspended forms. The primary migration route for metals present in near-surface soils is considered to be erosional transport towards the drainage ditch. Previous investigations have revealed elevated levels of cadmium, chromium, lead, silver, and zinc in the drainage sediments, which appear to be attributable to migration from the nearby area where subsurface samples were collected in the current investigation.

Naphthalene, a light molecular weight PAH, PCBs, phthalates, and pesticides are typically strongly bound to organic matter in soils and sediment and are not expected to migrate significantly except in conjunction with surface water erosional patterns.

26.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies considerably. Transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or a physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater and saturated zone soils) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation. PCBs are considered slow to biodegrade, with certain isomers more resistant to biodegradation. Naphthalene, phthalates, and pesticides exhibit varying rates of biodegradation in the environment, but over time may be expected to gradually attenuate.

26.6.3 Observed Chemical Contaminant Trends

A principle objective of the current investigation is to determine the vertical extent of contamination for substances detected in shallow soils during the previous 1993 investigation. Based upon samples collected at depths of one, three, and 10 feet in depth, no significant vertical migration of metals was observed, with the possible exception of silver, which was detected at a slightly elevated level in one sample at the 3-foot depth. No VOCs, phthalates, or PAHs were detected in deeper soils, indicating lack of vertical migration of these contaminants. PCBs were detected at very low levels in two subsurface samples collected at the 3-foot depth, one sample from 6 feet, and in one sample from 10 feet. However,

PCB concentrations did not exceed ARARs in this investigation or in the previous investigation, and PCBs are typically strongly bound to soil, which greatly diminishes their future potential for vertical migration.

26.6.4 Conclusions

Certain metals (notably cadmium, chromium, copper, lead, and zinc) and organics (naphthalene and phthalates) were detected in shallow subsurface soils but were not found in deeper subsurface soils. Therefore, impacts of migration of these substances appear limited to surficial drainage ditch sediments, where historical sampling data indicate that metals were detected at slightly elevated levels.

In the current investigation, silver was detected at a slightly elevated level at one intermediate depth soil sample (3-foot interval), but the level detected did not exceed state standards and there is no evidence for deeper migration of this metal. PCBs were also found in some of the deeper subsurface soils, but the detected levels did not exceed state standards and the potential for future vertical migration appears very low. In addition, PCBs were not detected in drainage ditch sediments in the previous investigation.

The previous investigation showed the presence of trace levels of PCE in shallow surface soils and toluene in sediments. However, the current investigation did not detect any VOCs in either shallow or deep subsurface soils, which indicates the lack of any future potential for impacts to groundwater from VOCs in surface or subsurface soils in this area.

26.7 BASELINE RISK ASSESSMENT

This section of the RI report presents the results of the baseline risk assessment for Site 27. The risk assessment was performed using the approach outlined in Section 2.4 and includes, for all receptor pathways, a comprehensive application of the more rigorous methods for eliminating COPCs by comparing results to background and quantifying dermal absorption (discussed in Section 2.4.6).

Table 26-3 provides the selected COPCs and representative concentrations of inorganic and organics in site-related subsurface soil. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3, and 2.4.6. For subsurface soil, all detected organic compounds were retained as COPCs. Aluminum, beryllium, chromium, cobalt, iron, manganese, mercury, nickel, and vanadium were eliminated from consideration as subsurface soil COPCs based on a comparison of average levels to twice the background level. However, since arsenic is a class A carcinogen, it could not be eliminated from consideration. Table 26-1 presents the comparison of COPCs to background concentrations for metals in subsurface soil. No other metals could be eliminated based on comparison to background upper 95 percent UTLs.

TABLE 26-3
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 27 (mg/kg)
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ANTIMONY	1.82	NONPARAMETRIC
ARSENIC	3.49	NONPARAMETRIC
BARIUM	45.07	NONPARAMETRIC
CADMIUM	17.57	NONPARAMETRIC
COPPER	55.34	NONPARAMETRIC
LEAD	137.72	NONPARAMETRIC
SILVER	4.91	NONPARAMETRIC
ZINC	199.55	NONPARAMETRIC
4,4'-DDD*	11.98	NORMAL
4,4'-DDE*	8.81	NORMAL
4,4'-DDT*	19.61	NORMAL
ALPHA-CHLORDANE*	1.81	NORMAL
AROCLOR-1254*	69.10	NORMAL
AROCLOR-1260*	115.39	NORMAL
BIS(2-ETHYLHEXYL)PHTHALATE*	1969.54	NORMAL
DI-N-BUTYLPHTHALATE*	58.00	NORMAL
DIELDRIN*	1.60	NORMAL
ENDRIN ALDEHYDE*	6.01	NORMAL
HEPTACHLOR*	0.27	NORMAL
NAPHTHALENE*	89.00	NORMAL

* = Organics are in (ug/kg)

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation alternatives are identified for a site.

26.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential receptors and industrial receptors).

26.7.1.1 Future Industrial Employee

The estimated total RME cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 27 are 1.9E-05 (ingestion), 2.2E-05 (dermal contact), and 5.6E-09 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range. Arsenic is the principal COPC contributing to the subsurface soil cancer risk is (ingestion, 97 percent of the cancer risk for this pathway; and dermal contact, 81 percent of the cancer risk for this pathway).

The estimated RME noncarcinogenic HIs for the future industrial employee, assuming exposure to subsurface soil, are 5.4E-02 (ingestion), 2.2E-02 (dermal contact), and 3.3E-05 (inhalation of dusts). Adverse noncarcinogenic health effects are not anticipated because the sum of these HIs is below 1.0.

Estimated RME carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soils at Site 27 in Tables 26-4 and 26-5, respectively.

26.7.1.2 Future Residential Receptor

The estimated total RME cancer risks for the future lifetime resident assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 27 are 8.4E-05 (ingestion), 7.2E-05 (dermal contact), and 3.4E-09 (inhalation of COPCs in fugitive dust). The RME cancer risks for the three exposure pathways are individually within the target acceptable risk range, but the sum of these cancer risks (total risk) was slightly greater than 1E-04, the upper end of the target risk range. The principal COPCs contributing to subsurface soil RME cancer risks are arsenic (ingestion - 98 percent of the cancer risk for this exposure pathway; dermal contact - 83 percent of the cancer risk for this pathway) and PCBs (dermal contact - 17 percent of the cancer risk for this pathway).

Central tendency assumptions were applied to calculate cancer risks for the future residential receptor for exposure to subsurface soil via ingestion, dermal contact, and inhalation. The sum of these central tendency cancer risks is 3.7E-05, which is within the 1E-04 to 1E-06 target acceptable risk range. Central

TABLE 26-4
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 27
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
BIS(2-ETHYLHEXYL)PHTHALATE	9.6E-09	N/A	1.8E-12
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
DIELDRIN	9.0E-09	N/A	2.0E-12
ENDRIN ALDEHYDE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
4,4'-DDD	1.0E-09	N/A	1.9E-13
4,4'-DDE	1.0E-09	N/A	1.9E-13
4,4'-DDT	2.3E-09	N/A	5.2E-13
ALPHA-CHLORDANE	8.2E-10	N/A	1.8E-13
AROCLOR-1254	1.9E-07	1.4E-06	3.4E-11
AROCHLOR-1260	3.1E-07	2.3E-06	5.7E-11
HEPTACHLOR	4.2E-10	N/A	9.5E-14
ANTIMONY	N/A	N/A	N/A
ARSENIC	1.8E-05	1.8E-05	4.1E-09
BARIUM	N/A	N/A	N/A
CADMIUM	N/A	N/A	1.4E-09
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	1.9E-05	2.2E-05	5.6E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 26-5
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 27
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
BIS(2-ETHYLHEXYL)PHTHALATE	9.6E-05	N/A	1.8E-08
DI-N-BUTYLPHTHALATE	5.7E-07	N/A	1.1E-10
DIELDRIN	3.1E-05	N/A	5.8E-09
ENDRIN ALDEHYDE	N/A	N/A	N/A
NAPHTHALENE	2.2E-06	N/A	4.0E-10
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	3.8E-05	N/A	7.1E-09
ALPHA-CHLORDANE	2.9E-05	N/A	5.5E-09
AROCLOR-1254	N/A	N/A	N/A
AROCHLOR-1260	N/A	N/A	N/A
HEPTACHLOR	5.3E-07	N/A	9.8E-11
ANTIMONY	4.5E-03	N/A	8.3E-07
ARSENIC	1.1E-02	1.1E-02	2.1E-06
BARIUM	6.3E-04	N/A	1.2E-05
CADMIUM	3.4E-02	1.1E-02	1.8E-05
COPPER	1.4E-03	N/A	2.5E-07
LEAD	N/A	N/A	N/A
SILVER	9.6E-04	N/A	1.8E-07
ZINC	6.5E-04	N/A	1.2E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

tendency generates a lower risk estimate than RME because it assumes typical rather than upper range receptor behavior patterns related to the ingested dose.

The estimated RME noncarcinogenic HIs for the future child receptor, assuming exposure to subsurface soil, are 7.1E-01 (ingestion), 1.8E-01 (dermal contact), and 3.4E-05 (inhalation of dusts). Adverse noncarcinogenic health effects are not anticipated because the sum of these HIs is below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soil at Site 27 in Tables 26-6 and 26-7, respectively.

26.7.1.3 Lead Results

Lead was not found above the EPA level of concern (400 mg/kg) in soil samples taken during the RI.

The IEUBK Lead model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 27 exposures are presented in Appendix I.

26.7.2 Conclusions

Subsurface soil was sampled at Site 27. The potential receptors for this site were future industrial and residential receptors.

The RME cancer risk associated with the future residential (subsurface soil) exposure scenario is greater than 1E-04; the upper end of the target risk range. Arsenic (via ingestion of and dermal contact with soil) is the major COPC that contributed to this cancer risk. However, the RME estimate for the future residential receptor is probably overconservative because a central tendency calculation shows that cancer risks are more likely to be within the mid-range of the target acceptable risk range.

The RME cancer risk associated with the future industrial (subsurface soil) exposure scenario was approximately 4E-05, within the target acceptable risk range. RME noncarcinogenic HIs associated with the future residential and future industrial (subsurface soil) exposure scenarios were below 1.0, the cutoff point below which adverse effects are not expected to occur.

Lead soil concentrations at the site were below EPA guidelines and are not expected to be associated with significant increases in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

TABLE 26-6
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 27
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
BIS(2-ETHYLHEXYL)PHTHALATE	4.3E-08	N/A	1.1E-12
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
DIELDRIN	4.0E-08	N/A	1.2E-12
ENDRIN ALDEHYDE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
4,4'-DDD	4.5E-09	N/A	1.1E-13
4,4'-DDE	4.7E-09	N/A	1.2E-13
4,4'-DDT	1.0E-08	N/A	3.2E-13
ALPHA-CHLORDANE	3.7E-09	N/A	1.1E-13
AROCLOR-1254	8.3E-07	4.5E-06	2.1E-11
AROCHLOR-1260	1.4E-06	7.5E-06	3.5E-11
HEPTACHLOR	1.9E-09	N/A	5.8E-14
ANTIMONY	N/A	N/A	N/A
ARSENIC	8.2E-05	6.0E-05	2.5E-09
BARIUM	N/A	N/A	N/A
CADMIUM	N/A	N/A	8.8E-10
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	8.4E-05	7.2E-05	3.4E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 26-6a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 27
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
BIS(2-ETHYLHEXYL)PHTHALATE	6.9E-09	N/A	3.4E-13
DI-N-BUTYLPHTHALATE	N/A	N/A	N/A
DIELDRIN	6.5E-09	N/A	3.8E-13
ENDRIN ALDEHYDE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
4,4'-DDD	7.2E-10	N/A	3.5E-14
4,4'-DDE	7.5E-10	N/A	3.7E-14
4,4'-DDT	1.7E-09	N/A	9.8E-14
ALPHA-CHLORDANE	5.9E-10	N/A	3.5E-14
AROCLOR-1254	1.3E-07	1.4E-06	6.5E-12
AROCHLOR-1260	2.2E-07	2.4E-06	1.1E-11
HEPTACHLOR	3.1E-10	N/A	1.8E-14
ANTIMONY	N/A	N/A	N/A
ARSENIC	1.3E-05	1.9E-05	7.7E-10
BARIUM	N/A	N/A	N/A
CADMIUM	N/A	N/A	2.7E-10
COPPER	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
SILVER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	1.4E-05	2.3E-05	1.1E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 26-7
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 27
SUBSURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
BIS(2-ETHYLHEXYL)PHTHALATE	1.3E-03	N/A	1.9E-08
DI-N-BUTYLPHTHALATE	7.4E-06	N/A	1.1E-10
DIELDRIN	4.1E-04	N/A	6.1E-09
ENDRIN ALDEHYDE	N/A	N/A	N/A
NAPHTHALENE	2.8E-05	N/A	4.3E-10
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	5.0E-04	N/A	7.5E-09
ALPHA-CHLORDANE	3.8E-04	N/A	5.8E-09
AROCLOR-1254	N/A	N/A	N/A
AROCHLOR-1260	N/A	N/A	N/A
HEPTACHLOR	6.9E-06	N/A	1.0E-10
ANTIMONY	5.8E-02	N/A	8.7E-07
ARSENIC	1.5E-01	9.2E-02	2.2E-06
BARIUM	8.2E-03	N/A	1.2E-05
CADMIUM	4.5E-01	8.8E-02	1.9E-05
COPPER	1.8E-02	N/A	2.6E-07
LEAD	N/A	N/A	N/A
SILVER	1.3E-02	N/A	1.9E-07
ZINC	8.5E-03	N/A	1.3E-07

N/A = NOT APPLICABLE, NO TOXICITY VALUE OR ABSORPTION FACTOR HAS BEEN ESTABLISHED FOR THIS CHEMICAL

Risk characterization results (total RME cancer risks and total RME noncarcinogenic HIs) are presented for all potential receptors at Site 27 in Table 26-8 for subsurface soil. Table 26-8a presents the relevant central tendency risk estimates associated with future residential receptors for subsurface soil.

The baseline risk assessment procedure resulted in the elimination of all COPCs with associated risk above target guideline limits. However, it must be noted that the objective of this study was not to perform a site-wide characterization. Samples taken in the RI (1995) were biased, based on previous sampling, toward the area of known contamination to delineate vertical migration for contaminants for remedial design considerations. The result of using only the 1995 RI data could have biased the human health risk assessment results high or low.

26.8 ECOLOGICAL RISK ASSESSMENT

26.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Site 27 is located adjacent to Building E-14 in a gravel parking area. A small drainage ditch is located between the railroad tracks southeast of the site and Building E-14. The ditch is shallow and contains water only after periods of heavy rainfall. Runoff from the site flows toward the drainage ditch. Although the ditch slopes gently to the southeast, standing water infiltrates and generally does not flow off-site. An upland forest is located approximately 75 feet east of the site, across the railroad tracks. The upland forest is dominated by pitch pine and a variety of oak species. A small grove of oaks and pines is located just south of the paint chip area. No surface water is present near the site. The closest surface water is the East Branch of Mingamahone Brook, located 1,500 feet east of the site. Therefore, although the drainage ditch does not lead to other surface water, the site is located in the Mingamahone Brook watershed. No other RI sites are located near Site 27; the closest other RI site is Site 3, which is located about one mile to the southeast.

Site 27 is relatively small, and since the site is mostly graveled, it contains no ecological habitat. The nearby woodlands contain excellent upland habitat. Most mammals found in the Mainside area, such as white-tailed deer, gray fox, and small mammals are expected to utilize the forested areas. In addition, the edge of the woods provides an "edge effect" that may attract a wide variety of wildlife, including gamebirds. No sensitive habitats or threatened and endangered species are known to occur on or near Site 27.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathway from the site is overland runoff. Overland runoff from precipitation may carry constituents to the drainage ditch adjacent to the site. The drainage ditch and the railroad bed

TABLE 26-8
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 27
NWS EARLE, COLTS NECK, NEW JERSEY

		Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current	Future	Future	Future	Current	Future	Future Resident		Future
Medium	Exposure Routes	Industrial Employee	Industrial Employee	Lifetime Resident	Recreational Child	Industrial Employee	Industrial Employee	Child	Adult	Recreational Child
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.9E-05^	8.4E-05^	N/A	N/A	5.4E-02^	7.1E-01^	N/A	N/A
	Dermal Contact	N/A	2.2E-05^	7.2E-05^	N/A	N/A	2.2E-02^	1.8E-01^	N/A	N/A
	Inhalation of Fugitive Dust	N/A	5.6E-09^	3.4E-09^	N/A	N/A	3.3E-05^	3.4E-05^	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	4.1E-05	1.6E-04	-	-	7.6E-02	8.9E-01	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.

TABLE 26-8a
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 27
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	1.4E-05^	N/A	N/A	N/R	N/R	N/A	N/A
	Dermal Contact	N/A	N/R	2.3E-05^	N/A	N/A	N/R	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/R	1.1E-09^	N/A	N/A	N/R	N/R	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	TOTAL	-	-	3.7E-05	-	-	-	-	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central tendency calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.

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prevent contaminant migration to the upland areas. In addition, the drainage ditch is small, rarely holds water, and does not drain to other surface water; therefore, it is not expected to carry contaminants off-site. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. However, the absence of surface water near the site mitigates groundwater to surface water contaminant migration.

Exposure Routes

Terrestrial receptors at Site 27 may be exposed to soil contaminants via incidental ingestion of soil or by ingestion of contaminated food items, although this is expected to be minimal since terrestrial habitat is limited on the site and contaminant migration to the forested areas is unlikely. Terrestrial receptors may also come into contact with contaminants in drainage ditch surface water by using it for drinking, although this pathway is generally insignificant and surface water is rarely present in the ditch. Thus, due to the lack of habitat and surface water, use of the site by terrestrial wildlife is minimal. Terrestrial vegetation may be exposed to contaminants in surface soils at Site 27. However, since the site is small and mostly covered with gravel, evaluation of potential risks to terrestrial plants was not applicable.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1993 SI activities for this site. In particular, contaminants detected in drainage ditch sediments were considered preliminary COPCs. Contaminants in SI and 1995 RI soil samples were evaluated qualitatively.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

26.8.2 Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminated sediments. Sediment ET values are presented in Table 2-29.

26.8.3 Preliminary Exposure Assessment

Contaminant concentrations in sediment used for this initial screening were obtained from data generated during SI activities. Eight sediment samples were taken in the adjacent drainage area, and the maximum

detected contaminant concentrations from those samples combined were used as conservative representative exposure point concentrations. The drainage ditch is usually dry and contains no aquatic habitat. Therefore, the ditch essentially contains occasionally wet soils. Nonetheless, the eight samples were conservatively assessed as sediments. Data from SI and RI soil samples are assessed qualitatively in Section 26.8.5. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

26.8.4 Risk Characterization

Several inorganics exceeded ETs in sediments and were retained as final COPCs (Table 26-9). Antimony (HQ = 7.6) and barium (HQ = 4.98) exceeded the only ET values available for those contaminants. Mercury and silver exceeded the most conservative ET values available and were retained as final COPCs, but did not exceed less conservative values. Cadmium, chromium, copper, cyanide, lead, and zinc exceeded most and less conservative ETs. Two pesticides, 4,4'-DDE and 4,4'-DDT, exceeded most conservative ETs and were retained as final COPCs, but did not exceed less conservative ETs. Aluminum and selenium were conservatively retained as final COPCs since no suitable ETs were available.

The toxicological properties of final COPCs in sediment are summarized in Appendix M.

26.8.5 Summary and Conclusions

The site consists of a gravel-covered parking area in the vicinity of buildings, railroad tracks, and a paved road. Therefore, limited ecological habitat exists on the site. The wooded area to the east provides excellent upland habitat and is most likely used by a wide variety of upland receptors. Runoff from the site flows to the adjacent drainage ditch, though water in the ditch infiltrates and does not flow off-site. No significant surface water is present near the site, mitigating potential groundwater to surface water contaminant migration.

Ten soil samples were taken on and near the area containing paint chips as part of SI activities at the site. These samples contained relatively high concentrations of several metals and low levels of some organics and PCBs. Subsurface soil samples were taken in the paint chip area to investigate the vertical extent of contaminants in soil as part of 1995 RI activities. Several metals were detected in elevated concentrations in those samples. Data from sediment samples collected in the drainage ditch during the SI were used for quantitative assessment. Potential risks from several metals were moderately high, and potential risks from organics were low. Cadmium, cyanide, lead, and zinc appear to pose the majority of potential risk. Because appropriate ETs were unavailable, aluminum and selenium were conservatively retained as final COPCs, but both were detected in relatively low concentrations.

TABLE 26-9
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SITE 27
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	2/2	3940	1190	NA		Retained-No suitable threshold available
Antimony	1/2	ND	15.2	2.0	7.6	Retained-HQ > 1
Arsenic	2/2	6.2	4.3	8.2	0.52	Eliminated-Does not exceed threshold
Barium	2/2	10.6	199	40	4.98	Retained-HQ > 1
Cadmium	2/2	ND	36.3	1.2/9.6	30.3/3.78	Retained-HQ > 1
Chromium	7/8	56	471	81/370	5.81/1.27	Retained-HQ > 1
Copper	7/8	13	434	34/270	12.8/1.61	Retained-HQ > 1
Cyanide	1/2	ND	1.84	0.1/0.25	18.0/7.36	Retained-HQ > 1
Lead	8/8	34.3	786	47/218	16.7/3.60	Retained-HQ > 1
Manganese	2/2	9.2	165	460	0.36	Eliminated-Does not exceed threshold
Mercury	2/2	0.07	0.2	0.15/0.71	1.33/0.28	Retained-HQ > 1
Nickel	2/2	6	15.8	21	0.75	Eliminated-Does not exceed threshold
Selenium	1/2	ND	1.6	NA		Retained-No suitable threshold available
Silver	1/2	ND	2.5	1.0/3.7	2.50/0.68	Retained-HQ > 1
Zinc	7/8	26.9	840	150/410	5.60/2.05	Retained-HQ > 1
Organics[3]						
4,4'-DDE	1/2	1.7	7.3	2.2/27	3.22/0.27	Retained-HQ > 1
4,4'-DDT	1/2	19	21	1.6/46	13.1/0.45	Retained-HQ > 1
Acetone	1/2	ND	20	64	0.31	Eliminated-Does not exceed threshold
Benzo(a)anthracene	1/2	560	19	330	0.06	Eliminated-Does not exceed threshold
Chrysene	1/2	940	31	330	0.09	Eliminated-Does not exceed threshold
Di-n-butylphthalate	2/2	160	32	11000	2.90E-03	Eliminated-Does not exceed threshold
Gamma-chlordane	1/2	0.095	0.37	7	0.05	Eliminated-Does not exceed threshold
Fluoranthene	1/2	1800	62	2900	0.02	Eliminated-Does not exceed threshold
Methylene chloride	2/2	ND	34	427	0.08	Eliminated-Does not exceed threshold
Phenanthrene	1/2	1900	46	850	0.05	Eliminated-Does not exceed threshold
Pyrene	1/2	1900	57	660	0.09	Eliminated-Does not exceed threshold
Toluene	1/2	480	3	670	4.48E-02	Eliminated-Does not exceed threshold

ND = None detected
NA = No suitable benchmark was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

The results of 1993 SI and 1995 RI indicate that concentrations of metals are present in site soils and in the drainage ditch that pose significant potential risk to ecological receptors. However, these potential risks are mitigated by several factors. First of all, Site 27 is small, limiting significant receptor use. Second, the drainage ditch contains no standing water and no aquatic habitat. Only terrestrial receptors would come into contact with the ditch, but are not expected to significantly use the area since no habitat is present. Furthermore, water in the ditch, present only after heavy rainfall, tends to infiltrate rather than flow off-site, and no surface water is present near the site. Therefore, contaminant migration downstream or contaminant contributions to the watershed appear to be negligible. For these reasons, further ecological study at Site 27 appears to be unwarranted, but removal of paint chips and associated soils, and limited removal of ditch sediments appears to be appropriate.

26.9 EVALUATION AND RECOMMENDATIONS

26.9.1 Evaluation Summary

Previous investigations provided sufficient information to justify the removal of obviously contaminated soils from the former shot blast and paint chip dump areas. This investigation confirmed previous findings and provided data for use in remedial design for the removal action.

The results of 1993 SI and 1995 RI indicate that concentrations of metals are present in site soils and in the drainage ditch at concentrations that pose significant potential risk to ecological receptors. However, contaminant migration downstream or contaminant contributions to the watershed appear to be negligible. Therefore, further ecological study at Site 27 appears to be unwarranted, but removal of paint chips and associated soils, and limited removal of ditch sediments appears to be appropriate.

26.9.2 Recommendations

A focused feasibility study for soil and sediments removal should be considered.

27.0 SITE 29: PCB SPILL SITE

27.1 SITE BACKGROUND AND PHYSICAL SETTING

This site is located in a storage yard (north of Site 16/F) where an unknown quantity of PCBs spilled from a transformer in 1981. No record exists suggesting that PCB compounds flowed any significant distance overland or in a ditch. Within 5 days after the spill, all discolored soil (over 120 cubic feet) was disposed off-site. NWS Earle is building a one-story, brick building at the site that will function as a new hazardous waste storage facility. A railroad spur and wetlands are located east of the site, and Saipan Road is located along the western side. Figure 27-1 is a site map.

27.2 PREVIOUS INVESTIGATIONS

27.2.1 Summary of Activities and Results

The 1983 IAS, consisting of interviews and site observations, noted that there was a PCB spill. Reportedly, all visible evidence of the spill was removed in an immediate removal action. The site was not recommended for a confirmation study.

During the 1992 SI field investigation, five soil samples (from 0.5 to 1.5 feet bgs) were collected from the area of the PCB spill at Site 29. Samples were obtained within the relatively small area labeled "approximate location of spill area" on Figure 27-1. Minor amounts of pesticides and PCBs were detected at concentrations below New Jersey clean-up standards. One sample contained high concentrations of TPH (28,000 mg/kg).

As part of the environmental site evaluation for the proposed hazardous waste storage facility, additional field work was performed at the site. To further evaluate the possible impacts from past activities and to assess subsurface soil conditions for foundation design, seven soil borings were completed at the site in mid-1993 (Haley & Aldrich, Incorporated, 1993). All 1993 soil borings and monitoring wells were installed within the area labeled "new hazardous waste storage facility under construction" shown on Figure 21-1. Soil borings were completed to depths ranging from 17 to 42 feet bgs and were sampled at 5 and 10 feet bgs. Six of the seven soil borings were converted to monitoring wells. Trace levels of VOCs, semivolatiles, pesticides, and PCBs were detected in the soils, all below New Jersey subsurface soil criteria. Groundwater samples indicated that trace to low levels of VOCs and semivolatiles were present, and no detectable concentrations of pesticides or PCBs were present. Elevated levels of benzene (30 ppb) and DCE (25 ppb) were reported in former well MW29-04. Total lead and total chromium were

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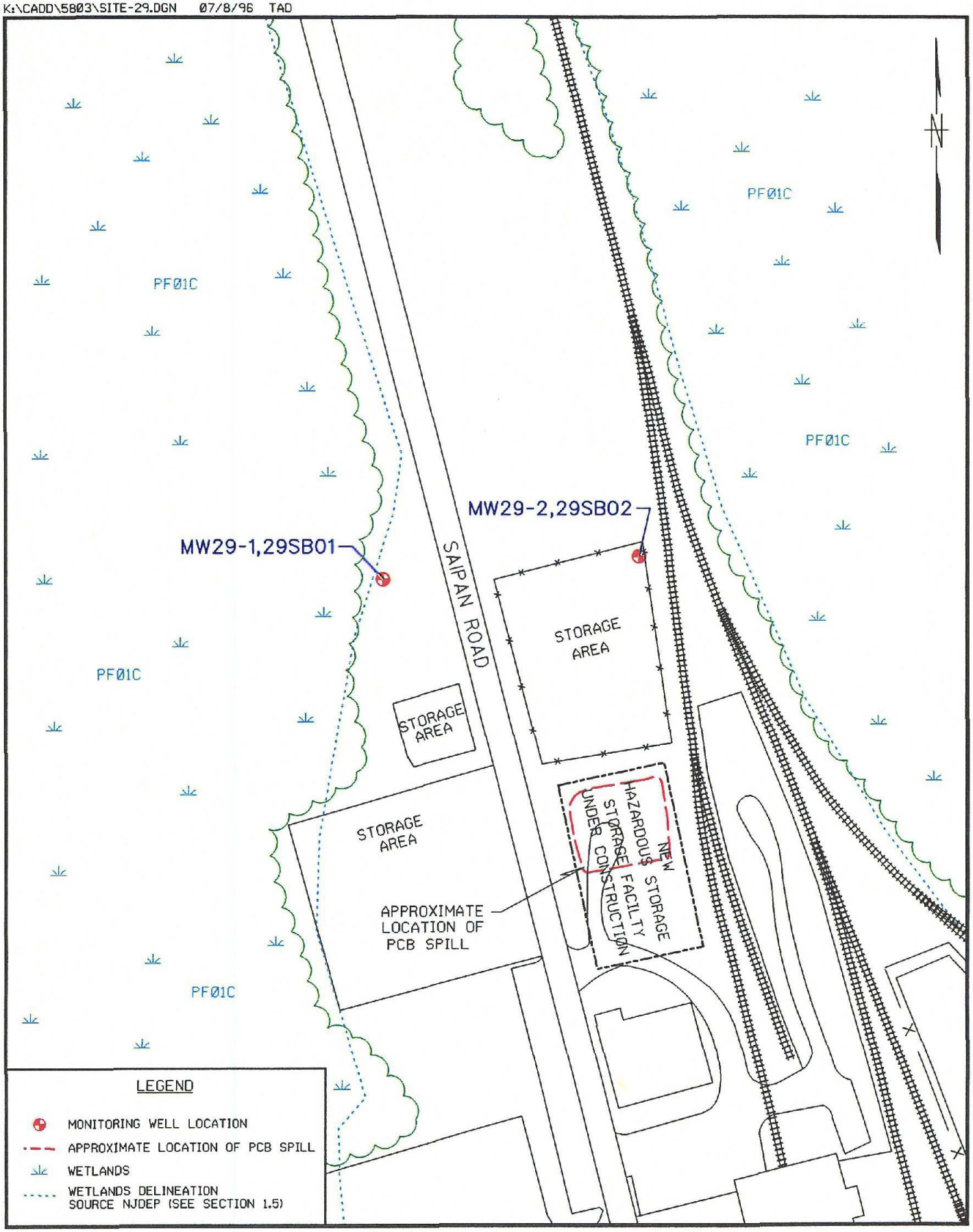

SAMPLE LOCATIONS

SITE 29 - PCB SPILL SITE

0 100 200

SCALE IN FEET

FIGURE 27-1

Brown & Root Environmental

present in groundwater at levels above state criteria. The six wells installed in 1993 were destroyed by subsequent construction activities at the site.

Soil was removed for construction of the new hazardous waste storage facility to a depth of approximately 8 feet below grade in the entire area labeled "new hazardous waste storage facility under construction" (Figure 27-1) before 1995 RI field activities were carried out. Due to dry conditions, no groundwater was encountered in the excavation. Consequently, the original plan for RI activities at the site was not feasible (since the entire site had been removed), and therefore was modified in the field after consultation with EPA and NJDEP. The excavated site soils were stockpiled, sampled, analyzed to determine disposal options, and found to be non-hazardous.

27.2.2 Summary of Conclusions

The original removal action apparently was effective in removing spilled PCBs. However, low levels of various organics were found in groundwater and low levels of PCBs and organics were found in soil samples.

Construction activities for the new hazardous waste storage facility virtually removed the entire study area.

27.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on previous investigations and removal actions, follow-up remedial investigation activities were developed to meet the following objectives:

- Investigate subsurface soil quality downgradient of the former site.
- Confirm groundwater quality downgradient of the former site.
- Perform risk analysis to determine if further action is required.

27.3 RI FIELD INVESTIGATIONS

Between July and October 1995, B&R Environmental conducted the following field investigation activities at Site 29:

- Sampling and analysis of subsurface soil samples from two soil borings (Section 27.3.1)
- Drilling and installation of two shallow permanent monitoring wells (Section 27.3.2)

- Sampling and analysis of groundwater from the wells (Section 27.3.2)
- Measurement of static water levels in the monitoring wells (Section 27.3.2)

B&R Environmental conducted a survey to establish the horizontal locations and vertical elevations of the permanent monitoring wells. Surveying notes are provided in Appendix F.

27.3.1 Soil Borings and Subsurface Soil Sampling

Two soil borings (29 SB 01 and 29 SB 02), which were converted into monitoring wells (MW29-01 and MW29-02), were drilled in July 1995 to investigate the horizontal and vertical extent of soil contamination. Figure 27-1 shows sample locations. The borings ranged in depth from 17 to 18 feet bgs. Saturated conditions were encountered in the borings from 8 to 9 feet below grade. Subsurface soil samples were collected continuously to the water table using a 3-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. Maximum HNu readings in both borings ranged from 1 to 4 ppm or less than 10 ppm action level at the 2 to 4 feet intervals. Stains and odors were not observed. Soil boring log sheets were prepared for each boring to evaluate subsurface lithologies (see Appendix C).

B&R Environmental collected one subsurface soil sample from each boring from the interval that showed the highest level of contamination, based on visual observations or HNu readings. The subsurface soil samples were submitted to Lancaster Laboratories for TCL pesticides/PCBs, moisture, and TPH analyses. pH was measured in 29 SB 01-02. Sample log sheets are presented in Appendix D. Soil boring characteristics and sample information are summarized in Table 27-1.

27.3.2 Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

Six monitoring wells were previously located on site; however, they were destroyed during soil excavation and removal for a non-related investigation.

B&R Environmental added two shallow permanent monitoring wells (MW29-01 and MW29-02) near the site in July 1995 (Figure 27-1) to investigate groundwater quality in the vicinity of the site. MW29-01 had a total depth of 18 feet and encountered saturated conditions at approximately 9 feet below grade.

Table 27-1
Site 29 Soil Boring Characteristics Summary
NWS Earle, Colts Neck, New Jersey

Soil Boring Number	Total Depth[1] (feet)	Ground Surface Elevation	Laboratory Sample Number	Laboratory Sample Depth Interval[1] (feet)	Analytical Parameter
29 SB 01 (MW 29-01)	18	97.36	29SB01-02	2 - 4	TCL PCBs and TPH
29 SB 02 (MW 29-02)	17	98.44	29SB02-02	2 - 4	TCL PCBs and TPH

(1) In feet below grade

MW29-02 had a total depth of 17 feet and encountered saturated conditions at approximately 8 feet below grade during drilling. The borings were drilled to approximately 8 feet below the water table and completed as cased wells, screened across the water table.

The wells were constructed with a 2-inch-diameter, flush jointed and threaded, Schedule 40, PVC well casing and 2-inch-diameter, Schedule 40, 0.10-foot slotted well screen fitted with a PVC bottom cap. Ten-foot screens were installed in the wells. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 2 feet above the top of the screen. A 2-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height of approximately 1 foot bgs. The wells were completed with a 2-foot-high stickup surrounded by a 4- by-4 foot concrete pad keyed 1 foot into the well annulus. The monitoring well construction sheets are in Appendix C. See Table 27-2 for the monitoring well characteristics summary.

The wells were developed a minimum of 3 days after installation. Groundwater temperature, pH, conductivity, and turbidity were monitored during development. Approximately 240 gallons of water were removed from both MW29-01 and MW29-02.

Static-Water-Level Measurements

To define groundwater flow directions and horizontal and vertical groundwater gradients, B&R Environmental collected two rounds of static-water-level measurements. The first round of water-level measurements was collected on August 7, 1995, the second on October 17, 1995. Static-water levels were measured from the top of the PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation ranged from approximately 89.50 to 89.79 feet above MSL during the first round of measurements and from approximately 89.28 to 89.54 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 27-3. Based on measured groundwater levels and the flow direction observed in the adjacent Site 16, groundwater flow is expected to be toward the north-northwest.

Groundwater Sampling

B&R Environmental obtained samples in August 1995 from the two newly installed wells (MW29-01 and MW29-02) (Figure 27-2) to evaluate the impact of site activities on groundwater and to provide data for use in the risk assessment and the evaluation of remedial action alternatives. Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Table 27-2
Site 29 - Monitoring Well Characteristics Summary
NWS Earle, Colts Neck, New Jersey

Monitoring Well Number	Total Depth[1] (feet)	Ground Surface Evaluation[2]			Diameter (inches)	Screened Interval Depth[1] (feet)	Filter Pack Interval Depth[1] (feet)	Date Installed
		Top of Concrete Pad[2] (feet)	Top of PVC Riser[2] (feet)	Top of Protective Casing[2] (feet)				
MW29-01	16	97.36	99.42	100.02	8	6 - 16	4 - 16	7/7/95
MW29-02	17	98.44	100.39	101.10	9	7 - 17	5 - 17	7/7/95

Note: All wells were constructed with Schedule 40 polyvinyl chloride (PVC) well casing.

(1) In feet below grade. Reading obtained during monitoring well installation. See Table 27-3 for more accurate measurements.
(2) In feet above mean sea level.

TABLE 27-3
SITE 29 STATIC-WATER-LEVEL MEASUREMENT SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY

Monitoring Well Number	August 7, 1995			October 17, 1995		
	Depth to Water Table[1] (feet)	Top of PVC Riser[2]	Elevation of Water Table[2]	Depth to Water Table[1] (feet)	Top of PVC Riser[2]	Elevation of Water Table[2]
MW29-01	9.92	99.42	89.50	10.14	99.42	89.28
MW29-02	10.60	100.39	89.79	10.85	100.39	89.54

(1) In feet below top of riser
(2) In feet above mean sea level

Prior to sampling, B&R Environmental purged the wells, using the micro-purge protocol to minimize turbidity, until groundwater parameters stabilized within acceptable limits. Care was taken to ensure little or no drawdown in water levels occurred throughout the purge and sample process.

The two groundwater samples (29 GW 01 and 29 GW 02) were submitted to Lancaster Laboratories for TCL, VOC, TCL SVOC, TCL pesticides/PCBs, and TAL metals analyses. Sample log sheets are presented in Appendix D.

27.4 SITE CHARACTERISTICS

27.4.1 Geology

Regional mapping places Site 29 within the outcrop area of the Kirkwood Formation; upper colluvium may be present at the site. The upper colluvium has a maximum thickness of 10 feet, the Kirkwood Formation ranges between 60 to 100 feet in thickness, and the soil borings installed for the two monitoring wells are no more than 42 feet deep. The lithology of the sediments encountered in the on-site borings generally agrees with the published description of the upper colluvium and the Kirkwood Formation. In general, the borings encountered fill material, olive gray and brown, silty, fine- to coarse-grained sand with gravel (possibly representative of the upland gravel) and yellowish-brown and olive, pebbly, silty, fine- to coarse-grained sand and sandy clay (probably representative of the Kirkwood Formation).

Based upon the boring log descriptions, well MW29-01 penetrated fill material and the Kirkwood Formation, and well MW29-02 penetrated the upland gravel and the Kirkwood Formation.

27.4.2 Hydrogeology

Groundwater in the Kirkwood aquifer beneath the site occurs under unconfined conditions. Static-water-level measurements and water-table elevations are summarized in Table 27-3. There are insufficient data points to contour the water table beneath Site 29; however, the elevational data from both August and October 1995 indicate a westward component to shallow groundwater at the site. There does not appear to be a significant seasonal variation in groundwater flow direction.

Based on boring log descriptions, well MW29-01 is screened across the contact between the fill material and the Kirkwood Formation, and well MW29-02 is screened in the Kirkwood Formation.

27.5 NATURE AND EXTENT OF CONTAMINATION

27.5.1 Subsurface Soils

Two site-related subsurface soil samples (29 SB 01-02 and 29 SB 02-02) were collected at Site 29 (Figure 27-1). Table 27-4 presents the occurrence and distribution of organic chemicals detected in site-related subsurface soil samples and compares them to background as presented in Section 31. Table 27-4a presents a comparison of detected compounds to ARARs and TBCs. Figure 27-2 shows sample locations and concentration of compounds which exceed ARARs and TBCs.

27.5.1.1 Organics

4,4'-DDE (16 ug/kg to 320 ug/kg) and 4,4'-DDT (43 ug/kg to 420 ug/kg) were each detected in two background subsurface soil samples. Several pesticides were detected in site-related subsurface soil samples collected at Site 29. 4,4'-DDD (35.6 ug/kg to 38 ug/kg), 4,4'-DDE (28.9 ug/kg to 34 ug/kg), and 4,4'-DDT (28.6 ug/kg to 39 ug/kg) were each detected in two site-related subsurface soil samples collected at Site 29. Alpha-BHC, alpha-chlordane, and gamma-chlordane were each detected in one site-related subsurface soil sample collected at Site 29 at concentrations of 0.067 ug/kg, 0.64 ug/kg, and 0.84 ug/kg, respectively.

27.5.1.2 Miscellaneous Parameters

Miscellaneous paramters analyses of two subsurface soils collected at Site 29 consisted of moisture, pH, and TPH. TPH levels in two site-related samples were below background levels. Percent moisture and pH levels, did not exceed background levels and ranges, respectively. Results for miscellaneous parameters are presented in Appendix A.

27.5.2 Groundwater

Two site-related groundwater samples (29 GW 01 and 29 GW 02) were collected (Figure 27-1). Tables 27-5 and 27-6 present the occurrence and distribution of inorganic chemicals detected in site-related groundwater samples and compare them to background. Table 27-5a presents a comparison of detected compounds to ARARs and TBCs. Figure 27-2 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

TABLE 27-4
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE 29
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	NOT DETECTED	-	-	2 / 2	35.6 - 38	38
4,4'-DDE	2 / 8	16 - 330	121.91	2 / 2	28.9 - 34	34
4,4'-DDT	2 / 8	43 - 420	157.34	2 / 2	28.6 - 39	39
ALPHA-BHC	NOT DETECTED	-	-	1 / 2	0.067	0.067
ALPHA-CHLORDANE	NOT DETECTED	-	-	1 / 2	0.64	0.64
GAMMA-CHLORDANE	NOT DETECTED	-	-	1 / 2	0.84	0.84

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TABLE 27-4a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE 29

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	29SB01-02		29SB02-02		---	---	---	---	ARARS & TBCs		
LOCATION:	29SB01		29SB02		---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI		1995 RI								
PESTICIDES	**ug/kg**		**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	35.6		38.0	J					3000	12000	50000
4,4'-DDE	28.9		34.0						2000	9000	50000
4,4'-DDT	28.6		39.0						2000	9000	500000
alpha-BHC	1.9	U	0.067	J					-	-	-
alpha-chlordane	1.9	U	0.64	NJ					-	-	-
endrin	3.7	U	0.36	R					17000	310000	50000
gamma-chlordane	1.9	U	0.84	J					-	-	-

TABLE 27-4a
COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCS - SITE 29
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

TABLE 27-4b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE 29

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	29SB01-02	29SB02-02	---	---	---	ARARS & TBCs		
LOCATION:	29SB01	29SB02	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI	1995 RI						
MISCELLANEOUS								
moisture %	10.1	15.1				-	-	-
pH	6.3	n/a				-	-	-
petroleum hydrocarbons **mg/kg**	130	90.0				10000 @	10000 @	-

TABLE 27-4b
COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE 29
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

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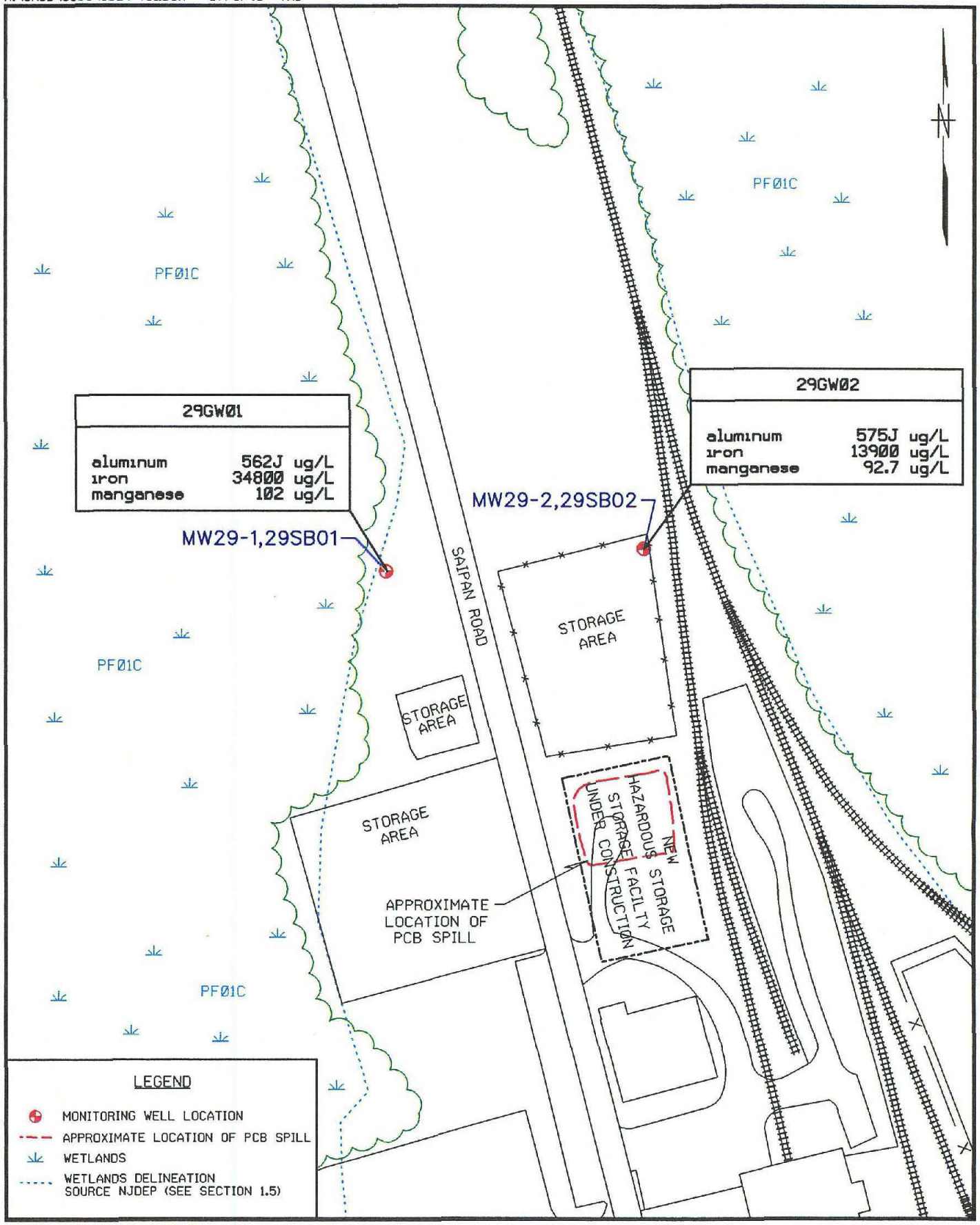

CONCENTRATIONS ABOVE SCREENING LEVELS

SITE 29 - PCB SPILL SITE

FIGURE 27-2

0 100 200

SCALE IN FEET

Brown & Root Environmental

TABLE 27-5
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN GROUNDWATER AT SITE 29
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD?	REPRESENTATIVE CONCENTRATION
ALUMINUM	11 / 11	287 - 7870	5097.82	2 / 2	562 - 575	568.50	NO	575
ARSENIC	1 / 11	5.8 - 5.8	4.05	1 / 2	3.7	2.68	NO	3.7
BARIUM	11 / 11	2.6 - 518	229.60	2 / 2	17.1 - 21.3	19.20	NO	21.3
CADMIUM*	5 / 11	0.6 - 1.9	1.21	1 / 2	0.94	0.57	NO	0.94
CALCIUM	11 / 11	506 - 17200	8306.55	2 / 2	25400 - 41400	33400.00	YES	41400
CHROMIUM	NOT DETECTED	-	-	2 / 2	8.3 - 14.1	11.20	YES	14.1
IRON	11 / 11	153 - 7690	4197.09	2 / 2	13900 - 34800	24350.00	YES	34800
LEAD	3 / 11	2.1 - 3	2.44	1 / 2	2	1.38	NO	2
MAGNESIUM	11 / 11	273 - 27400	8449.64	2 / 2	4070 - 6720	5395.00	NO	6720
MANGANESE	11 / 11	3.3 - 65	46.18	2 / 2	92.7 - 102	97.35	YES	102
MERCURY	11 / 11	0.005 - 0.12	0.12	2 / 2	0.04 - 0.065	0.05	NO	0.065
NICKEL	10 / 11	0.81 - 25.5	11.98	2 / 2	1 - 1.5	1.25	NO	1.5
POTASSIUM	11 / 11	350 - 3245	2810.55	2 / 2	2910 - 3270	3090.00	YES	3270
SODIUM	11 / 11	1850 - 11650	8449.09	2 / 2	7310 - 42900	25105.00	YES	42900
VANADIUM	10 / 11	0.69 - 42.25	16.48	2 / 2	2.8 - 3.4	3.10	NO	3.4
ZINC	6 / 9	3.7 - 348	178.61	2 / 2	3.4 - 3.8	3.60	NO	3.8

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 27-6
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN GROUNDWATER AT SITE 29
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,2-DICHLOROETHENE (TOTAL)	NOT DETECTED	-	-	1 / 2	1	1

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TABLE 27-5a

COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCs - SITE 29

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	29GW01	29GW02	---	---	---	---	ARARS & TBCs		
LOCATION:	29GW01	29GW02	---	---	---	---	Maximum Contaminant Level (MCL)	Drinking Water Health Advisory (Lowest Criterion Shown)	NJDEP Groundwater Quality Standard
DATA SOURCE:	1995 RI	1995 RI							
INORGANICS	**ug/L**	**ug/L**					**ug/L**	**ug/L**	**ug/L**
aluminum	562 E J	575 E J					-	-	200
arsenic	3.3 U	3.7					50.0	-	8.00
barium	17.1	21.3					2000	2000 a	2000
cadmium	0.94	0.38 U					5.00	5.00 e	4.00
calcium	25400	41400					-	-	-
chromium, total	14.1	8.3					100 *	100 a	100
iron	34800 E	13900 E					-	-	300
lead	2.0 J	1.5 U					15.0	-	10.0
magnesium	4070	6720					-	-	-
manganese	102 E	92.7 E					-	-	50.0
mercury	0.065	0.040					2.00	2.00 b	2.00
nickel	1.0	1.5					100	100 a	100
potassium	3270	2910					-	-	-
sodium	42900	7310					-	-	50000
vanadium	2.8	3.4					-	-	-
zinc	3.8	3.4					-	2000 a	5000
VOLATILES	**ug/L**	**ug/L**					**ug/L**	**ug/L**	**ug/L**
1,2-dichloroethene (total)	1.0 J	10.0 U					70.0 a	70.0 a	10.0

TABLE 27-5a
COMPARISON OF GROUNDWATER ANALYTICAL DATA TO ARARS AND TBCS - SITE 29
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to MCLs, MCLGs, or SMCLs:

- - No standard is available for this chemical in this classification.

a - Where applicable, value(s) represent the more stringent of criteria for total, cis-, and trans- isomers.

* - Criteria are for total chromium.

** - Action level 1300 ug/L for water treatment technology for public water supply systems.

*** - Action level 15 ug/L for water treatment technology for public water supply systems.

Footnotes to Health Advisories:

- - No standard is available for this chemical in this classification.

a - The listed health advisory criterion, lifetime adult, is equal to the most stringent of the EPA health advisories for this chemical.

b - The listed health advisory criterion, long-term adult, is equal to the most stringent of the EPA health advisories for this chemical.

c - The listed health advisory criterion, one-day child, is equal to the most stringent of the EPA health advisories for this chemical.

d - The listed health advisory criterion, ten-day child, is equal to the most stringent of the EPA health advisories for this chemical.

e - The listed health advisory criterion, long-term child, is equal to the most stringent of the EPA health advisories for this chemical.

27.5.2.1 Inorganics

Higher concentrations of metals were seen in the site-related samples, which showed the presence of all the metals found in background. Arsenic was also found in one groundwater sample. The following metals and their corresponding concentrations were detected in both site-related samples: aluminum, 562 ug/L to 575 ug/L; barium, 17.1 ug/L to 21.3 ug/L; chromium, 8.3 ug/L to 14.1 ug/L; iron, 13,900 ug/L to 34,800 ug/L; manganese, 92.7 ug/L to 102 ug/L; mercury, 0.04 ug/L to 0.065 ug/L; nickel, 1 ug/L to 1.5 ug/L; vanadium, 2.8 ug/L to 3.4 ug/L; and zinc, 3.4 ug/L to 3.8 ug/L. Arsenic, cadmium, and lead were each detected once at levels of 3.7 ug/L, 0.94 ug/L, and 2 ug/L, respectively.

27.5.2.2 Organics

1,2-DCE was detected in one groundwater sample (29 GW 01) at a concentration of 1.0 ug/L.

27.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site 29 is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 27.6.1. Persistence of detected chemicals in the environment is discussed in Section 27.6.2. Section 27.6.3 presents a brief discussion of contaminant trends.

27.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site 29 revealed one volatile compound (1,2-DCE) present in the groundwater and several pesticides in the subsurface soil. In addition, two metals were present in groundwater at levels greater than the ranges detected in background samples. The physical transport data for the detected contaminants are presented in Table 2-10. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

The organic compound, 1,2-DCE, is volatile and characteristically mobile in the environment (either through soil gas migration or groundwater transport). 1,2-DCE may have originated at source locations not identified in this investigation or from source locations that have since been depleted of VOC contaminants.

Six pesticides were identified in the organic subsurface soil samples. These compounds are relatively immobile in the subsurface environment and are preferentially bound to the soil phase. These compounds are not subject to groundwater transport to the same extent as compounds with high water solubilities.

Both groundwater samples exhibited slightly elevated iron levels and one sample displayed a low level of arsenic. In monitoring wells at Site 29, low turbidity readings were achieved by sampling using dedicated low-flow bladder pumps. Metals detected in the groundwater samples represent the presence of dissolved metals that have relatively high mobility in groundwater.

27.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Chemical transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different from a toxicological or physical transport perspective.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater, saturated zone soils, surface water, and sediment) are most likely to be transformed in the environment.

1,2-DCE is one of the degradation by-products of TCE and PCE. This compound can be further degraded to form vinyl chloride. In addition, the persistence of this compound in soil is influenced by its solubility and high volatility.

Metals such as iron and arsenic can change oxidation state, thereby becoming more or less mobile in a particular medium but they are considered very persistent in nature.

27.6.3 Observed Chemical Contaminant Trends

One volatile organic compound (1,2-DCE) was detected at a low level in one out of two groundwater samples collected at Site 29. The same compound was detected at low levels in groundwater during a 1993 sampling investigation. The previous 1,2-DCE detection was in the former monitoring well MW4, which was located east of Saipan Road between Building S-83 and the area of the former PCB spill. The well exhibiting this compound (MW29-01) is located west of Saipan Road. Based on results from past and current sampling, there are no obvious source areas with high levels of 1,2-DCE at Site 29.

Several pesticide compounds were detected at low levels in subsurface soil, including several compounds that had been previously reported in the surface soil in a 1993 investigation at the site. These compounds are relatively immobile in the subsurface environment and are preferentially bound to the soil phase. These

compounds are not subject to groundwater transport to the same extent as compounds with high water solubilities.

Arsenic was detected at a low level, near the instrument detection limit, in one site-related groundwater sample but was not detected in background groundwater samples. Results near the limit of detection in a single sample do not clearly demonstrate the presence of elevated levels in groundwater. Iron was detected in two groundwater samples at levels greater than the range observed in background groundwater samples.

The proximity of Site 16/F should be noted because of the potential for Site 16/F contaminants to be found in Site 29 area groundwater. The direction of groundwater flow is expected to be in the same general direction, but it is not clear if groundwater from Site 29 monitoring wells could be associated with groundwater from Site 16/F wells. It is interesting to note however, that both MW29-01 and MW16-06 contain 1,2-DCE in the groundwater, and that former monitor well MW-4 at Site 29 was found with 1,2-DCE and benzene at levels approaching those found in MW16-06.

27.6.4 Conclusions

Based upon the data from two new monitoring wells that were sampled during this investigation and the results from monitoring well sampling during a 1993 investigation, 1,2-DCE is not present at high concentrations in groundwater near this site. 1,2-DCE is probably the result of biodegradation of TCE or PCE from source areas that have since been depleted of contamination or from low-level sources not identified during this investigation.

Six pesticide compounds were detected in the subsurface soil, including several compounds detected at low levels in the earlier investigation. These compounds are considered relatively immobile in soil and are not expected to migrate readily.

Subsurface soils from this investigation generally revealed low concentrations of TPH. The 1993 investigation revealed elevated levels of TPH at one of seven subsurface soil locations.

Only two metals were detected in groundwater at levels greater than background. Results for arsenic were near the detection limit. The results for iron were slightly higher in monitoring well MW29-01 than in MW29-02. Based on data from only two wells, the distribution of these two metals in groundwater at the site cannot be accurately predicted. These data suggest very limited potential for impacts to groundwater, since other detected metals in groundwater at Site 29 were present at levels similar to the range of concentrations found in background samples.

27.7 BASELINE RISK ASSESSMENT

This section of the RI report presents the results of the baseline risk assessment for Site 29. The risk assessment was performed using the approach outlined in Section 2.4. Tables 27-7 and 27-8 provide the selected COPCs and representative concentrations of organics in site-related subsurface soil and inorganics and organics in site-related groundwater, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The result of the conservative baseline risk assessment was greater than a value of 1.0 for non-cancer risk; therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. Section 22.7.1.4 discusses the modifications made to the conservative preliminary baseline risk assessment.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation alternatives are identified for a site.

27.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential and industrial receptors).

27.7.1.1 Future Industrial Employee

The estimated total RME cancer risks for the future industrial receptor for exposure to COPCs in groundwater at Site 29 are within the 1E-04 to 1E-06 target acceptable risk range. (Ingestion exposures contributed the major portion of these risks.)

The estimated total RME cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 29 are 1.3E-08 (ingestion), 2.5E-08 (dermal contact), and 2.6E-12 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is below the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate ARARs.

TABLE 27-7
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE 29 (ug/kg)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
4,4'-DDD	38	NONPARAMETRIC
4,4'-DDE	34	NONPARAMETRIC
4,4'-DDT	39	NONPARAMETRIC
ALPHA-BHC	0.067	NONPARAMETRIC
ALPHA-CHLORDANE	0.64	NONPARAMETRIC
GAMMA-CHLORDANE	0.84	NONPARAMETRIC

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TABLE 27-8
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
GROUNDWATER - SITE 29 (ug/L)
NWS EARLE, COLTS NECK, NEW JERSEY

CHEMICAL OF CONCERN	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ARSENIC	3.7	NONPARAMETRIC
CADMIUM	0.94	NONPARAMETRIC
IRON	34800	NONPARAMETRIC
1,2-DICHLOROETHENE (TOTAL)	1	NONPARAMETRIC

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The estimated RME noncarcinogenic HIs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 29 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future industrial receptors exposed to subsurface soil at Site 29 in Tables 27-9 and 27-10, respectively.

The conservative preliminary baseline risk assessment yielded an estimated noncarcinogenic HI greater than 1.0 for the future industrial receptor assuming exposure to COPCs in groundwater at Site 29. (Ingestion exposures contributed the significant portion of risk.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for industrial exposure to groundwater are discussed in Section 27.7.1.4 and presented in Tables 27-11, 27-12, and 27-12a.

27.7.1.2 Future Residential Receptor

The estimated total RME cancer risks for the future residential receptor for exposure to COPCs in groundwater at Site 29 are within the 1E-04 to 1E-06 target acceptable risk range. (Ingestion exposures contributed the major portion of these risks.)

The estimated total RME cancer risks for the future lifetime resident assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 29 are 5.7E-08 (ingestion), 8.2E-08 (dermal contact), and 1.6E-12 (inhalation of COPCs in fugitive dust). The subsurface soil cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The estimated RME noncarcinogenic HIs for the future child resident assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site 29 are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected because the sum of these HIs is below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to surface soil at Site 29 in Tables 27-13 and 27-14, respectively.

The conservative preliminary baseline risk assessment yielded an estimated noncarcinogenic HI greater than 1.0 for the future child resident assuming exposure to COPCs in groundwater at Site 29. (Ingestion exposures contributed the significant portion of risk.) Therefore, additional risk analysis was performed

TABLE 27-9
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 29
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	3.2E-09	6.2E-09	5.9E-13
4,4'-DDE	4.0E-09	7.9E-09	7.5E-13
4,4'-DDT	4.6E-09	9.0E-09	1.0E-12
ALPHA-BHC	1.5E-10	2.3E-10	3.3E-14
ALPHA-CHLORDANE	2.9E-10	5.7E-10	6.5E-14
GAMMA-CHLORDANE	3.8E-10	7.4E-10	8.5E-14
TOTAL RISK	1.3E-08	2.5E-08	2.6E-12

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 27-10
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 29
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	7.6E-05	1.5E-04	1.4E-08
ALPHA-BHC	N/A	N/A	N/A
ALPHA-CHLORDANE	1.0E-05	2.0E-05	1.9E-09
GAMMA-CHLORDANE	1.4E-05	2.7E-05	2.5E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

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TABLE 27-11
RME CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE 29
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION	GROUNDWATER DERMAL CONTACT
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A
ARSENIC	1.9E-05	8.4E-09
IRON	N/A	N/A
TOTAL RISK	1.9E-05	8.4E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 27-12
RME NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 29
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN				
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	LIVER	DIGESTIVE SYSTEM	GROUNDWATER DERMAL CONTACT
1,2-DICHLOROETHENE (TOTAL)	1.1E-03	1.1E-03		1.1E-03		1.0E-05
ARSENIC	1.2E-01		1.2E-01			5.2E-05
IRON	1.1E+00			1.1E+00	1.1E+00	9.3E-03
	HI BY TARGET ORGAN	1.1E-03	1.2E-01	1.1E+00	1.1E+00	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 27-12a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE 29
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN				
SUBSTANCE	GROUNDWATER INGESTION	CARDIO-VASCULAR SYSTEM	SKIN	LIVER	DIGESTIVE SYSTEM	GROUNDWATER DERMAL CONTACT
1,2-DICHLOROETHENE (TOTAL)	6.7E-04	6.7E-04		6.7E-04		8.9E-06
ARSENIC	5.4E-02		5.4E-02			3.3E-05
IRON	4.9E-01			4.9E-01	4.9E-01	5.7E-03
	HI BY TARGET ORGAN	6.7E-04	5.4E-02	4.9E-01	4.9E-01	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 27-13
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 29
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDD	1.4E-08	2.1E-08	3.6E-13
4,4'-DDE	1.8E-08	2.6E-08	4.6E-13
4,4'-DDT	2.1E-08	3.0E-08	6.3E-13
ALPHA-BHC	6.6E-10	7.6E-10	2.0E-14
ALPHA-CHLORDANE	1.3E-09	1.9E-09	4.0E-14
GAMMA-CHLORDANE	1.7E-09	2.5E-09	5.2E-14
TOTAL RISK	5.7E-08	8.2E-08	1.6E-12

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

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TABLE 27-14
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 29
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	1.0E-03	1.2E-03	1.5E-08
ALPHA-BHC	N/A	N/A	N/A
ALPHA-CHLORDANE	1.4E-04	1.7E-04	2.0E-09
GAMMA-CHLORDANE	1.8E-04	2.2E-04	2.7E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for residential exposure to groundwater are discussed in Section 27.7.1.4 and presented in Tables 27-15, 27-16, and 27-16a.

27.7.1.3 Lead Results

Lead was not found above the EPA level of concern (400 mg/kg) in soil samples or above the EPA action level (15 ug/L) in groundwater samples taken during the RI.

The IEUBK Lead Model (v. 0.99) was used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site 29 exposures are presented in Appendix I.

27.7.1.4 Amended Risk Assessment

The amended risk assessment recalculated the cancer and non-cancer risks at Site 29 for future residential and future industrial receptors assuming exposure to COPCs in groundwater.

Comparison to Background

Cadmium was eliminated from consideration as a groundwater COPC based on a comparison of average level to twice the background level. However, since arsenic is a class A carcinogen, it could not be eliminated from consideration. Table 27-5 presents the comparison of COPCs to background concentrations. No other metals could be eliminated based on comparison to background upper 95 percent UTLs.

After elimination of COPCs similar to background, the final RME cancer risks for the future lifetime resident and the future industrial receptor assuming exposure to COPCs in groundwater at Site 29 are within the mid-range of the target acceptable risk range. Arsenic (via ingestion) is the principal COPC contributing to the groundwater RME cancer risks. Estimated RME carcinogenic risks are presented for future industrial and future residential receptors exposed to groundwater at Site 29 in Tables 27-11 and 27-15, respectively.

Consideration of Target Organ Grouping

The revised noncarcinogenic HIs were greater than 1.0 for exposure to groundwater via ingestion by future residential and future industrial receptors; therefore, these risks were grouped according to target organ.

TABLE 27-15
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE 29
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	GROUNDWATER INGESTION - LIFETIME	GROUNDWATER DERMAL CONTACT - LIFETIME	INHALATION OF VOAS IN GW - ADULT
1,2-DICHLOROETHENE (TOTAL)	N/A	N/A	N/A
ARSENIC	8.3E-05	2.0E-07	N/A
IRON	N/A	N/A	N/A
TOTAL RISK	8.3E-05	2.0E-07	N/A

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 27-16
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 29
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	LIVER	DIGESTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
1,2-DICHLOROETHENE (TOTAL)	7.1E-03	7.1E-03		7.1E-03		3.9E-04	N/A
ARSENIC	7.9E-01		7.9E-01			1.6E-03	N/A
IRON	7.4E+00			7.4E+00	7.4E+00	2.9E-01	N/A
	HI BY TARGET ORGAN	7.1E-03	7.9E-01	7.4E+00	7.4E+00		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 27-16a
CENTRAL TENDENCY NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE 29
GROUNDWATER, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

		GW INGESTION BY TARGET ORGAN					
SUBSTANCE	GROUNDWATER INGESTION - CHILD	CARDIO-VASCULAR SYSTEM	SKIN	LIVER	DIGESTIVE SYSTEM	GROUNDWATER DERMAL CONTACT - CHILD	INHALATION OF VOAS IN GW - ADULT
1,2-DICHLOROETHENE (TOTAL)	3.3E-03	3.3E-03		3.3E-03		2.6E-04	N/A
ARSENIC	2.7E-01		2.7E-01			7.8E-04	N/A
IRON	2.4E+00			2.4E+00	2.4E+00	1.4E-01	N/A
	HI BY TARGET ORGAN	3.3E-03	2.7E-01	2.4E+00	2.4E+00		

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

The resulting final RME HIs are greater than 1.0. Iron was the principal COPC responsible for HIs of 7.4 for the target organs liver and digestive system with the future residential child and for HIs of 1.1 (same target organs) with the future industrial receptor. Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0. RME noncarcinogenic risks are presented for future industrial and future residential receptors exposed to groundwater at Site 29 in Tables 27-12 and 27-16, respectively.

Application of Central Tendencies Guidance

Central tendency assumptions were applied to calculate non-cancer risks for exposure to COPCs in groundwater for the future child resident and for the future industrial employee. Central tendency generates a lower risk estimate than RME because it assumes typical rather than upper range receptor behavior patterns related to the ingested dose. Based on this evaluation, the estimated central tendency noncarcinogenic HIs are less than 1.0 for the future industrial receptor; however, for the future child resident, the noncarcinogenic HIs are greater than 1.0 for the liver and digestive system (HIs of 2.4; principal contributor - iron). Adverse noncarcinogenic effects cannot be ruled out when the HI is greater than 1.0.

Estimated central tendency noncarcinogenic HIs are presented for exposure to groundwater for future industrial receptors in Table 27-12a and for future residential child receptors in Table 27-16a.

27.7.2 Conclusions

Subsurface soil and groundwater were sampled at Site 29. The potential receptors for this site were future industrial and future residential receptors. The RME cancer risks associated with the future residential and future industrial (subsurface soil and groundwater) exposure scenarios were within the 1E-04 to 1E-06 target acceptable risk range. Iron (via ingestion of groundwater) was the principal COPC that contributed to these carcinogenic risks.

The noncarcinogenic HQs associated with future industrial (groundwater) and future residential (groundwater) exposure scenarios exceeded 1.0; the cutoff point below which adverse effects are not expected to occur. Iron (via ingestion of groundwater) was the COPC that exceeded 1.0 for these exposure scenarios. In addition, central tendency risk estimates for residential exposure to groundwater yielded HIs greater than 1.0 for the liver and digestive system as the target organs.

Lead concentrations at the site were below EPA guideline limits and are not expected to be associated with significant increases in blood-lead levels based on the results of the IEUBK Lead Model (v. 0.99).

The amended risk assessment procedure did not result in the elimination of all COPCs which had calculated risk above target guideline limits. Iron remained with HQs above 1.0 for groundwater ingestion by the future residential child receptor.

Risk characterization results (total RME cancer risks and total RME noncarcinogenic HIs) are presented for all potential receptors at Site 29 in Table 27-17 for subsurface soil and groundwater. Table 27-17a presents the relevant central tendency risk estimates associated with future residential receptors for groundwater.

27.8 ECOLOGICAL RISK

27.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

The PCB spill site comprises a relatively small area, which was located in a graveled parking lot in a heavily developed area. The developed area also contains Site 16, located approximately 300 yards south of Site 29, and Site 1, located approximately 300 yards to the northeast. Site 29 currently is the site of construction of the new NWS Earle hazardous waste storage facility, and therefore contains no vegetation. Drainage from the site is northward to a small swale. Water flows in the swale only after periods of heavy rain. The swale contains saturated soil and some *Phragmites.* Forested wetlands are present to the east, across the railroad tracks near the spill site. Wetlands are also present to the west of Saipan Road, approximately 300 feet west of the site. Wetland vegetation east and west of the spill site is dominated by red maple, pitch pine, and gray birch on Manahawkin muck soils. The spill site contains no ecological habitat, while the off-site wetlands contain excellent habitat, primarily for terrestrial receptors. Since the wetland areas are mostly forested, they are probably utilized by white-tailed deer, gray and red fox, and several species of small mammals. Woodland avian species are also expected to utilize these wooded areas. The closest surface water is a small tributary of Hockhockson Brook located approximately 300 yards to the east, and as a result, Site 29 is located within the Hockhockson Brook Watershed. No sensitive habitats, other than the wetlands, or threatened or endangered species occur on or near the site.

TABLE 27-17
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 29
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	1.3E-08	5.7E-08	N/A	N/A	1.0E-04	1.3E-03	N/A	N/A
	Dermal Contact	N/A	2.5E-08	8.2E-08	N/A	N/A	2.0E-04	1.6E-03	N/A	N/A
	Inhalation of Fugitive Dust	N/A	2.6E-12	1.6E-12	N/A	N/A	1.9E-08	2.0E-08	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	1.9E-05^	8.3E-05^	N/A	N/A	1.1E+00@	7.4E+00@	N/A	N/A
	Dermal Contact	N/A	8.4E-09^	2.0E-07^	N/A	N/A	9.4E-03^	2.9E-01^	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	1.9E-05	8.3E-05	-	-	1.1E+00	7.7E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

TABLE 27-17a
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE 29
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index***				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/R	N/R	N/A	N/A	N/R	N/R	N/A	N/A
	Dermal Contact	N/A	N/R	N/R	N/A	N/A	N/R	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/R	N/R	N/A	N/A	N/R	N/R	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	N/R	N/R	N/A	N/A	4.9E-01@	2.4E+00@	N/A	N/A
	Dermal Contact	N/A	N/R	N/R	N/A	N/A	5.7E-03^	1.4E-01^	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/A**	N/A	N/A	N/A	N/A	N/A**	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	-	-	-	-	5.0E-01	2.5E+00	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = No volatiles were detected in groundwater
*** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assessment.
@ - Result is the maximum of the HIs among the affected target organs from the amended risk assessment.

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Contaminant Sources, Release Mechanisms, and Migration Pathways

The major release pathway from the site is overland runoff, and to a lesser extent, infiltration of contaminants. Precipitation runoff may carry constituents to nearby wetland areas, although the railroad area to the east and Saipan Road and the storage area to the west severely inhibit this migration pathway, as does low flow in the drainage swale. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a contaminant may be carried with the flow of groundwater to downgradient locations. Groundwater from the site may eventually discharge to wetland surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. This migration pathway is limited, however, since surface water is scarce near the site, even in the wetlands.

Exposure Routes

Terrestrial receptors associated with Site 29 may be exposed to surface soil contaminants via incidental ingestion of soil and ingestion of contaminated food items, although this is limited since the site is heavily developed. Terrestrial receptors may also come into contact with contaminants in Site 29 surface water by using it as drinking water, but this is unlikely since surface water near the site is limited.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1993 SI and 1995 RI activities for this site. In particular, contaminants detected in Site 29 soils were considered preliminary COPCs.

27.8.2 Summary and Conclusions

Site 29 PCB spill area was remediated as part an immediate removal action at the time of the original spill. It contains little ecological habitat of value due to construction on the site, although forested wetland habitats are present near the site. Runoff of contaminants to the forested wetland areas is possible, but is inhibited by the developed areas around the site, and infrequent flow in the drainage swale. The spill area was small and was excavated within five days after the spill, minimizing the probability of migration. In the SI, five soil samples were taken in the area where soils were removed. Trace levels of some organochlorine pesticides, PCBs, and TPH were detected, and one elevated concentration (28,000 mg/kg) of TPH was detected. For the most part, subsurface soil samples taken during 1995 RI activities contained low levels (below levels of concern) of the same compounds detected in the SI. A sediment sample , 16 SD 01 (and a duplicate), taken in the storm drain east of Site 29 and south of Site 16, represents the only potential overland runoff pathway to the wetlands east of Site 29. No PCBs were detected in 16 SD 01

or its duplicate. With the exception of a few slightly elevated detections for some metals, 1995 RI groundwater samples indicated that impacts to groundwater at the site were minimal, and no PCBs or organochlorines were detected. Any residual PCBs, or organochlorine pesticides and petroleum hydrocarbons, detected at the site are not expected to significantly migrate via overland runoff or infiltration due to their strong affinity for organic fractions in soils and sediments, nor is there evidence that they may have migrated before they were removed, because of the quick and apparently adequate removal response.

Since risk numbers would be mitigated by the factors mentioned above, quantitative ecological risk assessment at Site 29 was not applicable. For these reasons, potential ecological risks from site contaminants appear negligible, as is the potential for contaminant contributions to the Hockhockson Brook Watershed. Therefore, Site 29 was excluded from further consideration.

27.9 EVALUATION AND RECOMMENDATIONS

27.9.1 Evaluation Summary

Groundwater downgradient of the site contains iron at concentrations resulting in non-cancer HQs above 1. Groundwater also has concentrations of aluminum, iron and manganese above NJDEP GWQSs.

Subsurface soil downgradient of Site 29 was found to be in the range of background quality.

Human health risk was found to be above guideline ranges due to iron in the groundwater.

There is no evidence that this site may be affecting ecological receptors in the area.

27.9.2 Recommendations

Site 29 monitoring wells may be able to serve as monitoring wells for Site 16/F.

No further action appears necessary.

28.0 EPIC SITE L: MSC VAN PARKING LOT

28.1 SITE BACKGROUND AND PHYSICAL SETTING

Epic Site L is comprised of a 15.7-acre area near Asbury Avenue and Pine Brook Road. Approximately one-third of the site was used at one time for storage of new and old telephone poles, railroad ballast stone, miscellaneous metal, plastic, and wood scrap material, and small asphalt and concrete piles. Materials have been stored at the site for 25 to 30 years, and past storage practices are not well documented. Figure 28-1 shows the site and RI sample locations.

28.2 PREVIOUS INVESTIGATIONS

28.2.1 Summary of Activities and Results

The Preliminary Assessment Addendum (1992) consisted of interviews and aerial photo analysis.

28.2.2 Summary of Conclusions

A stained area near a treated utility pole storage area and a hardened pile of asphalt were observed.

28.2.3 Data Gaps (Objectives of Remedial Investigation)

Based on limited investigations, follow-up remedial investigation activities were developed to meet the following objective:

- Determine if storage and disposal activities have impacted site soils.

28.3 RI FIELD INVESTIGATIONS

B&R Environmental collected eight surface soil samples (L SS 01 through L SS 08 including one field duplicate) in December 1995. Surface soil samples were obtained from representative locations at former storage areas at a depth of 0 to 0.5 feet bgs. The surface soil primarily consisted of grayish-brown to brown, silty, fine- to medium-grained sand. Figure 28-1 shows sample locations. Table 28-1 presents the sampling rationale for each sample taken. Surface soil samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOCs, TPH, TAL metals, and TCL pesticides/PCBs analysis.

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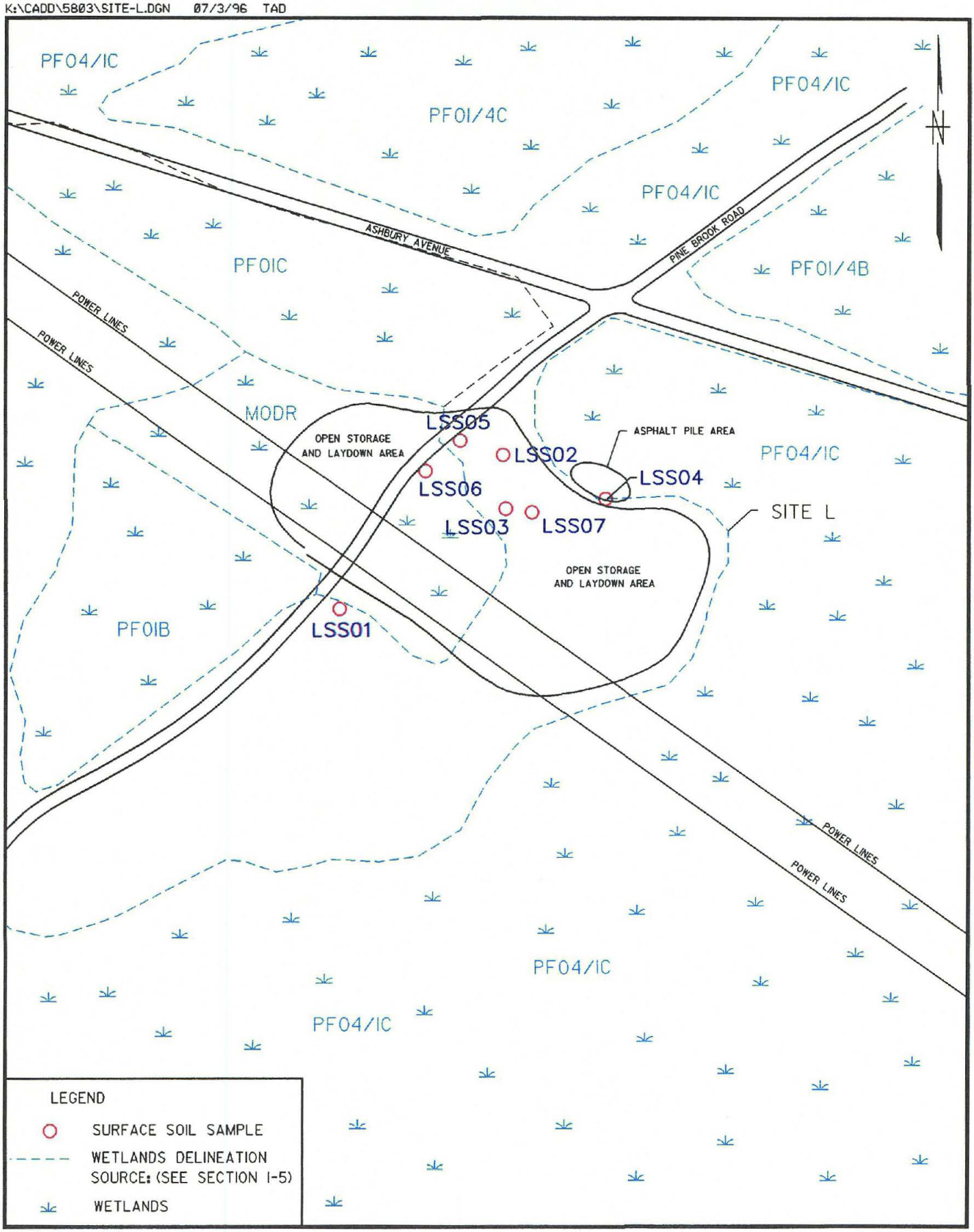

SAMPLE LOCATIONS

EPIC SITE L-MSC VAN PARKING LOT

0 200 400

SCALE IN FEET

FIGURE 28-1

Brown & Root Environmental

Table 28-1
EPIC Site L Sampling Locations and Rationale
NWS Earle, Colts Neck, New Jersey

Sample	Sample Location	Sampling Rationale
One surface soil sample (SS-1).	Collect from asphalt pile along powerline.	Determine if asphalt storage has impacted soil.
Two surface soil samples (SS-2 and SS-3).	Collect from pile of telephone poles.	Determine if telephone pole storage has impacted soil
One surface soil sample (SS-4).	Collect from asphalt pile north of site.	Determine if past/current storage activities have impacted soil.
Three surface soil samples (SS-5 to SS-7).	Collect at drainage depressions or areas where offsite migration is possible.	Determine if contamination may be moving from site.

The field team performed a survey to establish horizontal locations and elevations of the surface soil samples. Surveying notes are provided in Appendix F.

28.4 SITE CHARACTERISTICS

28.4.1 Geology

Regional mapping places Site L within the outcrop area of the Kirkwood Formation; upper colluvium may be present at the site. The upper colluvium consists of massive sand and gravel and may contain quartz and ironstone pebbles. The Kirkwood Formation consists of gray and tan, very fine- to medium-grained, quartz sand and dark-colored, micaceous, diatomaceous clay. The presence of upper colluvium or the Kirkwood Formation beneath the site cannot be confirmed because no soil borings were drilled at the site. The lithology of the sediments encountered in borings at Sites 5 and 10 generally agrees with the published description of the upper colluvium and the Kirkwood and Vincentown Formations. Site 5 is located about 3,000 feet east and Site 10 is located about 2,500 feet west-southwest of the site. In general, the borings at Site 5 encountered brown and gray, very fine- to medium-grained sand and dark-colored silt (probably representative of the Kirkwood Formation) and olive and olive-brown, slightly glauconitic, fine- to coarse-grained sand (possibly representative of the Vincentown Formation). The borings at Site 10 encountered gray pebbly sand (possibly representative of the upper colluvium), brownish-yellow, fine- to medium-grained sand (probably representative of the Kirkwood Formation), and olive and dark greenish-gray, glauconitic, fine- to medium-grained sand (probably representative of the Vincentown Formation).

28.4.2 Hydrogeology

Groundwater conditions at the site cannot be confirmed because no wells were installed at the site. However, groundwater in the Kirkwood and Vincentown aquifer beneath Sites 5 and 10, and presumably Site L, occurs under unconfined conditions, and the formations are interpreted to be hydraulically interconnected. The direction of shallow groundwater flow in the aquifer beneath Site 5, as indicated by the August and October groundwater contour maps, is toward the northeast. The direction of groundwater flow in the aquifer beneath Site 10, as indicated by the August and October groundwater contour maps, is toward the northwest, north, and northeast.

28.5 NATURE AND EXTENT OF CONTAMINATION

28.5.1 Surface Soils

Seven surface soil samples were collected at Epic Site L (Figure 28-1). Tables 28-2 and 28-3 present the occurrence and distribution of inorganic and organic chemicals, respectively, in site-related samples and compare them to background values as presented in Section 31. Tables 28-2a and 28-2b present a comparison of detected compounds to ARARS and TBCs. Figure 28-2 shows sample locations and concentrations of compounds that exceed ARARS and TBCs.

28.5.1.1 Inorganics

Concentrations of most metals in site-related surface soil samples were similar to the ranges associated with background samples. Site-related concentrations of arsenic, beryllium, and chromium were detected below the background concentration range. However, they are EPA-designated carcinogenic inorganic chemicals and therefore are included as COPCs.

Copper, lead, zinc, and cadmium were found at concentrations above background. The highest concentrations of these metals were seen in sample L SS 02. Cadmium was detected above background levels in sample L SS 03.

No inorganic chemicals were detected above New Jersey state standards.

28.5.1.2 Organics

Because most organic chemicals on the TCL are not naturally occurring, all detected organic compounds are included as COPCs. Site-related surface soil samples exhibited low levels of 15 PAHs, 1,3-dichlorobenzene, 1,4-dichlorobenzene, bis(2-chloroethyl)ether, hexachloroethane, phenol, and 10 pesticides. Methylene chloride, a common laboratory contaminant, was detected in one site-related sample (L SS 06) at a concentration of 8 ug/kg.

No organic compounds were detected above state standard levels.

Three compounds (fluoranthene, pyrene, and 4,4'-DDT) were detected at levels above background. The highest concentrations of fluoranthene (160 ug/kg to 3,800 ug/kg) and pyrene (150 ug/kg to 2,200 ug/kg) were detected in L SS 03-DUP. The highest concentration of 4,4'-DDT (1,500 ug/kg) was detected in sample L SS 01.

TABLE 28-2
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN SURFACE SOIL AT SITE L
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM*	4 / 4	1710 - 5310	6152.50	7 / 7	612 - 3000	1451.36	NO	2483.57
ARSENIC	4 / 4	1.35 - 14.4	13.43	6 / 7	0.93 - 5.9	2.67	NO	5.9
BARIUM*	4 / 4	1.85 - 31	22.53	7 / 7	1.9 - 24.3	11.41	NO	24.3
BERYLLIUM*	1 / 4	0.28	0.39	5 / 7	0.073 - 0.19	0.10	NO	0.19
CADMIUM*	1 / 4	0.57	0.67	6 / 7	0.069 - 1	0.37	NO	1
CALCIUM	4 / 4	40.1 - 519	551.80	7 / 7	59.1 - 10800	2168.99	YES	5018.85
CHROMIUM*	4 / 4	7.8 - 59.5	69.05	7 / 7	4.6 - 26.7	13.51	NO	26.7
COBALT*	2 / 4	0.75 - 5	3.15	5 / 7	0.15 - 2	0.54	NO	1.02
COPPER	4 / 4	0.97 - 8.4	10.06	7 / 7	2.6 - 37.8	11.80	YES	21.17
IRON*	4 / 4	3745 - 62500	52402.50	7 / 7	2390 - 8860	5476.43	NO	8860
LEAD*	4 / 4	1.8 - 39.4	37.30	7 / 7	6.55 - 78.6	30.24	NO	78.6
MAGNESIUM	4 / 4	71.7 - 619	578.85	7 / 7	46.15 - 1520	450.75	NO	846.18
MANGANESE*	4 / 4	3.45 - 214	128.33	7 / 7	6 - 65.1	28.73	NO	65.1
MERCURY*	4 / 4	0.035 - 0.17	0.18	7 / 7	0.0345 - 0.068	0.04	NO	0.05
NICKEL*	2 / 4	1.8 - 7.2	5.18	6 / 7	0.61 - 5.4	1.87	NO	3.11
POTASSIUM	4 / 4	95 - 792	912.50	7 / 7	49.2 - 642	254.06	NO	642
SILVER	2 / 4	0.37 - 0.67	0.69	1 / 7	0.18	0.10	NO	0.18
SODIUM	4 / 4	17.5 - 86.2	78.30	7 / 7	16.65 - 278	66.36	NO	135.43
VANADIUM*	4 / 4	11.05 - 64	70.13	7 / 7	7.6 - 24.4	15.06	NO	23.41
ZINC	3 / 4	1.1 - 27.6	22.80	7 / 7	5.3 - 162	37.16	YES	78.34

Note: Selected COPCs are indicated in boldface type.
* - Indicates COPCs eliminated based on amended risk assessment.

TABLE 28-3
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SURFACE SOIL AT SITE L
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
1,3-DICHLOROBENZENE	NOT DETECTED	-	-	1 / 7	63	63
1,4-DICHLOROBENZENE	NOT DETECTED	-	-	1 / 7	63	63
4,4'-DDD	NOT DETECTED	-	-	3 / 6	4.9 - 82	43.34
4,4'-DDE	2 / 4	16 - 330	277.86	4 / 7	1.6 - 120	73.09
4,4'-DDT	2 / 4	43 - 420	355.71	7 / 7	1.6 - 1500	637.19
ACENAPHTHENE	NOT DETECTED	-	-	2 / 7	47 - 66	66
ACENAPHTHYLENE	NOT DETECTED	-	-	1 / 7	42	42
ANTHRACENE	NOT DETECTED	-	-	2 / 7	87 - 170	170
BENZO(A)ANTHRACENE	NOT DETECTED	-	-	3 / 7	71 - 630	366.59
BENZO(A)PYRENE	NOT DETECTED	-	-	4 / 7	70 - 700	377.11
BENZO(B)FLUORANTHENE	NOT DETECTED	-	-	4 / 7	160 - 1150	744.89
BENZO(G,H,I)PERYLENE	NOT DETECTED	-	-	2 / 7	104 - 520	322.34
CARBAZOLE	NOT DETECTED	-	-	2 / 7	55 - 215	215
CHRYSENE	NOT DETECTED	-	-	4 / 7	90 - 1095	641.56
DIBENZ(A,H)ANTHRACENE	NOT DETECTED	-	-	1 / 7	190	190
DIBENZOFURAN	NOT DETECTED	-	-	2 / 7	56 - 74	74
DIELDRIN	1 / 4	0.49	0.49	1 / 5	0.3	0.3
FLUORANTHENE	2 / 4	40 - 84	84	5 / 7	46 - 3150	1527.74
FLUORENE	NOT DETECTED	-	-	2 / 7	53 - 120	120
GAMMA-CHLORDANE	NOT DETECTED	-	-	3 / 6	0.38 - 8	4.78
HEPTACHLOR	NOT DETECTED	-	-	2 / 7	0.17 - 0.27	0.27
HEPTACHLOR EPOXIDE	NOT DETECTED	-	-	1 / 7	1	1
HEXACHLOROETHANE	NOT DETECTED	-	-	1 / 7	47	47
INDENO(1,2,3-CD)PYRENE	NOT DETECTED	-	-	3 / 7	50 - 530	319.45
METHOXYCHLOR	NOT DETECTED	-	-	1 / 7	5.8	5.8
METHYLENE CHLORIDE	NOT DETECTED	-	-	1 / 7	8	6.67
NAPHTHALENE	NOT DETECTED	-	-	2 / 7	43 - 45	45
PHENANTHRENE	NOT DETECTED	-	-	4 / 7	65 - 1900	963.35
PHENOL	NOT DETECTED	-	-	1 / 7	43	43
PYRENE	1 / 4	46	46	4 / 7	150 - 1900	1082.98

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TABLE 28-2a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE L

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_LSS01	_LSS02	_LSS03	_LSS03-DUP	_LSS04	_LSS05	ARARS & TBCs		
LOCATION:	_LSS01	_LSS02	_LSS03	_LSS03	_LSS04	_LSS05	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.			
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	612	1450	977	1100	1710	879	-	-	-
arsenic	2.7	2.7	1.6	1.8	4.5	0.58 U	20.0	20.0	-
barium	2.4	24.3	1.6	2.2	10.4	5.6	700	47000	-
beryllium	0.061 U	0.10	0.084 U	0.084 U	0.19	0.073	1.00	1.00	-
cadmium	0.075 U	0.51	1.0 J	0.59 U	0.16	0.069	1.00	100	-
calcium	59.1	255	76.8	86.8	1720	417	-	-	-
chromium, total	24.0	5.8	6.7	7.4	26.7	4.6	-	500	-
cobalt	0.14 U	0.31	0.86 U	0.86 U	0.41	0.15	-	-	-
copper	3.5	37.8 J	3.0	2.2	5.8 J	5.2	600	600	-
iron	5000	3280	7060	7390	8860	2390	-	-	-
lead	12.0	78.6	6.2 J	6.9 J	15.6	45.9	400	600	-
magnesium	88.1	66.0	42.9	49.4	423	236	-	-	-
manganese	6.0	17.1	6.5 J	7.7 J	25.7	18.6	-	-	-
mercury	0.041	0.036	0.031	0.038	0.040	0.043	14.0	270	-
nickel	0.61	1.8	0.80 U	0.79 U	1.9	1.0	250	2400	-
potassium	211	49.2	63.2	73.7	642	60.8	-	-	-
silver	0.077 U	0.071 U	0.64 U	0.64 U	0.073 U	0.069 U	110	4100	-
sodium	30.9	24.5	19.8	13.5	33.0	27.4	-	-	-
vanadium	24.4	7.8	15.4 J	16.3 J	16.9	7.6	370	7100	-
zinc	8.1 J	162 J	5.3	5.3	22.0 J	7.5 J	1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
1,3-dichlorobenzene	400 U	370 U	63.0 J	370 U	380 U	350 U	5100000	10000000	100000
1,4-dichlorobenzene	400 U	370 U	63.0 J	370 U	380 U	350 U	570000	10000000	100000
acenaphthene	400 U	370 U	370 U	47.0 J	380 U	350 U	3400000	10000000	100000
acenaphthylene	400 U	370 U	370 U	370 U	380 U	350 U	-	-	-
anthracene	400 U	370 U	77.0 J	97.0 J	380 U	350 U	10000000	10000000	100000
benzo(a)anthracene	400 U	370 U	160 J	220 J	71.0 J	350 U	900	4000	500000
benzo(a)pyrene	400 U	370 U	85.0 J	110 J	80.0 J	350 U	660	660	100000

TABLE 28-2a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE L

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_LSS01		_LSS02		_LSS03		_LSS03-DUP		_LSS04		_LSS05		ARARS & TBCs		
LOCATION:	_LSS01		_LSS02		_LSS03		_LSS03		_LSS04		_LSS05		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.				
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	400	U	370	U	1100	E	1200	E	160	J	350	U	900	4000	50000
benzo(g,h,i)perylene	400	U	370	U	98.0	J	110	J	380	U	350	U	-	-	-
bis(2-chloroethyl)ether	400	U	370	U	43.0	J	370	U	380	U	350	U	-	-	-
carbazole	400	U	370	U	190	J	240	J	380	U	350	U	-	-	-
chrysene	400	U	370	U	990		1200		90.0	J	350	U	9000	40000	500000
dibenz(a,h)anthracene	400	U	370	U	370	U	370	U	380	U	350	U	660	660	100000
dibenzofuran	400	U	370	U	63.0	J	85.0	J	380	U	350	U	-	-	-
fluoranthene	400	U	46.0	J	2500		3800		160	J	350	U	2300000	10000000	100000
fluorene	400	U	370	U	370	U	53.0	J	380	U	350	U	2300000	10000000	100000
hexachloroethane	400	U	370	U	47.0	J	370	U	380	U	350	U	6000	100000	100000
indeno(1,2,3-cd)pyrene	400	U	370	U	120	J	140	J	50.0	J	350	U	900	4000	500000
naphthalene	400	U	370	U	43.0	J	370	U	380	U	350	U	230000	4200000	100000
phenanthrene	400	U	370	U	1400		2400		91.0	J	350	U	-	-	-
phenol	400	U	370	U	43.0	J	370	U	380	U	350	U	10000000	10000000	50000
pyrene	400	U	370	U	1600		2200		150	J	350	U	1700000	10000000	100000
VOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
methylene chloride	12.0	U	11.0	U	11.0	U	11.0	U	11.0	U	11.0	U	49000	210000	1000
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	82.0	NJ	3.7	U	3.7	U	3.7	U	9.8		3.5	U	3000	12000	50000
4,4'-DDE	120	J	3.7	U	3.7	U	3.7	U	96.0		3.6	U	2000	9000	50000
4,4'-DDT	1500		2.3	J	2.1	NJ	2.2	R	39.0		1.6	J	2000	9000	500000
alpha-chlordane	2.1	U	1.9	U	1.9	U	1.9	U	9.7	NJ	1.8	U	-	-	-
dieldrin	4.0	U	0.30	J	3.7	U	3.7	U	3.7	U	0.21	R	42.0	180	50000
endosulfan II	4.0	U	3.7	U	3.7	U	6.7	R	3.7	U	3.5	U	340000	6200000	50000
gamma-BHC (Lindane)	2.1	U	1.9	U	0.35	R	0.57	R	1.9	U	1.8	U	520	2200	50000
gamma-chlordane	0.60	R	1.9	U	1.9	U	1.9	U	8.0		1.8	U	-	-	-
heptachlor	2.1	U	0.17	J	1.9	U	1.9	U	0.27	NJ	1.8	U	150	650	50000
heptachlor epoxide	2.1	U	1.9	U	1.9	U	1.9	U	1.0	J	1.8	U	-	-	-

TABLE 28-2a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE L

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_LSS01		_LSS02		_LSS03		_LSS03-DUP		_LSS04		_LSS05		ARARS & TBCs		
LOCATION:	_LSS01		_LSS02		_LSS03		_LSS03		_LSS04		_LSS05		NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.		1995 RI, Dec.				
PESTICIDES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**	**ug/kg**	**ug/kg**
methoxychlor	20.0	U	19.0	U	5.8	NJ	8.5	R	19.0	U	18.0	U	280000	5200000	50000

TABLE 28-2a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE L

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_LSS06	_LSS07	---	---	---	---	ARARS & TBCs		
LOCATION:	_LSS06	_LSS07	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.							
INORGANICS	**mg/kg**	**mg/kg**					**mg/kg**	**mg/kg**	**mg/kg**
aluminum	1470	3000					-	-	-
arsenic	0.93	5.9					20.0	20.0	-
barium	17.1	18.2					700	47000	-
beryllium	0.15	0.12					1.00	1.00	-
cadmium	0.27	0.52					1.00	100	-
calcium	1850	10800					-	-	-
chromium, total	9.2	17.2					-	500	-
cobalt	0.39	2.0					-	-	-
copper	8.4 J	19.3 J					600	600	-
iron	3880	7700					-	-	-
lead	21.8	31.2					400	600	-
magnesium	776	1520					-	-	-
manganese	61.5	65.1					-	-	-
mercury	0.042	0.068					14.0	270	-
nickel	2.0	5.4					250	2400	-
potassium	195	552					-	-	-
silver	0.18	0.077 U					110	4100	-
sodium	54.1	278					-	-	-
vanadium	14.3	18.6					370	7100	-
zinc	19.6 J	35.6 J					1500	1500	-
SEMIVOLATILES	**ug/kg**	**ug/kg**					**ug/kg**	**ug/kg**	**ug/kg**
1,3-dichlorobenzene	380 U	400 U					5100000	10000000	100000
1,4-dichlorobenzene	380 U	400 U					570000	10000000	100000
acenaphthene	380 U	66.0 J					3400000	10000000	100000
acenaphthylene	380 U	42.0 J					-	-	-
anthracene	380 U	170 J					10000000	10000000	100000
benzo(a)anthracene	380 U	630					900	4000	500000
benzo(a)pyrene	70.0 J	700 E					660	660	100000

TABLE 28-2a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE L

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_LSS06		_LSS07		---	---	---	---	ARARS & TBCs		
LOCATION:	_LSS06		_LSS07		---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.		1995 RI, Dec.								
SEMIVOLATILES	**ug/kg**		**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
benzo(b)fluoranthene	160	J	960	E					900	4000	50000
benzo(g,h,i)perylene	380	U	520						-	-	-
bis(2-chloroethyl)ether	380	U	400	U					-	-	-
carbazole	380	U	55.0	J					-	-	-
chrysene	110	J	680						9000	40000	500000
dibenz(a,h)anthracene	380	U	190	J					660	660	100000
dibenzofuran	380	U	56.0	J					-	-	-
fluoranthene	170	J	1000						2300000	10000000	100000
fluorene	380	U	120	J					2300000	10000000	100000
hexachloroethane	380	U	400	U					6000	100000	100000
indeno(1,2,3-cd)pyrene	380	U	530						900	4000	500000
naphthalene	380	U	45.0	J					230000	4200000	100000
phenanthrene	65.0	J	710						-	-	-
phenol	380	U	400	U					10000000	10000000	50000
pyrene	170	J	1200						1700000	10000000	100000
VOLATILES	**ug/kg**		**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
methylene chloride	8.0	J	12.0	U					49000	210000	1000
PESTICIDES	**ug/kg**		**ug/kg**						**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	0.48	R	4.9	NJ					3000	12000	50000
4,4'-DDE	1.6	J	28.0						2000	9000	50000
4,4'-DDT	7.2		14.0						2000	9000	500000
alpha-chlordane	0.42	NJ	2.6	J					-	-	-
dieldrin	0.38	R	4.0	U					42.0	180	50000
endosulfan II	3.7	U	4.0	U					340000	6200000	50000
gamma-BHC (Lindane)	1.9	U	0.14	R					520	2200	50000
gamma-chlordane	0.38	J	3.1						-	-	-
heptachlor	1.9	U	2.0	U					150	650	50000
heptachlor epoxide	1.9	U	2.0	U					-	-	-

TABLE 28-2a

COMPARISON OF SURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE L

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_LSS06	_LSS07	---	---	---	---	ARARS & TBCs		
LOCATION:	_LSS06	_LSS07	---	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.							
PESTICIDES	ug/kg	ug/kg					ug/kg	ug/kg	ug/kg
methoxychlor	19.0 U	20.0 U					280000	5200000	50000

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

TABLE 28-2b

COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE L

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_LSS01	_LSS02	_LSS03	_LSS04	_LSS05	ARARS & TBCs		
LOCATION:	_LSS01	_LSS02	_LSS03	_LSS04	_LSS05	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.			
MISCELLANEOUS								
moisture %	18.2	10.1	9.6	12.4	7.1	-	-	-
pH	3.9	5.7	4.4	7.7	7.2	-	-	-
petroleum hydrocarbons mg/kg	80.0	40.0	n/a	60.0	40.0	10000 @	10000 @	-

SAMPLE NUMBER:	_LSS06	_LSS07	_LSS08	---	---	ARARS & TBCs		
LOCATION:	_LSS06	_LSS07	_LSS08	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.					
MISCELLANEOUS								
moisture %	11.7	17.3	9.6			-	-	-
pH	7.1	10.2	4.4			-	-	-
petroleum hydrocarbons mg/kg	130	2300	30.0			10000 @	10000 @	-

TABLE 28-2b
COMPARISON OF SURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE L
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

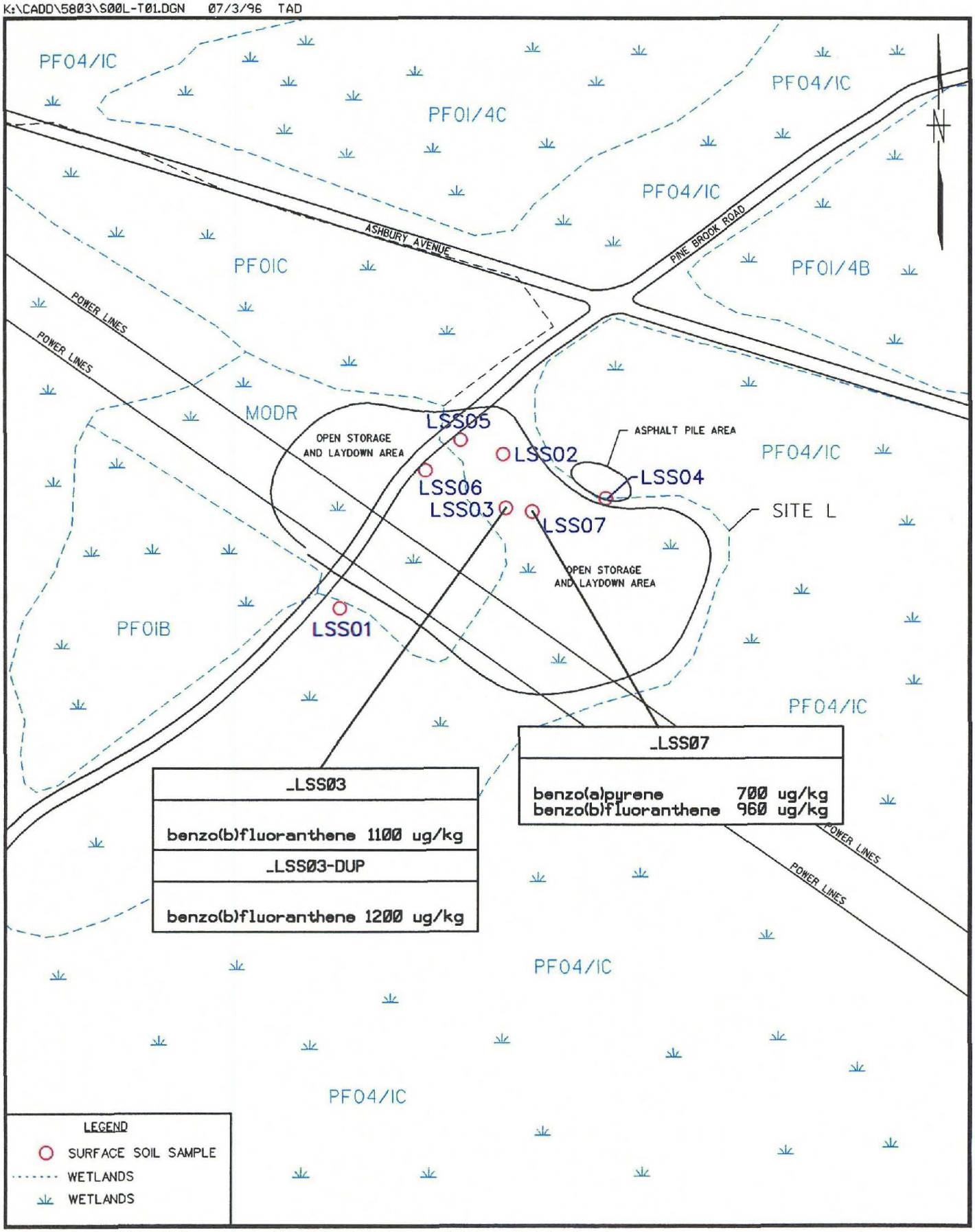
E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

K:\CADD\5803\S00L-T01.DGN 07/3/96 TAD



_LSS03
benzo(b)fluoranthene 1100 ug/kg
_LSS03-DUP
benzo(b)fluoranthene 1200 ug/kg

_LSS07	
benzo(a)pyrene	700 ug/kg
benzo(b)fluoranthene	960 ug/kg

0 200 400
SCALE IN FEET

CONCENTRATIONS ABOVE SCREENING LEVELS
EPIC SITE L-MSC VAN PARKING LOT

FIGURE 28-2

Brown & Root Environmental

28.5.1.3 Miscellaneous Parameters

The seven surface soil samples collected were analyzed for moisture (6.4 percent to 18.2 percent), pH (3.93 to 10.2), and TPH (30 mg/kg to 2,300 mg/kg). Samples L SS 06 and L SS 07 exhibited TPH levels greater than levels found in surface soil background samples.

28.6 CONTAMINANT FATE AND TRANSPORT

The only compounds found at concentrations above ARARs/TBCs were benzo(b)fluoranthene and benzo(a)pyrene, which slightly exceeded the NJDEP residential direct contact soil cleanup criteria. These PAH compounds are typically found associated with treated lumber such as utility poles and tend to adhere to soil carbon content. PAHs in soil tend to migrate with surface runoff but have little propensity to percolate to groundwater.

28.7 BASELINE RISK ASSESSMENT

This section of the RI report presents the results of the baseline risk assessment for Site L. The risk assessment was performed using the approach outlined in Section 2.4. Table 28-4 provides the selected COPCs and representative concentrations of inorganic and organics in site-related surface soil. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The result of the conservative baseline risk assessment was greater than a value of 1.0 for non-cancer risk and greater than 1E-04 for cancer risk; therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6. Section 28.7.1.4 discusses the modifications made to the conservative preliminary baseline risk assessment.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation alternatives are identified for a site.

28.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of current land use (industrial employee) and hypothetical future land use (residential receptors).

TABLE 28-4
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SURFACE SOIL - SITE L (mg/kg)
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
ALUMINUM	2483.57	NONPARAMETRIC
ARSENIC	5.9	NONPARAMETRIC
BARIUM	24.3	NONPARAMETRIC
BERYLLIUM	0.19	NONPARAMETRIC
CADMIUM	1	NONPARAMETRIC
CHROMIUM	26.7	NONPARAMETRIC
COBALT	1.02	NORMAL
COPPER	21.17	NORMAL
IRON	8860	NONPARAMETRIC
LEAD	78.6	NONPARAMETRIC
MANGANESE	65.1	NONPARAMETRIC
MERCURY	0.05	NORMAL
NICKEL	3.11	NORMAL
VANADIUM	23.41	NONPARAMETRIC
ZINC	78.34	NORMAL
1,3-DICHLOROBENZENE*	63.00	LOGNORMAL
1,4-DICHLOROBENZENE*	63.00	LOGNORMAL
4,4'-DDD*	43.34	NORMAL
4,4'-DDE*	73.09	NORMAL
4,4'-DDT*	637.19	NORMAL
ACENAPHTHENE*	66.00	LOGNORMAL
ACENAPHTHYLENE*	42.00	LOGNORMAL
ANTHRACENE*	170.00	LOGNORMAL
BENZO(A)ANTHRACENE*	366.59	NORMAL
BENZO(A)PYRENE*	377.11	NORMAL
BENZO(B)FLUORANTHENE*	744.89	NORMAL
BENZO(G,H,I)PERYLENE*	322.34	NORMAL
CARBAZOLE*	215.00	LOGNORMAL
CHRYSENE*	641.56	NORMAL
DIBENZ(A,H)ANTHRACENE*	190.00	NONPARAMETRIC
DIBENZOFURAN*	74.00	LOGNORMAL
DIELDRIN*/	0.30	LOGNORMAL
FLUORANTHENE*	1527.74	NORMAL
FLUORENE*	120.00	LOGNORMAL
GAMMA-CHLORDANE*	4.78	NORMAL
HEPTACHLOR*	0.27	LOGNORMAL
HEPTACHLOR EPOXIDE*	1.00	NONPARAMETRIC
HEXACHLOROETHANE*	47.00	LOGNORMAL
INDENO(1,2,3-CD)PYRENE*	319.45	NORMAL
METHOXYCHLOR*	5.80	LOGNORMAL
METHYLENE CHLORIDE*	6.67	NORMAL
NAPHTHALENE*	45.00	LOGNORMAL
PHENANTHRENE*	963.35	NORMAL
PHENOL*	43.00	LOGNORMAL
PYRENE*	1082.98	NORMAL

* = Organic chemicals are in (ug/kg)

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28.7.1.1 Current Industrial Employee

The estimated total cancer risks for the current industrial employee for exposure to COPCs in surface soil at Site L are 3.3E-05 (ingestion), 2.0E-05 (dermal contact), and 2.2E-08 (inhalation of COPCs in fugitive dust). The total surface soil cancer risk is within the 1E-04 to 1E-06 target acceptable risk range often used by EPA to determine the need for action at CERCLA/RCRA sites or to formulate ARARs. The principal COPCs contributing to the surface soil cancer risk are arsenic (ingestion, 93 percent of the cancer risk for this pathway; and dermal contact, 52 percent of the cancer risk for this pathway) and beryllium (dermal contact, 46 percent of the cancer risk for this pathway).

The estimated noncarcinogenic HIs for the current industrial employee assuming exposure to COPCs in surface soil at Site L are 7.9E-02 (ingestion), 3.5E-01 (dermal contact), and 1.8E-04 (inhalation of COPCs in fugitive dust). Adverse noncarcinogenic health effects are not expected when the HI is below 1.0.

Estimated carcinogenic risks and noncarcinogenic adverse effects are presented for current industrial receptors exposed to surface soils at Site L in Tables 28-5 and 28-6, respectively.

28.7.1.2 Future Residential Receptor

The conservative preliminary baseline risk assessment yielded estimated total cancer risks greater than 1E-04 for the future lifetime resident assuming exposure to COPCs in surface soil at Site L. In addition, this risk assessment yielded an estimated noncarcinogenic HI with a value greater than 1.0 for the future residential child assuming exposure to surface soil. (Ingestion exposures contributed the significant portion of cancer risk and ingestion and dermal contact contributed to non-cancer risks.) Therefore, additional risk analysis was performed according to EPA guidance as discussed in Section 2.4.6; the amended carcinogenic and noncarcinogenic risks for residential exposure to groundwater are discussed in Section 28.7.1.4 and presented in Tables 28-7 and 28-8, respectively.

28.7.1.3 Lead Results

No lead concentrations were found above the regulatory level of concern (400 mg/kg) in site surface soils.

The IEUBK Lead Model (v. 0.99) was also used to characterize potential effects associated with exposure to media containing lead. The IEUBK histograms for default and Site L exposures are presented in Appendix I.

28.7.1.4 Amended Risk Assessment

The amended risk assessment recalculated the cancer and non-cancer risks at Site 28 for the future lifetime resident assuming exposure to COPCs in surface soil.

TABLE 28-5
RME CARCINOGENIC RISK TO CURRENT INDUSTRIAL RECEPTORS - SITE L
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	3.6E-09	7.1E-09	6.7E-13
4,4'-DDE	8.7E-09	1.7E-08	1.6E-12
4,4'-DDT	7.6E-08	1.5E-07	1.7E-11
1,3-DICHLOROBENZENE	N/A	N/A	N/A
1,4-DICHLOROBENZENE	5.3E-10	8.2E-10	9.8E-14
ACENAPHTHENE	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	9.4E-08	2.9E-07	2.0E-11
BENZO(A)PYRENE	9.6E-07	1.0E-05	2.1E-10
BENZO(B)FLUORANTHENE	1.9E-07	5.9E-07	4.1E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
CARBAZOLE	1.5E-09	2.3E-09	2.8E-13
CHRYSENE	1.6E-09	5.1E-09	3.5E-13
DIBENZ(A,H)ANTHRACENE	4.8E-07	7.6E-06	1.0E-10
DIBENZOFURAN	N/A	N/A	N/A
DIELDRIN	1.7E-09	5.2E-09	3.7E-13
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-CHLORDANE	2.2E-09	4.2E-09	4.8E-13
HEPTACHLOR	4.2E-10	1.7E-09	9.5E-14
HEPTACHLOR EPOXIDE	3.2E-09	1.2E-08	7.1E-13
HEXACHLOROETHANE	2.3E-10	7.2E-10	5.1E-14
INDENO(1,2,3-CD)PYRENE	8.1E-08	2.5E-07	1.8E-11
METHOXYCHLOR	N/A	N/A	N/A
METHYLENE CHLORIDE	1.7E-11	5.5E-11	3.4E-15
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PHENOL	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ALUMINUM	N/A	N/A	N/A
ARSENIC	3.1E-05	1.0E-05	6.9E-09
BARIUM	N/A	N/A	N/A
BERYLLIUM	2.9E-07	8.9E-06	5.3E-11
CADMIUM	N/A	N/A	8.2E-11
CHROMIUM	N/A	N/A	1.5E-08
COBALT	N/A	N/A	N/A
COPPER	N/A	N/A	N/A
IRON	N/A	N/A	N/A
LEAD	N/A	N/A	N/A
MANGANESE	N/A	N/A	N/A
MERCURY	N/A	N/A	N/A
NICKEL	N/A	N/A	N/A
VANADIUM	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	3.3E-05	3.8E-05	2.2E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL
• CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 28-6
RME NONCARCINOGENIC HQS, CURRENT INDUSTRIAL RECEPTORS - SITE L
SURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION	SURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	1.2E-03	2.4E-03	2.3E-07
1,3-DICHLOROBENZENE	6.9E-07	1.1E-06	1.3E-10
1,4-DICHLOROBENZENE	N/A	N/A	1.0E-11
ACENAPHTHENE	1.1E-06	3.4E-06	2.0E-10
ACENAPHTHYLENE	N/A	N/A	N/A
ANTHRACENE	5.5E-07	1.7E-06	1.0E-10
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DIBENZ(A,H)ANTHRACENE	N/A	N/A	N/A
DIBENZOFURAN	1.8E-05	5.6E-05	3.4E-09
DIELDRIN	5.9E-06	1.8E-05	1.1E-09
FLUORANTHENE	3.7E-05	1.2E-04	6.9E-09
FLUORENE	2.9E-06	9.2E-06	5.4E-10
GAMMA-CHLORDANE	7.8E-05	1.5E-04	1.4E-08
HEPTACHLOR	5.3E-07	2.1E-06	9.8E-11
HEPTACHLOR EPOXIDE	7.5E-05	2.9E-04	1.4E-08
HEXACHLOROETHANE	4.6E-05	1.4E-04	8.5E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
METHOXYCHLOR	1.1E-06	2.0E-06	2.1E-10
METHYLENE CHLORIDE	1.1E-07	3.4E-07	2.0E-11
NAPHTHALENE	1.1E-06	3.4E-06	2.0E-10
PHENANTHRENE	N/A	N/A	N/A
PHENOL	7.0E-08	1.1E-07	1.3E-11
PYRENE	3.5E-05	1.1E-04	6.5E-09
ALUMINUM	2.4E-03	7.6E-04	4.5E-07
ARSENIC	1.9E-02	6.3E-03	3.6E-06
BARIUM	3.4E-04	2.6E-03	6.2E-06
BERYLLIUM	3.7E-05	1.2E-03	6.9E-09
CADMIUM	2.0E-03	1.2E-02	1.0E-06
CHROMIUM	5.2E-03	8.2E-02	9.7E-07
COBALT	1.7E-05	1.0E-04	3.1E-09
COPPER	5.2E-04	2.7E-04	9.6E-08
IRON	2.9E-02	9.0E-03	5.4E-06
LEAD	N/A	N/A	N/A
MANGANESE	1.3E-02	1.3E-01	1.7E-04
MERCURY	1.7E-04	7.5E-04	5.3E-08
NICKEL	1.5E-04	3.2E-04	2.8E-08
VANADIUM	3.3E-03	1.0E-01	6.1E-07
ZINC	2.6E-04	3.2E-04	4.7E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

TABLE 28-7
RME CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE L
SURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDD	1.6E-08	N/A	4.1E-13
4,4'-DDE	3.9E-08	N/A	9.9E-13
4,4'-DDT	3.4E-07	N/A	1.0E-11
1,3-DICHLOROBENZENE	N/A	N/A	N/A
1,4-DICHLOROBENZENE	2.4E-09	N/A	6.0E-14
ACENAPHTHENE	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	4.2E-07	N/A	1.2E-11
BENZO(A)PYRENE	4.3E-06	N/A	1.3E-10
BENZO(B)FLUORANTHENE	8.5E-07	N/A	2.5E-11
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
CARBAZOLE	6.7E-09	N/A	1.7E-13
CHRYSENE	7.3E-09	N/A	2.2E-13
DIBENZ(A,H)ANTHRACENE	2.2E-06	N/A	6.4E-11
DIBENZOFURAN	N/A	N/A	N/A
DIELDRIN	7.5E-09	N/A	2.3E-13
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-CHLORDANE	9.7E-09	N/A	3.0E-13
HEPTACHLOR	1.9E-09	N/A	5.8E-14
HEPTACHLOR EPOXIDE	1.4E-08	N/A	4.3E-13
HEXACHLOROETHANE	1.0E-09	N/A	3.1E-14
INDENO(1,2,3-CD)PYRENE	3.7E-07	N/A	1.1E-11
METHOXYCHLOR	N/A	N/A	N/A
METHYLENE CHLORIDE	7.8E-11	N/A	2.1E-15
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PHENOL	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	1.4E-04	1.0E-04	4.2E-09
COPPER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	1.5E-04	1.0E-04	4.5E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 28-8
RME NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE L
SURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - CHILD	SURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
4,4'-DDD	N/A	N/A	N/A
4,4'-DDE	N/A	N/A	N/A
4,4'-DDT	1.6E-02	N/A	2.4E-07
1,3-DICHLOROBENZENE	9.1E-06	N/A	1.4E-10
1,4-DICHLOROBENZENE	N/A	N/A	1.1E-11
ACENAPHTHENE	1.4E-05	N/A	2.1E-10
ACENAPHTHYLENE	N/A	N/A	N/A
ANTHRACENE	7.2E-06	N/A	1.1E-10
BENZO(A)ANTHRACENE	N/A	N/A	N/A
BENZO(A)PYRENE	N/A	N/A	N/A
BENZO(B)FLUORANTHENE	N/A	N/A	N/A
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
CARBAZOLE	N/A	N/A	N/A
CHRYSENE	N/A	N/A	N/A
DIBENZ(A,H)ANTHRACENE	N/A	N/A	N/A
DIBENZOFURAN	2.4E-04	N/A	3.5E-09
DIELDRIN	7.7E-05	N/A	1.1E-09
FLUORANTHENE	4.9E-04	N/A	7.3E-09
FLUORENE	3.8E-05	N/A	5.7E-10
GAMMA-CHLORDANE	1.0E-03	N/A	1.5E-08
HEPTACHLOR	6.9E-06	N/A	1.0E-10
HEPTACHLOR EPOXIDE	9.8E-04	N/A	1.5E-08
HEXACHLOROETHANE	6.0E-04	N/A	9.0E-09
INDENO(1,2,3-CD)PYRENE	N/A	N/A	N/A
METHOXYCHLOR	1.5E-05	N/A	2.2E-10
METHYLENE CHLORIDE	1.4E-06	N/A	2.2E-11
NAPHTHALENE	1.4E-05	N/A	2.2E-10
PHENANTHRENE	N/A	N/A	N/A
PHENOL	9.2E-07	N/A	1.4E-11
PYRENE	4.6E-04	N/A	6.9E-09
ARSENIC	2.5E-01	1.6E-01	3.8E-06
COPPER	6.8E-03	N/A	1.0E-07
ZINC	3.3E-03	N/A	5.0E-08

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL

Comparison to Background

Aluminum, barium, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, mercury, nickel, and vanadium were eliminated from consideration as surface soil COPCs based on a comparison of average levels to twice the background level. However, since arsenic is a class A carcinogen, it could not be eliminated from consideration. Table 28-2 presents the comparison of COPCs to background concentrations. No other metals could be eliminated based on comparison to background upper 95 percent UTLs.

Modified Dermal Absorption

As discussed in Section 2.4.6.2, cancer and non-cancer risks were recalculated using modified soil-to-skin absorption factors for three chemicals and excluding dermal effects for other COPCs. After these steps, the revised RME cancer risks are still above the target acceptable range, but the revised HI is within the target range (i.e., the HI was less than one for the future residential child, exposure to surface soil).

Total RME cancer risks for the future lifetime resident, assuming exposure to COPCs in surface soil at Site L, are 1.5E-04 (ingestion), 1.0E-04 (dermal contact), and 4.5E-09 (inhalation of COPCs in fugitive dust). The surface soil ingestion cancer risk exceeds the 1E-04 to 1E-06 target acceptable risk range. The principal COPC contributing to the surface soil cancer risk is arsenic (ingestion, 94 percent of the cancer risk for this pathway; and dermal contact, 100 percent of the cancer risk for this pathway).

Estimated RME carcinogenic risks and noncarcinogenic adverse effects are presented for future residential receptors exposed to surface soil at Site L in Tables 28-7 and 28-8, respectively.

Application of Central Tendencies Guidance

Central tendency assumptions were applied to calculate cancer risks for the future lifetime resident (exposure to surface soil). Central tendency generates a lower risk estimate than RME because it assumes typical, rather than upper range, receptor behavior patterns related to the ingested dose. Based on this evaluation, the estimated total central tendency cancer risks for the future lifetime resident for exposure to COPCs in surface soil at Site L are within the mid-range of the target acceptable risk range.

Estimated central tendency carcinogenic risks are presented for future residential receptors exposed to surface soil at Site L in Table 28-7a.

TABLE 28-7a
CENTRAL TENDENCY CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE L
SURFACE SOIL, AMENDED RISK
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SURFACE SOIL INGESTION - LIFETIME	SURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
4,4'-DDD	2.6E-09	N/A	1.3E-13
4,4'-DDE	6.2E-09	N/A	3.1E-13
4,4'-DDT	5.4E-08	N/A	3.2E-12
1,3-DICHLOROBENZENE	N/A	N/A	N/A
1,4-DICHLOROBENZENE	3.8E-10	N/A	1.9E-14
ACENAPHTHENE	N/A	N/A	N/A
ACENAPHTHYLENE	N/A	N/A	N/A
ANTHRACENE	N/A	N/A	N/A
BENZO(A)ANTHRACENE	6.7E-08	N/A	3.8E-12
BENZO(A)PYRENE	6.9E-07	N/A	3.9E-11
BENZO(B)FLUORANTHENE	1.4E-07	N/A	7.8E-12
BENZO(G,H,I)PERYLENE	N/A	N/A	N/A
CARBAZOLE	8.7E-10	N/A	4.2E-14
CHRYSENE	1.2E-09	N/A	6.7E-14
DIBENZ(A,H)ANTHRACENE	3.4E-07	N/A	2.0E-11
DIBENZOFURAN	N/A	N/A	N/A
DIELDRIN	1.2E-09	N/A	7.1E-14
FLUORANTHENE	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
GAMMA-CHLORDANE	1.6E-09	N/A	9.1E-14
HEPTACHLOR	3.1E-10	N/A	1.8E-14
HEPTACHLOR EPOXIDE	2.2E-09	N/A	1.3E-13
HEXACHLOROETHANE	1.7E-10	N/A	9.7E-15
INDENO(1,2,3-CD)PYRENE	5.9E-08	N/A	3.3E-12
METHOXYCHLOR	N/A	N/A	N/A
METHYLENE CHLORIDE	1.3E-11	N/A	6.4E-16
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
PHENOL	N/A	N/A	N/A
PYRENE	N/A	N/A	N/A
ARSENIC	1.0E-05	1.4E-05	5.9E-10
COPPER	N/A	N/A	N/A
ZINC	N/A	N/A	N/A
TOTAL RISK	1.1E-05	1.4E-05	6.7E-10

N/A = NOT APPLICABLE, NO TOXICITY VALUE IS ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

28.7.2 Conclusions

Surface soil was sampled at Site L. The potential receptors for this site were current industrial and future residential receptors.

The estimated RME cancer risk associated with future residential (surface soil) exposure scenarios was above 1E-04, the upper end of the target risk range. Arsenic (via ingestion of and dermal contact with surface soil) was the major COPC that contributed to the cancer risk for the future residential receptor exposure scenario. However, this RME estimate is probably overconservative, because a central tendency calculation shows that cancer risks are more likely to be within the mid-range of the target acceptable risk range.

Based on the amended risk assessment, RME estimates of noncarcinogenic HIs associated with future residential (surface soil) exposure scenarios were below 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur. Risk characterization results (total cancer risks and total noncarcinogenic HIs) are presented for all potential receptors at Site L in Table 28-9 and 28-9a for surface soil.

Lead concentrations at the site were not detected at levels that may be expected to be associated with significant increases in blood-lead levels based on the results (blood-lead levels greater than 10 ug/dl are expected in 0.07 percent of the population of children, age 0 through 6 years) of the IEUBK Lead Model (v. 0.99). The cutoff level is five percent of the population with blood-lead greater than 10 ug/dl, the protection level most often used by EPA (1994).

The amended risk assessment procedure resulted in the elimination of all COPCs that had calculated risk above target guideline limits. Arsenic could not be eliminated from consideration because it is a class A carcinogen.

28.8 ECOLOGICAL RISK ASSESSMENT

28.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

EPIC Site L is approximately 15 acres in size and is located within and adjacent to a large power line easement. Most of the site is comprised of bare soil, piles of stone and asphalt, concrete rubble, and scattered patches of grass. Vegetation under the power line is dominated by *Vaccinium* sp. and various species of grasses. Woodlands surround the easement and are primarily composed of chestnut oak and pitch pine. A small wetland dominated by red maple is located approximately 300 feet northeast of Epic

TABLE 28-9
SUMMARY OF ESTIMATED RME CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE L
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	3.3E-06	N/A	1.5E-04^	N/A	7.7E-02	N/A	2.8E-01^	N/A	N/A
	Dermal Contact	3.8E-05	N/A	1.0E-04^	N/A	3.5E-01	N/A	1.6E-01^	N/A	N/A
	Inhalation of Fugitive Dust	2.2E-08	N/A	4.5E-09^	N/A	1.9E-04	N/A	4.2E-04^	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		4.1E-05	-	2.5E-04	-	4.3E-01	-	4.4E-01	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assesment.

TABLE 28-9a
SUMMARY OF CENTRAL TENDENCY CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE L
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/R	N/A	1.1E-05^	N/A	N/R	N/A	N/R	N/A	N/A
	Dermal Contact	N/R	N/A	1.4E-05^	N/A	N/R	N/A	N/R	N/A	N/A
	Inhalation of Fugitive Dust	N/R	N/A	6.7E-10^	N/A	N/R	N/A	N/R	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	-	2.5E-05	-	-	-	-	-	-

N/A = Not applicable because this media is not associated with this potential receptor
N/R - Central Tendency calculation not required
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects
^ - Value from amended risk assesment.

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Site L. In addition, a small, grassy pocket wetland, approximately 1/5 acre in size, is located in the power line easement in the southeastern section of the site. Water in the wetland areas is scarce and ephemeral. NJDEP Geographic Information System data initially indicated that the site was surrounded by wetlands, but ground-truthing revealed that the wetlands mentioned above are the only wetland areas present. In addition, a small, shallow drainage depression is located south of the power line easement and flows to the southwest. Water is present in the depression only after periods of heavy rainfall, and the topography of the site is flat. As a result, water tends to perch and infiltrate on the site rather than run off to the drainage depression or other areas. No surface water bodies exist on or near the site. The closest surface water is a branch of Hockhockson Brook located 2/3 mile to the west, and Epic Site L is located in the Hockhockson Brook Watershed.

The open areas on the site, containing the refuse, contain no ecological habitat, other than some scattered patches of grasses, and the wooded areas and wetlands provide excellent habitat, mainly for terrestrial receptors. Most mammals that inhabit the installation, such as white-tailed deer, gray and red fox, and several species of small mammals are expected to utilize these areas, as are most species of birds found on the base that are attracted to woodlands. No sensitive habitats, other than the wetland, or threatened or endangered species occur on or around the site.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathway from the open storage area is overland runoff and, to a lesser extent, infiltration of contaminants. Overland runoff from precipitation may carry constituents to off-site areas, particularly to surface soils in surrounding terrestrial habitats or to the wetland areas. Nonetheless, surface runoff is impeded by the flat topography. Infiltrating precipitation on the site may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a contaminant may be carried with the flow of groundwater to downgradient locations. Groundwater from the site may eventually discharge to surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. However, the scarcity of surface water on and near the site, even in the wetlands, minimizes this pathway.

Exposure Routes

Terrestrial animals at EPIC Site L may be exposed to surface soil contaminants via incidental ingestion of soil and ingestion of contaminated food items, although the absence of terrestrial habitat on the site largely inhibits these routes. Terrestrial receptors may also come into contact with contaminants in EPIC Site L surface water by using it for drinking, although this pathway is generally insignificant and surface water is scarce at the site. Terrestrial vegetation may be exposed to contaminants in soils but is limited on the site and of poor ecological value. The lack of surface water on and near the site also precludes exposure routes for aquatic receptors.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this site. In particular, contaminants detected in Epic Site L surface soils were considered preliminary COPCs. No other investigations have been conducted at this site.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

28.8.1.2 Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminated surface soil. Surface soil and terrestrial ET values are presented in Table 2-30.

28.8.2 Preliminary Exposure Assessment

Contaminant concentrations in environmental media used for this initial screening were obtained from data generated during 1995 RI activities. Data collected during December 1995 surface soil sampling were evaluated. The maximum detected contaminant concentrations in surface soil were used as conservative representative exposure point concentrations. Background concentrations are presented for comparative purposes and are maximum values detected in facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

28.8.3 Risk Characterization

For inorganics in surface soils, aluminum (HQ = 5.0), chromium (HQ = 66.7), and vanadium (HQ = 1.2) exceeded ET values and were retained as final COPCs (Table 28-10). Several organics, mainly PAHs, slightly exceeded ET values, and 4,4-DDT and several other PAHs moderately exceeded ET values. Beryllium, carbazole, dibenzofuran, and hexachloroethane were conservatively retained as final COPCs since no suitable ET values were available. For terrestrial plants, aluminum (HQ = 60), chromium (HQ = 26.7), lead (HQ = 1.6), vanadium (HQ = 12.2), and zinc (HQ = 3.2) exceeded ET values and were retained as final COPCs (Table 28-11). No suitable terrestrial plant ET values were available for the

TABLE 28-10
SURFACE SOIL CONTAMINANTS OF POTENTIAL CONCERN - EPIC SITE L
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	7/7	5310	3000	600	5.0	Retained-HQ > 1
Arsenic	6/7	14.4	5.9	60	0.09	Eliminated-Does not exceed threshold
Barium	7/7	31	24.3	3000	0.008	Eliminated-Does not exceed threshold
Beryllium	5/7	0.28	0.19	NA		Retained-No suitable threshold available
Cadmium	6/7	0.57	1	20	0.05	Eliminated-Does not exceed threshold
Chromium	7/7	59.5	26.7	0.4	66.7	Retained-HQ > 1
Cobalt	5/7	5	2	1000	0.002	Eliminated-Does not exceed threshold
Copper	7/7	8.4	37.8	50	0.76	Eliminated-Does not exceed threshold
Lead	7/7	39.4	78.6	500	0.15	Eliminated-Does not exceed threshold
Manganese	7/7	214	65.1	100	0.65	Eliminated-Does not exceed threshold
Mercury	7/7	0.17	0.068	0.1	0.68	Eliminated-Does not exceed threshold
Nickel	6/7	7.2	5.4	200	0.027	Eliminated-Does not exceed threshold
Silver	1/7	0.67	0.18	50	0.004	Eliminated-Does not exceed threshold
Vanadium	7/7	64	24.4	20	1.2	Retained-HQ > 1
Zinc	7/7	27.6	162	200	0.81	Eliminated-Does not exceed threshold
Organics						
1,3-Dichlorobenzene	1/7	ND	63	100	0.63	Eliminated-Does not exceed threshold

TABLE 28-10
SURFACE SOIL CONTAMINANTS OF POTENTIAL CONCERN - EPIC SITE L
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
1,4-Dichlorobenzene	1/7	ND	63	100	0.63	Eliminated-Does not exceed threshold
4,4'-DDD	3/6	ND	82	100	0.82	Eliminated-Does not exceed threshold
4,4'-DDE	4/7	330	120	100	1.2	Retained-HQ > 1
4,4'-DDT	7/7	420	1500	100	15.0	Retained-HQ > 1
Acenapthene	2/7	ND	66	100	0.66	Eliminated-Does not exceed threshold
Acenapthylene	1/7	ND	42	100	0.42	Eliminated-Does not exceed threshold
Anthracene	2/7	ND	170	100	1.7	Retained-HQ > 1
Benzo(a)anthracene	3/7	ND	630	100	6.3	Retained-HQ > 1
Benzo(a)pyrene	4/7	ND	700	100	7.0	Retained-HQ > 1
Benzo(b)fluoranthene	4/7	ND	1150	100	11.5	Retained-HQ > 1
Benzo(g,h,i)perylene	2/7	ND	520	100	5.2	Retained-HQ > 1
Carbazole	2/7	ND	215	NA		Retained-No suitable threshold available
Chrysene	4/7	ND	1095	100	10.9	Retained-HQ > 1
Dibenzo(a,h)anthracene	1/7	ND	190	100	1.9	Retained-HQ > 1
Dibenzofuran	2/7	ND	74	NA		Retained-No suitable threshold available
Dieldrin	1/5	0.49	0.3	100	0.003	Eliminated-Does not exceed threshold
Fluoranthene	5/7	84	3150	100	31.5	Retained-HQ > 1
Fluorene	2/7	ND	120	100	1.20	Retained-HQ > 1
Gamma-Chlordane	3/6	ND	8	100	0.08	Eliminated-Does not exceed threshold
Heptachlor	2/7	ND	0.27	100	0.002	Eliminated-Does not exceed threshold
Heptachlor Epoxide	1/7	ND	1	100	0.01	Eliminated-Does not exceed threshold

TABLE 28-10
SURFACE SOIL CONTAMINANTS OF POTENTIAL CONCERN - EPIC SITE L
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Hexachloroethane	1/7	ND	47	NA		Retained-No suitable threshold available
Indeno(1,2,3-cd)pyrene	3/7	ND	530	100	5.3	Retained-HQ > 1
Methoxyclor	1/7	ND	5.8	100	0.06	Eliminated-Does not exceed threshold
Methylene Chloride	1/7	ND	8	300	0.03	Eliminated-Does not exceed threshold
Napthalene	2/7	ND	45	100	0.45	Eliminated-Does not exceed threshold
Phenanthrene	4/7	ND	1900	100	19.0	Retained-HQ > 1
Phenol	1/7	ND	43	30	1.43	Retained-HQ > 1
Pyrene	4/7	46	1900	100	19.0	Retained-HQ > 1

ND = None detected
NA = No suitable threshold was available
• all organic values are in μg/kg

TABLE 28-11
TERRESTRIAL PLANT CONTAMINANTS OF POTENTIAL CONCERN - EPIC SITE L
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	7/7	5310	3000	50	60.0	Retained-HQ > 1
Arsenic	6/7	14.4	5.9	10	0.59	Eliminated-Does not exceed threshold
Barium	7/7	31	24.3	500	0.05	Eliminated-Does not exceed threshold
Beryllium	5/7	0.28	0.19	10	0.02	Eliminated-Does not exceed threshold
Cadmium	6/7	0.52	1	3	0.33	Eliminated-Does not exceed threshold
Chromium	7/7	59.5	26.7	1	26.7	Retained-HQ > 1
Cobalt	5/7	4.27	2	20	0.1	Eliminated-Does not exceed threshold
Copper	7/7	8.4	37.8	100	0.38	Eliminated-Does not exceed threshold
Lead	7/7	39.4	78.6	50	1.6	Retained-HQ > 1
Manganese	7/7	182.6	65.1	500	0.13	Eliminated-Does not exceed threshold
Mercury	7/7	0.17	0.068	0.3	0.23	Eliminated-Does not exceed threshold
Nickel	6/7	7.2	5.4	30	0.18	Eliminated-Does not exceed threshold
Silver	1/7	1.9	0.18	2	0.09	Eliminated-Does not exceed threshold
Vanadium	7/7	64	24.4	2	12.2	Retained-HQ > 1
Zinc	7/7	27.6	162	50	3.2	Retained-HQ > 1
Organics						

ND = None detected
NA = No suitable benchmark was available
• No suitable ETs were available for organics

organics detected in surface soils. Hence, they were conservatively retained as final COPCs. The toxicological profiles of all final COPCs are summarized in Appendix M.

28.8.4 Summary and Conclusions

EPIC Site L contains no ecological habitat of value, with the exception of some grassy areas. The upland areas surrounding the site and the wetland areas to the northeast and southeast provide excellent habitat and probably are utilized by a wide variety of terrestrial receptors. Runoff from the site is inhibited by the flat topography of the area and is presumed to be insignificant. Groundwater to surface water discharge of contaminants is precluded by the lack of surface water near the site, even in the wetlands. The drainage depression is considered to be too shallow to receive groundwater discharge.

HQ values for inorganics in surface soils were indicative of low potential risk, with the exception of chromium. However, the maximum concentration of chromium detected was less than background. Also, the only available ET value for chromium appears to be heavily conservative, possibly contributing to the elevated HQ. Beryllium was conservatively retained as a final surface soil COPC since no suitable threshold was available but was less than background. HQ values for most organics in surface soils were indicative of low potential risk, although 4,4-DDT and some PAHs had HQs indicative of low to moderate potential risk. Carbazole, dibenzofuran, and hexachloroethane were all conservatively retained as final COPCs since no suitable ETs were available but were all present at low concentrations and had low frequencies of detection. For terrestrial plants, HQs for inorganics were indicative of low potential risk, with the exception of aluminum, chromium, and vanadium. These three inorganics had HQs indicative of moderate potential risk. Nonetheless, all of these contaminants had maximum concentrations lower than background. No suitable terrestrial plant ETs were available for organics that were detected in surface soils, but little vegetation of ecological value is present on the site. Also, most organics do not translocate in root tissue to the degree that most inorganics do.

Potential risks to animal receptors from inorganics in surface soils are insignificant, and potential risks from some organics are low to moderate. Potential risks to terrestrial plants are low for most inorganics, and elevated HQs for some inorganics are mitigated by low concentrations in surface soil. Organics in surface soils could not be fully assessed due to the absence of suitable ETs. However, little suitable habitat is present on the landfill, where the surface soils were taken. Potential risks from surface soil contaminants will be more relevant if the site is abandoned in the future. For the most part, no significant migration pathways exist that could carry contaminants to better habitats off site. Runoff is limited and groundwater discharge to surface water is not applicable. As a result, contaminant contributions to the Hockhockson Brook Watershed appear to be negligible. Additional soil or wetland sediment samples taken further from the site may confirm the presumed absence of contaminant migration, but no evidence suggests that this migration is occurring. Hence, further sampling in surrounding areas may be helpful, but potential risks to ecological receptors at EPIC Site L do not appear to be significant. Additional sampling would be more

appropriate in the future if the site is abandoned and allowed to undergo ecological succession, resulting in increased receptor use of site soils.

28.9 EVALUATION AND RECOMMENDATION

28.9.1 Evaluation Summary

Low levels of two organic compounds typically encountered in treated lumber were found in surface soil at or below the NJDEP Non-Residential Direct Contact Soil Cleanup Criterion. These compounds tend to migrate with surface soil in runoff but not to groundwater. The low-concentration found, combined with a topography unlikely to result in significant off-site migration, indicates minimal risk to surrounding habitat.

28.9.2 Recommendations

Additional sampling of off-site wetland or drainage areas for potential PAH migration to confirm no impact on ecological receptors could be considered.

29.0 EPIC SITE Q: FIRE FIGHTING SCHOOL

29.1 BACKGROUND AND PHYSICAL SETTING

EPIC Site Q occupies a 5.5-acre area at the southwestern corner of NWS Earle. The fire-fighting school has been in use since 1975 and is used by a variety of state and county groups to practice fire fighting. The station is operated by the Military Sealift Command, which reports having all necessary operating permits and is inspected on a regular basis by the NJDEP. An oil/water separator and retention pond are present at the site. The station has a permit for disposal of the water from the separator to the pond. The pond is monitored and is maintained at or below discharge limits. Firefighting training takes place on a concrete pad, which prevents the infiltration of flammable material in the soil. Although water falling on the concrete pad is normally collected for treatment in the oil-water separator, there was some evidence noted that water flowed over the berm to the southeast of the pad. Figure 29-1 shows the site layout and sample locations.

29.2 PREVIOUS INVESTIGATIONS

29.2.1 Summary of Activities and Results

The Preliminary Assessment Addendum (1992) consisted of interviews and aerial photo analysis. Discharges from an oil- water separator to the adjacent pond are monitored and in compliance under terms of a NJPDES permit.

29.2.2 Summary of Conclusions

No further action was deemed necessary.

29.2.3 Data Gaps (Objectives of Remedial Investigation)

Determine potential impact to various site related media as follows:

- Groundwater quality was questioned because of cracks observed in containment pavement.

- Runoff over berm in the southeast corner of the site may have impacted soils and groundwater.

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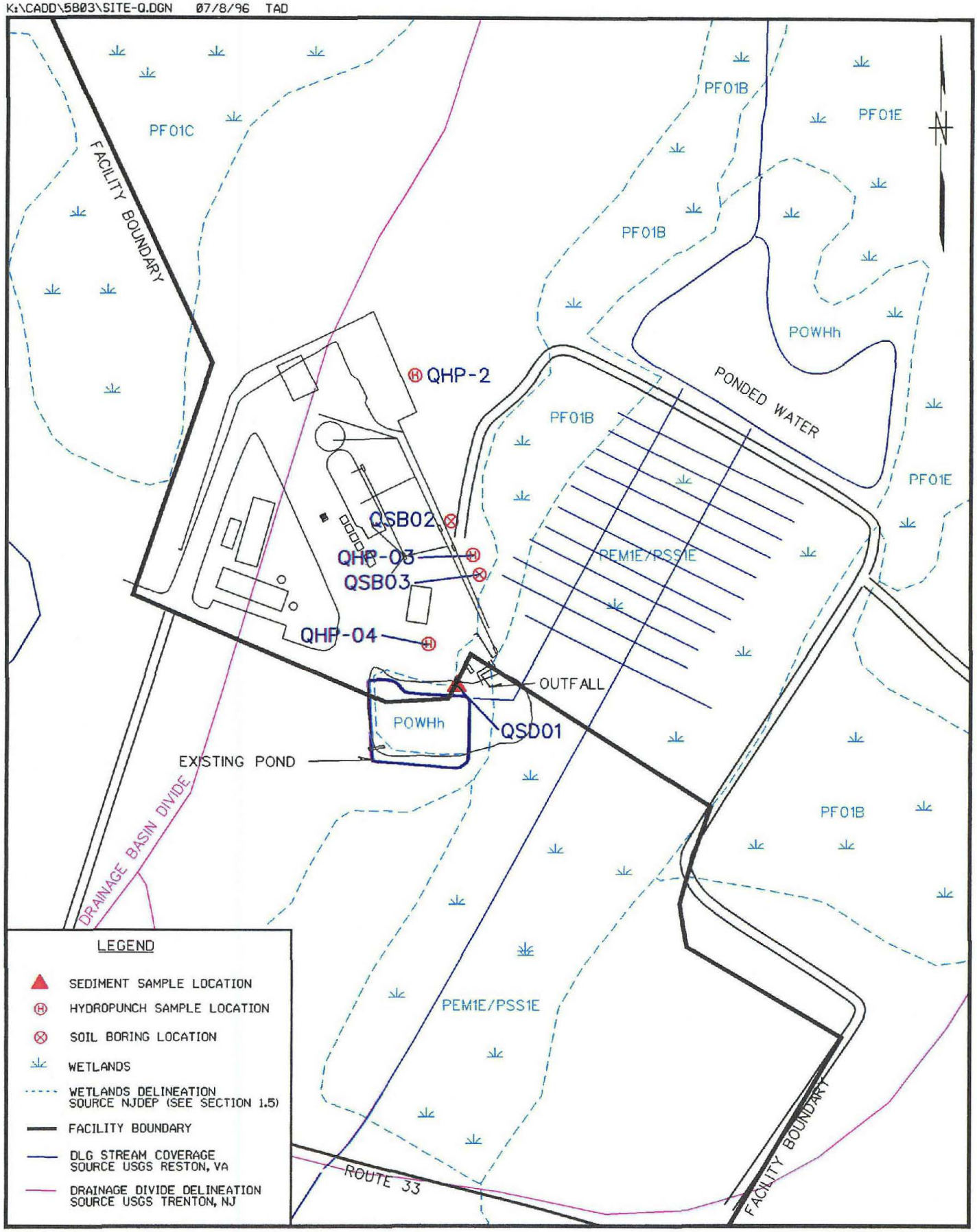


SAMPLE LOCATIONS

EPIC SITE Q - FIRE FIGHTING SCHOOL

0 200 400

SCALE IN FEET

FIGURE 29-1

Brown & Root Environmental

- Sediment quality in pond was questioned because of potential discharges prior to installation of oil-water separator upgrades.

29.3 RI FIELD INVESTIGATIONS

In December 1995, B&R Environmental conducted the following field investigation activities:

- Sampling and analysis of groundwater from three hydropunch locations (Section 29.3.1).
- Sampling and analysis of one sediment sample from the pond (Section 29.3.2)
- Sampling and analysis of subsurface soil from one hand auger boring and one soil boring. (Section 29.3.3).

The field team conducted a survey to establish horizontal locations and vertical elevations of the hydropunch sample locations, soil borings, and the sediment location. Surveying notes are provided in Appendix F.

29.3.1 Hydropunch Groundwater Sampling

B&R Environmental attempted to collect three hydropunch groundwater samples (Q HP 02 through Q HP 04) to assess groundwater quality for possible impacts from past firefighting training activities. Due to very slow recharge of groundwater in the hydropunch tool, the first hydropunch sample location (Q-HP-04) was abandoned and a decision was made with the Navy to install temporary well points at the three proposed hydropunch locations. The temporary monitoring wells were constructed of 2-inch-diameter PVC hacksaw slotted casing (Q HP 03 and Q HP 04) and factory slotted casing (Q HP 02) equipped with a 2-inch bottom cap. The wells were screened across the water table and Morie No. 1 sand was placed around the slotted well casing. Table 29-1 presents the hydropunch (temporary monitoring well) characteristics summary.

Groundwater samples collected from the temporary wells appeared slightly turbid to turbid with a dark green (Q HP 04) to olive-green (Q HP 02 and Q HP 03) tint. Groundwater samples were submitted to Lancaster Laboratories for TCL VOC, TCLSVOC, and TPH analysis. Sample log sheets are presented in Appendix D. Table 29-2 presents the sample analytical results.

Table 29-1
Site Q Hydropunch Characteristics Summary
NWS Earle,Colts Neck, New Jersey

Hydropunch*[3] Groundwater Location	Total Depth[1] (feet)	Ground Surface Elevation	Approximate Depth to Water[1] (feet)	Screened Interval Depth[1] (feet)
Q HP 02	20	[2]	12	10 - 20
Q HP 03	10	[2]	6	4 - 10
Q HP 04	10	[2]	5	4 - 10

[1] In feet below grade. Reading obtained during hydropunch installation.
[2] Not surveyed.
[3] Temporary monitoring well installed.

Table 29-2
EPIC Site Q (Fire Fighting School)
Hydropunch Groundwater Analysis
Analytical Results (Validated)

		Q-HP-04 Sample Results		Q-HP-03 Sample Results		Q-HP-02 Sample Results	
VOLATILE ORGANICS	CRQL	UG/L		UG/L		UG/L	
ACETONE	10	10	U	4	J	2	J
CHLOROFORM	10	8	J	10	U	14	
SEMIVOLATILE ORGANICS	CRQL	UG/L		UG/L		UG/L	
NAPHTHALENE	10	10	U	2	J	10	U
2-METHYLNAPHTHALENE	10	10	U	3	J	10	U
BIS(2-ETHYLHEXYL)PHTHALATE	10	3	J	10	U	1	J
TPH ANALYSIS		LOQ	MG/L	LOQ		LOQ	MG/L
TOTAL PETROLEUM HYDROCARBONS		3	8	3	6	3	1 J

U -- NOT DETECTED RESULT (DETECTION/QUANTITATION LIMIT LISTED)

J -- POSITIVE VALUE IS ESTIMATED AND LESS THAN QUANTITATION LIMIT

29.3.2 Sediment Sample

One sediment sample was collected from the retention pond near the outfall of the oil/water separator, 10 feet from shore east of the wooden pier. The sample material was black mud/clay with organic material (decaying leaves and pine needles). No HNu readings above background were recorded. Water depth at the sample point was approximately 18 inches. The sediment sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, and TPH analysis. Sample log sheets are presented in Appendix D.

29.3.3 Soil Boring and Sampling

Two subsurface soil samples were collected from Q SB 02 soil boring (Q SB 02-02 and Q SB 02-04) at depths of 2 to 4 feet and 4 to 6 feet, respectively. One subsurface soil sample was collected from a hand auger boring (Q SB 03) at a depth of 0.5 to 1 foot. Sample locations are shown on Figure 29-1.

Both subsurface soil samples collected at Q SB 02 were moist to wet, olive-green clayey, silty, fine-grained sand. HNu readings at both depths were slightly above background. The soil sample collected at Q SB 03 was clayey, silty, fine-grained sand with some well-rounded (quartz) pebbles. No reading above background was noted at Q SB 03. Soil boring logs are included in Appendix C. Subsurface soil samples were submitted to Lancaster Laboratories for TCL VOC and TCL SVOC analysis. In addition, the shallow subsurface soil sample (Q SB 03) was analyzed for TPH. Appendix D contains the sample log sheets.

29.4 SITE CHARACTERISTICS

29.4.1 Geology

Regional mapping places Site Q within the outcrop area of the Kirkwood Formation. The Kirkwood Formation ranges between 60 to 100 feet in thickness, and the soil boring is 8 feet deep. The lithology of the sediments encountered in the on-site boring generally agrees with the published description of the Kirkwood and Vincentown Formations. Assuming a portion of the Kirkwood Formation was removed by erosion, it is possible that the on-site soil boring penetrated the underlying Vincentown Formation. The boring encountered light brown pebbly, silty clay (probably representative of the Kirkwood Formation) and black, silty, fine-grained sand and olive-green and light brown silty, clayey, fine-grained sand (probably representative of the Vincentown Formation).

29.4.2 Hydrogeology

Groundwater in the Kirkwood and Vincentown aquifer beneath the site occurs under unconfined conditions and the formations are assumed to be hydraulically interconnected. Static-water-level measurements were not collected at this site. Therefore, the direction of shallow groundwater flow is unknown. Based upon topography, groundwater flow beneath the site is anticipated to be westward toward Yellow Brook.

Based on the boring log description, the temporary monitoring wells may have been screened in the Vincentown Formation.

29.5 NATURE AND EXTENT OF CONTAMINATION

29.5.1 Subsurface Soils

Three subsurface soil samples were collected at EPIC Site Q (Figure 29-1). Table 29-3 presents the occurrence and distribution of organic chemicals in site-related samples and compares them to background values as presented in Section 31. Tables 29-3a and 29-3b present a comparison of detected compounds to ARARs and TBCs. Figure 29-2 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

29.5.1.1 Organics

Because most organic chemicals on the TCL are not naturally occurring, all detected organic compounds are included as COPCs. Site-related subsurface soil samples exhibited low levels of six PAHs and TCE.

Organic compounds were not detected above background or state standard levels.

29.5.1.2 Miscellaneous Parameters

The three subsurface soil samples were analyzed for moisture (15.4 percent to 17.6 percent). A TPH concentration of 50 mg/kg was detected in sample Q SB 03-01.

TABLE 29-3
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SUBSURFACE SOIL AT SITE Q
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
2-METHYLNAPHTHALENE	NOT DETECTED	-	-	2 / 3	600 - 700	700
ACENAPHTHENE	NOT DETECTED	-	-	2 / 3	56 - 63	63
DIBENZOFURAN	NOT DETECTED	-	-	2 / 3	74 - 77	77
FLUORENE	NOT DETECTED	-	-	2 / 3	110 - 120	120
NAPHTHALENE	NOT DETECTED	-	-	1 / 3	44	44
PHENANTHRENE	NOT DETECTED	-	-	2 / 3	250 - 260	260
TRICHLOROETHENE	NOT DETECTED	-	-	3 / 3	2 - 55	55

TABLE 29-3a

COMPARISON OF SUBSURFACE SOIL ANALYTICAL DATA TO ARARS AND TBCs - SITE Q

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_QSB02-02	_QSB02-04	_QSB03-01	---	---	---	ARARS & TBCs		
LOCATION:	_QSB02	_QSB02	_QSB03	---	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.						
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	600	700	390 U				-	-	-
acenaphthene	56.0 J	63.0 J	390 U				3400000	10000000	100000
dibenzofuran	74.0 J	77.0 J	390 U				-	-	-
fluorene	110 J	120 J	390 U				2300000	10000000	100000
naphthalene	44.0 J	400 U	390 U				230000	4200000	100000
phenanthrene	260 J	250 J	390 U				-	-	-
VOLATILES	**ug/kg**	**ug/kg**	**ug/kg**				**ug/kg**	**ug/kg**	**ug/kg**
trichloroethene	2.0 J	55.0	9.0 J				23000	54000	1000

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

TABLE 29-3b

COMPARISON OF SUBSURFACE SOIL MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE Q

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_QSB02-02	_QSB02-04	_QSB03-01	---	---	ARARS & TBCs		
LOCATION:	_QSB02	_QSB02	_QSB03	---	---	NJDEP Soil Residential Direct Contact Cleanup Criteria	NJDEP Soil Non-Residential Direct Contact Cleanup Criteria	NJDEP Soil Impact to Groundwater Cleanup Criteria
DATA SOURCE:	1995 RI, Dec.	1995 RI, Dec.	1995 RI, Dec.					
MISCELLANEOUS								
moisture %	17.6	16.8	15.4			-	-	-
petroleum hydrocarbons mg/kg	n/a	n/a	50.0			10000 @	10000 @	-

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

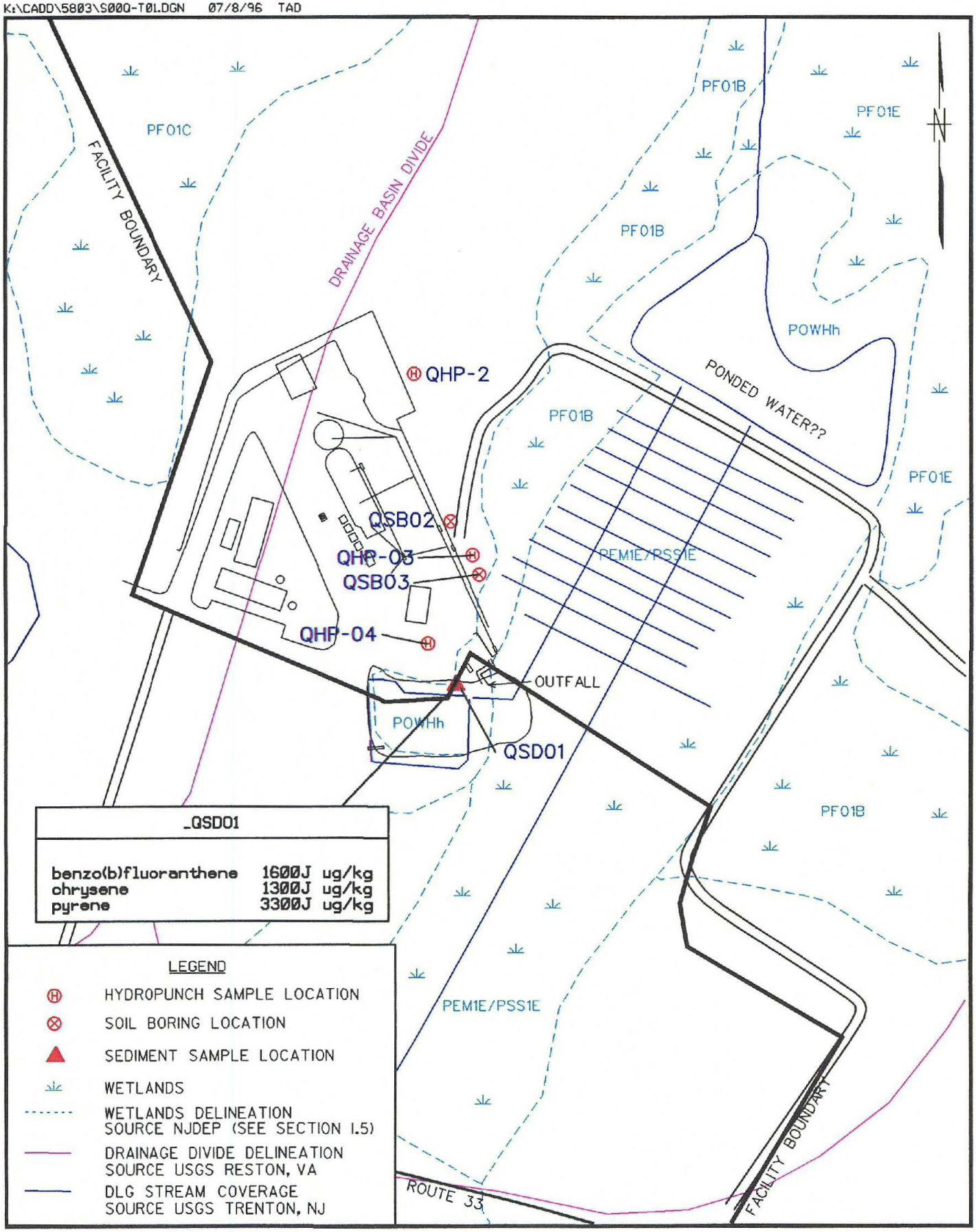
E - Result exceeds one or more of the selected ARARs.

Footnotes to soil criteria:

- - No standard is available for this chemical in this classification.

@ - Value is New Jersey guideline for maximum total concentration of all organic compounds in soil (including VOCs, SVOCs, and TPH).

K:\CADD\5803\S00Q-T01.DGN 07/8/96 TAD



CONCENTRATIONS ABOVE SCREENING LEVELS

EPIC SITE Q - FIRE FIGHTING SCHOOL

FIGURE 29-2

Brown & Root Environmental

29.5.2 Sediment

One sediment sample was collected at Site Q (Figure 29-1). Table 29-4 presents the occurrence and distribution of organic chemicals in site-related samples and compares them to background values as presented in Section 31. Tables 29-4a and 29-4b present a comparison of detected compounds to ARARs and TBCs. Figure 29-2 shows sample locations and concentrations of compounds which exceed ARARs and TBCs.

29.5.2.1 Organics

All detected organic compounds are included as COPCs. Fluoranthene and xylene (total) were detected in sample Q SD 01 at concentrations of 1,500 ug/kg and 93 ug/kg, respectively.

Three PAHs were detected above background levels in sediment sample Q SD 01. The PAHs detected were benzo(b)fluoranthene (1600 ug/kg), chrysene (1300 ug/kg), and pyrene (3300 ug/kg).

No organic compounds were detected above state standard levels.

29.5.2.2 Miscellaneous Parameters

The sediment sample was analyzed for moisture (72.4 percent) and TPH (17,000 mg/kg). The level of TPH detected was greater than the background ranges.

29.6 CONTAMINANT FATE AND TRANSPORT

The behavior of contaminants in the environment at Site Q is described in this subsection. Various chemicals detected and their transport potential in the environment are discussed in Section 29.6.1. Persistence of detected chemicals in the environment is discussed in Section 29.6.2. Section 29.6.3 presents a brief discussion of contaminant trends.

29.6.1 Detected Chemicals and Transport Potential

Analytical results for the media sampled at Site Q indicate moderate levels of TPH and relatively low levels of PAHs and one aromatic volatile in sediment; low levels of PAHs and TCE in subsurface soil; and two low molecular weight PAHs, one phthalate, chloroform, acetone, and TPH in one or more temporary well samples. The physical transport data for the detected contaminants are presented in Table 2-10.

TABLE 29-4
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN SEDIMENT AT SITE Q
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

SUBSTANCE	BACKGROUND			SITE-RELATED		
	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	1 / 1	1600	1600
CHRYSENE	2 / 3	250 - 940	940	1 / 1	1300	1300
FLUORANTHENE	2 / 3	300 - 1800	1800	1 / 1	1500	1500
PYRENE	2 / 3	350 - 1900	1900	1 / 1	3300	3300
XYLENE (TOTAL)	NOT DETECTED	-	-	1 / 1	93	93

TABLE 29-4a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - SITE Q

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	_QSDO1	---	---	---	---	---	---	ARARS & TBCs
LOCATION:	_QSDO1	---	---	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI, Dec.							
SEMIVOLATILES	**ug/kg**							**ug/kg**
benzo(b)fluoranthene	1600 E J							330 F
chrysene	1300 E J							330 F
fluoranthene	1500 J							2900 Q
pyrene	3300 E J							660 L
VOLATILES	**ug/kg**							**ug/kg**
xylene (total)	93.0 J							-

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

. - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 29-4b

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE Q

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		_QSD01		---	---	---	---	---	---	ARARS & TBCs
LOCATION:		_QSD01		---	---	---	---	---	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI, Dec.								
MISCELLANEOUS										
moisture	%	72.4	J							-
petroleum hydrocarbons	mg/kg	17000	J							-

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

2-Methyl naphthalene and naphthalene are light-range PAHs found in diesel and gasoline range fuels that exhibit moderate water solubility. Their presence in hydropunch sample Q HP 03 could indicate the potential for short-range groundwater migration of these substances. Groundwater migration is also possible for related petroleum hydrocarbons (TPH) detected at levels greater than background in samples Q HP 03 and Q HP 04. However, these temporary well samples exhibited relatively high turbidity, which could indicate contamination present in suspended soil particulates rather than in the dissolved phase.

Acetone and chloroform are considered volatile and mobile in the environment and were detected at trace levels in one groundwater sample. Bis(2-ethylhexyl)phthalate, detected in two groundwater samples, is a common plasticizer that can slowly leach from discarded plastics in the environment.

Acetone is also considered a common lab contaminant; however, the application of data validation protocols did not eliminate this compound from consideration in this case. Bis(2-ethylhexyl)phthalate, detected in two groundwater samples at trace levels, is a common plasticizer that is found in laboratory gloves and packaging. The significance of two trace level detections of this compound at levels below quantitation limits is questionable, since phthalates were not detected elsewhere in site-related samples and are not related to known previous site activities. Based upon limited detections, it is safe to conclude that there is not a widespread potential for groundwater contamination with acetone, chloroform, or bis(2-ethylhexyl)phthalate at this site.

Trichloroethene exhibits a high degree of water solubility and volatility; hence, this substance may migrate through leaching to groundwater or evaporation from soil.

Organic contaminants detected in sediment exhibit differing mobilities. PAHs are considered relatively immobile in the subsurface, whereas xylene, a volatile compound, is considered to be relatively mobile. The potential for PAH migration impacts is low due to the organic carbon present in sediments, which tends to bind PAHs. Xylene exhibits moderate solubility and also a high Henry's Law constant, which indicates a potential for volatilization from water or soil.

Light and medium molecular weight PAHs were detected in subsurface soil and sediment. With the exception of 2-methylnaphthalene, the detected compounds have low water solubility and are strongly bound to soil. Heavier PAHs are not expected to leach to groundwater or migrate readily except through erosional dispersion, although 2-methylnaphthalene may leach or dissolve to some extent.

29.6.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Transformation of a chemical to degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The product chemical(s) may or

may not be significantly different toxicologically or different from a physical transport perspective. If the transformational process is known or suspected, product chemicals can be predicted and extent of transformation can be determined from chemical reaction rate data. Other transformational processes may be identified empirically from analytical data.

Although most chemicals are resistant to chemical change because of their stability and/or lack of reaction sites, many of the more mobile species are subjected to at least limited transformation. Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in saturated media (groundwater, saturated zone soils, surface water, and sediment) are most likely to be transformed in the environment. Higher molecular weight contaminants tend to be less mobile and less prone to chemical transformation.

PAHs present in soil or sediment can be biodegraded but the rate of degradation is slower for the higher molecular weight compounds. The rate of degradation depends on a number of factors including oxygen, carbon sources, nutrients, pH, moisture, and appropriate acclimatized organisms. The lighter PAHs, including naphthalene and 2-methylnaphthalene, will gradually attenuate through leaching/dissolution, leaving behind residues consisting primarily of the heavier PAHs.

A variety of unicellular and multicellular organisms take up and accumulate phthalate esters, and bioaccumulation is considered an important fate process (Clement Associates, 1985). Biodegradation is also considered an important fate process. Because phthalate esters are degraded under most conditions and can be metabolized by multicellular organisms, it is unlikely that long-term bioaccumulation or biomagnification occurs.

The low levels of trichloroethene detected in subsurface soil may attenuate over time through volatilization, leaching, and/or biodegradation.

29.6.3 Observed Chemical Contaminant Trends

Despite their relatively high water solubilities, volatile organics were not detected at significant levels in groundwater. Trichloroethene was detected in three subsurface soils but was not found in any groundwater samples. The VOCs acetone and chloroform were detected at low levels in groundwater, near or below quantitation limits. Neither of these substances were detected in other media samples, nor are these compounds identified as being related to site activities. Since acetone and chloroform are sometimes found to be related to laboratory contamination, impacts to groundwater should not be concluded based upon limited data.

The presence of TPH and light PAHs in hydropunch groundwater samples indicates a likelihood that the fire training activities, spills, or discharges have impacted shallow groundwater to a limited extent near the

sampled locations (Q HP 03, which is downgradient of the first oil water separator, and Q HP 04, which is near the holding tanks adjacent to the retention pond). The PAH contaminants detected in groundwater without the concomitant presence of benzene, toluene, ethyl benzene, or xylene suggests that light-range fuel constituents are not present or have dissipated through other mechanisms before groundwater impacts could occur.

PAHs were detected in one of two subsurface soils located near the first oil/water separator; however, the levels were generally low. Source locations for the detected groundwater PAHs could be near the oil/water separators, but localized sources are not pinpointed by the subsurface samples displaying relatively low TPH and PAH contamination. Similarly, the relatively low levels of PAHs in the subsurface soil collected near the retention pond may reflect contamination from site activities but does not pinpoint source locations for the detected groundwater TPH contamination in this area.

The source of the PAH contamination in the sediment from the retention basin likely to be the outfall from the fire training area. Aqueous samples were not collected from the retention basin; however, monitoring of the pond is performed to comply with NJDEP requirements and the pond is reportedly maintained at or below discharge limits. Once adsorbed onto sediment, PAHs typically remain strongly bound and have limited potential for re-dissolution and migration in surface water.

29.6.4 Conclusions

Low concentrations of PAHs and TPH detected in groundwater samples indicates the presence of fuel-related hydrocarbons that are likely to be related to fire training activities, spills, or discharges. TPH contamination of groundwater is indicated near the first oil/water separator and near the retention pond. Low-level subsurface soil and sediment contamination with PAHs and volatile organics related to fuels is also indicated in these areas. However, these temporary well samples exhibited relatively high turbidity, which could indicate contamination present in suspended soil particulates rather than in the dissolved phase. There is a potential for limited groundwater migration with the lighter PAHs and hydrocarbons; however, none of the most mobile fuel-related contaminants (benzene, toluene, ethyl benzene, or xylene) were detected in groundwater. Contaminant migration in groundwater may therefore be limited and could gradually diminish over time if no new source develops.

The low levels of VOCs acetone and chloroform detected in groundwater were not found in other media samples and do not appear to be related to known site activities. Since acetone and chloroform are sometimes found to be related to laboratory contamination, impacts to groundwater should not be concluded based upon limited data.

Bis(2-ethylhexyl)phthalate, which was detected at trace levels in hydropunch groundwater samples, is of unknown origins. This compound has a low rate of leaching to groundwater and is typically related to

plastics discarded in the environment or possible contamination from laboratory gloves or packaging. It is not known whether residues from plastics are related to fire training activities.

TCE, which was detected at low levels in three subsurface soils, is not related to known site activities. No localized TCE source area is indicated or apparent, based upon limited soil sampling. Since groundwater contamination with TCE was not observed, it should be concluded that there is not a potential for widespread groundwater contamination with TCE at Site Q.

PAH contaminants detected in the sediment at Site Q have low potential for impacts to groundwater. Xylene detected in the sediment near the retention pond is potentially mobile in the environment; however, the concentration near the discharge point is relatively low.

29.7 BASELINE RISK ASSESSMENT

This section presents the results of the baseline risk assessment for Site Q. The risk assessment was performed using the approach outlined in Section 2.4. Tables 29-5 and 29-6 provide the selected COPCs and representative concentrations of organics in site-related subsurface soil and sediment, respectively. COPCs and representative concentrations were selected as described in Sections 2.4.1.1, 2.4.1.2, and 2.4.1.3. Exposure pathways, potential receptors, uncertainties, and conclusions are included.

The risk assessment only identifies exposure and risks, not acceptable levels of these parameters. The results of this risk assessment are used for input into the risk management process, where clean-up goals and remediation alternatives are identified for a site.

29.7.1 Risk Characterization

The results of the risk assessment are presented in the risk characterization and are discussed on a receptor-specific basis. The identified potential receptors have been evaluated on the basis of hypothetical future land use (residential receptors, recreational receptors, and industrial receptors).

29.7.1.1 Future Industrial Employee

The estimated total cancer risks for the future industrial employee for exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site Q are 2.1E-10 (ingestion), 6.6E-10 (dermal contact), and 4.3E-14 (inhalation of COPCs in fugitive dust). The total subsurface soil cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

TABLE 29-5
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SUBSURFACE SOIL - SITE Q (ug/kg)
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
2-METHYLNAPHTHALENE	700	NONPARAMETRIC
ACENAPHTHENE	63	NONPARAMETRIC
DIBENZOFURAN	77	NONPARAMETRIC
FLUORENE	120	NONPARAMETRIC
NAPHTHALENE	44	NONPARAMETRIC
PHENANTHRENE	260	NONPARAMETRIC
TRICHLOROETHENE	55	NONPARAMETRIC

TABLE 29-6
REPRESENTATIVE CONCENTRATION AND STATISTICAL DISTRIBUTION OF COPCS
SEDIMENT - SITE Q (ug/kg)
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	REPRESENTATIVE CONCENTRATION	STATISTICAL DISTRIBUTION
BENZO(B)FLUORANTHENE	1600	NONPARAMETRIC
CHRYSENE	1300	NONPARAMETRIC
FLUORANTHENE	1500	NONPARAMETRIC
PYRENE	3300	NONPARAMETRIC
XYLENE (TOTAL)	93	NONPARAMETRIC

The estimated individual noncarcinogenic HQs for the future industrial employee assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soils) at Site Q are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs for future industrial receptors exposed to subsurface soils at Site Q are presented in Tables 29-7 and 29-8, respectively.

29.7.1.2 Future Residential Receptor

The estimated total cancer risks for the future lifetime resident assuming exposure to COPCs in subsurface soil (assuming subsurface soils become future surface soils) at Site Q are 9.9E-10 (ingestion), 2.2E-09 (dermal contact), and 2.7E-14 (inhalation of COPCs in fugitive dust). The subsurface soil cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The estimated individual noncarcinogenic HQs for the future child resident assuming exposure to COPCs in subsurface soil (assuming subsurface soil becomes future surface soils) at Site Q are less than 1.0 for ingestion, dermal contact, and inhalation exposure pathways. adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs are presented for future residential receptors exposed to subsurface soils at Site Q in Tables 29-9 and 29-10, respectively.

29.7.1.3 Future Recreational Receptor

The estimated total cancer risk for the future recreational child assuming exposure to COPCs in sediment during wading at Site Q is 1.3E-08 (ingestion). This sediment cancer risk is below the 1E-04 to 1E-06 target acceptable risk range.

The estimated individual HQs for the future recreational child assuming exposure to COPCs in sediment during wading at Site Q are less than 1.0 for ingestion and dermal contact exposure pathways. Adverse noncarcinogenic effects are not expected when the HQs are below 1.0.

Estimated carcinogenic risks and noncarcinogenic HQs for future recreational receptors exposed to sediment at Site Q are presented in Tables 29-11 and 29-12, respectively.

TABLE 29-7
CARCINOGENIC RISK TO FUTURE INDUSTRIAL RECEPTORS - SITE Q
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
DIBENZOFURAN	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
TRICHLOROETHENE	2.1E-10	6.6E-10	4.3E-14
TOTAL RISK	2.1E-10	6.6E-10	4.3E-14

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
*CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 29-8
NONCARCINOGENIC HQS, FUTURE INDUSTRIAL RECEPTORS - SITE Q
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION	SUBSURFACE SOIL DERMAL CONTACT	INHALATION OF COPCS IN FUGITIVE DUST
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	1.0E-06	3.2E-06	1.9E-10
DIBENZOFURAN	1.9E-05	2.9E-05	3.5E-09
FLUORENE	2.9E-06	9.2E-06	5.4E-10
NAPHTHALENE	1.1E-06	3.4E-06	2.0E-10
PHENANTHRENE	N/A	N/A	N/A
TRICHLOROETHENE	9.0E-06	2.8E-05	1.7E-09

N/A - NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 29-9
CARCINOGENIC RISK TO FUTURE RESIDENTIAL RECEPTORS - SITE Q
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - LIFETIME	SUBSURFACE SOIL DERMAL CONTACT - LIFETIME	INHALATION OF COPCS IN FUGITIVE DUST - LIFETIME
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	N/A	N/A	N/A
DIBENZOFURAN	N/A	N/A	N/A
FLUORENE	N/A	N/A	N/A
NAPHTHALENE	N/A	N/A	N/A
PHENANTHRENE	N/A	N/A	N/A
TRICHLOROETHENE	9.5E-10	2.2E-09	2.7E-14
TOTAL RISK	9.5E-10	2.2E-09	2.7E-14

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
*CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 29-10
NONCARCINOGENIC HQS, FUTURE RESIDENTIAL RECEPTORS - SITE Q
SUBSURFACE SOIL
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SUBSURFACE SOIL INGESTION - CHILD	SUBSURFACE SOIL DERMAL CONTACT - CHILD	INHALATION OF COPCS IN FUGITIVE DUST - CHILD
2-METHYLNAPHTHALENE	N/A	N/A	N/A
ACENAPHTHENE	1.3E-05	2.6E-05	2.0E-10
DIBENZOFURAN	2.5E-04	2.4E-04	3.7E-09
FLUORENE	3.8E-05	7.5E-05	5.7E-10
NAPHTHALENE	1.4E-05	2.7E-05	2.1E-10
PHENANTHRENE	N/A	N/A	N/A
TRICHLOROETHENE	1.2E-04	2.3E-04	1.8E-09

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

TABLE 29-11
CARCINOGENIC RISK, WADING, FUTURE RECREATIONAL RECEPTORS - SITE Q
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
BENZO(B)FLUORANTHENE	1.3E-08	*
CHRYSENE	1.0E-10	*
FLUORANTHENE	N/A	N/A
XYLENE (TOTAL)	N/A	N/A
PYRENE	N/A	N/A
TOTAL RISK	1.3E-08	

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL
* CANCER RISK FOR PAHS NOT ESTIMATED FOR DERMAL EXPOSURE

TABLE 29-12
NONCARCINOGENIC HQS, WADING, FUTURE RECREATIONAL RECEPTORS - SITE Q
SEDIMENT
NWS EARLE, COLTS NECK, NEW JERSEY

SUBSTANCE	SEDIMENT INGESTION	SEDIMENT DERMAL CONTACT
BENZO(B)FLUORANTHENE	NA	NA
CHRYSENE	NA	NA
FLUORANTHENE	4.8E-06	1.9E-06
XYLENE (TOTAL)	5.9E-09	1.3E-09
PYRENE	1.4E-05	5.6E-06

N/A = NOT APPLICABLE, NO TOXICITY VALUE HAS BEEN ESTABLISHED FOR THIS CHEMICAL

2.9.7.1.4 Lead Results

Lead was not found above the EPA level of concern (400 mg/kg) in soil samples taken during the RI.

29.7.2 Conclusions

Subsurface soil and sediment were sampled at Site Q. The potential receptors for this site were future industrial, residential, and recreational receptors.

The cancer risks associated with future industrial (subsurface soil), future residential (subsurface soil), and future recreational (sediment) exposure scenarios were all below 1E-06, the lower end of the target risk range.

Noncarcinogenic HQs associated with future industrial (subsurface soil), future residential (subsurface soil), and future recreational (sediment) exposure scenarios were all below 1.0, the cutoff point below which adverse noncarcinogenic effects are not expected to occur.

Risk characterization results (total cancer risks and total noncarcinogenic HQs) for subsurface soil and sediment are presented for all potential receptors at Site Q in Table 29-13.

29.8 ECOLOGICAL RISK ASSESSMENT

29.8.1 Preliminary Problem Formulation

Habitat Types and Ecological Receptors

Epic Site Q, the location of the Fire Fighting School, is covered by pavement, gravel, and buildings. Most runoff from the area drains to an oil/water separator that ultimately empties into a retention pond south of the fire fighting area. Wooded upland areas are located northeast and west of the site, and are dominated by chestnut oak. Wetlands are located to the southeast, south, and southwest, and consist of Atlantic white cedar swamp surrounded by a fringe of sweetgum and red maple. The soils in the wetlands are generally saturated to the surface and covered by sphagnum moss. Soils in the wetlands are characterized as Manahawkin muck. A branch of Yellow Brook is located approximately 200 feet east of the site, and another branch of Yellow Brook is located approximately 400 feet west of the site. Yellow Brook connects with the Manasquan River approximately two miles south of Epic Site Q, and the

TABLE 29-13
SUMMARY OF ESTIMATED CANCER RISKS AND NONCARCINOGENIC HAZARD INDICIES - SITE L
NWS EARLE, COLTS NECK, NEW JERSEY

Medium	Exposure Routes	Estimated Incremental Cancer Risk				Estimated Hazard Index**				
		Current Industrial Employee	Future Industrial Employee	Future Lifetime Resident	Future Recreational Child	Current Industrial Employee	Future Industrial Employee	Future Resident		Future Recreational Child
								Child	Adult	
Surface Soil	Incidental Ingestion	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Dermal Contact	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
	Inhalation of Fugitive Dust	N/S	N/A	N/S	N/A	N/S	N/A	N/S	N/A	N/A
Subsurface Soil	Incidental Ingestion	N/A	2.1E-11	9.5E-10	N/A	N/A	3.3E-05	4.3E-04	N/A	N/A
	Dermal Contact	N/A	6.6-10	2.2E-09	N/A	N/A	7.3E-05	6.0E-04	N/A	N/A
	Inhalation of Fugitive Dust	N/A	4.3E-14	2.7E-14	N/A	N/A	6.1E-09	6.4E-09	N/A	N/A
Sediment	Incidental Ingestion	N/A	N/A	N/A	1.3E-08	N/A	N/A	N/A	N/A	1.9E-05
	Dermal Contact	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7.5E-06
Groundwater	Ingestion	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Dermal Contact	N/A	N/S	N/S	N/A	N/A	N/S	N/S	N/A	N/A
	Inhalation of Volatiles*	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S	N/A
Surface Water	Incidental Ingestion	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
	Dermal Contact	N/A	N/A	N/A	N/S	N/A	N/A	N/A	N/A	N/S
TOTAL		-	2.1E-11	3.1E-09	1.3E-08	-	1.1E-04	1.0E-03	-	2.6E-05

N/A = Not applicable because this media is not associated with this potential receptor
N/S = Not sampled
* = During Showering, Adult Residents Only
** = Hazard Indicies (i.e., summation of hazard quotients) are used only for comparison purposes and do not reflect actual additive noncarcinogenic effects

Manasquan River then flows about four miles southeast to its confluence with the Mingamahone River. Thus, Epic Site Q is located in the Mingamahone watershed.

The school area contains no viable habitat, while the pond, swamp, and upland areas provide excellent habitat. Most terrestrial mammals, including white-tailed deer, grey fox, and small mammals, and most species of birds found in the Mainside area and are attracted to forested areas are expected to use the adjacent upland areas. Most wetland species found in the Mainside area are most likely to use the pond and nearby wetland areas. No sensitive habitats other than the wetlands, and no threatened or endangered species are known to occur on or near the site.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathway from the fire fighting area is overland runoff. Overland runoff from precipitation may carry constituents to the oil/water separator and ultimately to the retention pond. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Groundwater from the site may eventually discharge to surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. However, the concrete pad on which fire fighting activities are conducted greatly inhibits infiltration, precludes significant groundwater to surface water contaminant migration. In addition, no pathways appear to exist for contaminant migration to the upland and wetland areas around the site.

Exposure Routes

Terrestrial receptors at Epic Site Q may be exposed to surface soil contaminants via incidental ingestion of soil and ingestion of contaminated food items, although the lack of terrestrial habitat on the site largely inhibits these routes. Since the site is developed and little vegetation is present, potential risks to terrestrial plants were not investigated. Terrestrial receptors may also come into contact with contaminants in Epic Site Q surface water by using it for drinking, although this pathway is generally insignificant. For these reasons, the exposure routes of main concern at the site are for receptors that use the pond. Aquatic, semi-aquatic, and terrestrial organisms inhabiting the retention pond may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic and semi-aquatic organisms in the pond may also be exposed to constituents from contaminated groundwater that flows into surface water, although this is expected to be minimal.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this site. In particular, contaminants detected in pond sediments were considered preliminary COPCs. Contaminants in subsurface soil and groundwater samples taken as part of the 1995 RI were evaluated qualitatively.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

29.8.2 Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminated sediments. Sediment ET values are presented in Table 2-29.

29.8.3 Preliminary Exposure Assessment

Contaminant concentrations in sediment used for this initial screening were obtained from data generated during 1995 RI activities. Data collected during December 1995 sediment sampling in the retention pond were evaluated. The maximum detected contaminant concentrations in a sediment sample taken in the pond were used as conservative representative exposure point concentrations. Based on the chemicals used at the site, the sediment sample was analyzed for VOCs, SVOCs, and TPH. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

29.8.4 Risk Characterization

In retention pond sediments, benzo(b)fluoranthene and chrysene exceeded most conservative ET values and were retained as COPCs, but did not exceed less conservative values (Table 29-14). Pyrene exceeded the most conservative ET value available, and slightly exceeded a less conservative ET value. Xylene slightly exceeded the only sediment ET available for that organic. The toxicological properties of all COPCs in sediments are summarized in Appendix M.

TABLE 29-14
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - EPIC SITE Q
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (μg/kg)	Maximum Concentration (μg/kg)	Ecotox Threshold (μg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Organics						
Benzo(b)fluoranthene	1/1	490.0	1600	330/1700	4.85/0.94	Retained-HQ > 1
Chrysene	1/1	940.0	1300	330/2800	3.94/0.46	Retained-HQ > 1
Fluoranthene	1/1	1800.0	1500	2900	0.52	Eliminated-Does not exceed threshold
Pyrene	1/1	1900.0	3300	660/2600	5.0/1.27	Retained-HQ > 1
Xylene (total)	1/1	ND	93.0	25	3.72	Retained-HQ > 1

ND = None detected

1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.

2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.

29.8.5 Summary and Conclusions

Epic Site Q contains little or no terrestrial habitat, although upland and wetland habitats are located around the site. The only habitat on the site is the aquatic habitat associated with the retention pond south of the fire fighting area. Runoff from the site drains to an oil/water separator and empties into the retention pond. Groundwater to surface water contaminant migration to the pond or nearby wetlands is possible, but is limited since the paved and graveled nature of the site inhibits infiltration. In addition, only low levels of a few organic contaminants were detected in 1995 RI subsurface soil and groundwater samples.

HQ values for contaminants in retention pond sediments were low, with the exception of pyrene. Nonetheless, the concentration of pyrene only slightly exceeded the less conservative ET value and is not likely to alone pose significant risk to aquatic receptors. In addition, this PAH has an affinity for organic fractions in sediments; therefore, it may not be bioavailable. No outlets for surface water exist in the pond and contaminant concentrations in pond sediments were not significantly elevated, which precludes contaminant contributions to the Mingamahone Brook watershed. Also, the station has a permit for disposal of water from the separator to the pond, and the pond is monitored and maintained at or below discharge limits. As a result, although pyrene in sediments may pose moderate potential risk, overall risks to aquatic receptors are low, and further study or remediation based on ecological concerns at Epic Site Q does not appear to be warranted.

29.9 EVALUATION AND RECOMMENDATIONS

29.9.1 Evaluation Summary

No compounds were found at concentrations above ARARs. Benzo(b)fluoranthene, chrysene and pyrene, were detected at levels exceeding sediment ecological toxicity threshold values. These PAH compounds are typically found associated with treated lumber such as utility poles or railroad ties, and tend to adhere to soil carbon content. PAHs in soil tend to migrate with surface run-off but have little propensity to percolate to groundwater.

The low concentration of chloroform found in groundwater below the MCL, but above the GWQS, does not represent a significant threat to human health, and the shallow groundwater from the area is not likely to be used for human consumption.

Current site activities are monitored on a continuing basis under the State NPDES permit process.

29.9.2 Recommendations

Due to the levels of contaminants found in sediments, runoff controls should be reviewed and improvements considered.

30.0 WATERSHED SITES

30.1 WATERSHED SAMPLING

Due to the sensitive nature of the hydrologic setting at NWS Earle, which includes a significant area of groundwater recharge and encompasses the headwaters and/or drainage basins of three major coastal plain rivers, a comprehensive watershed sampling program was conducted. Sampling locations included eight watershed divisions, including the Shark River and seven tributary drainages upstream of the remaining three coastal plain river drainages. Six of the watersheds are located within the Mainside area, and two are located within the Waterfront area. A total of 19 surface water and 18 sediment samples were collected, in addition to those associated with background sampling. Sample locations are shown on Figures 30-1 and 30-2 and are provided in the following list. See Table 30-1 for a summary of surface water and sediment samples.

30.1.1 Mainside

Pine Brook Watershed

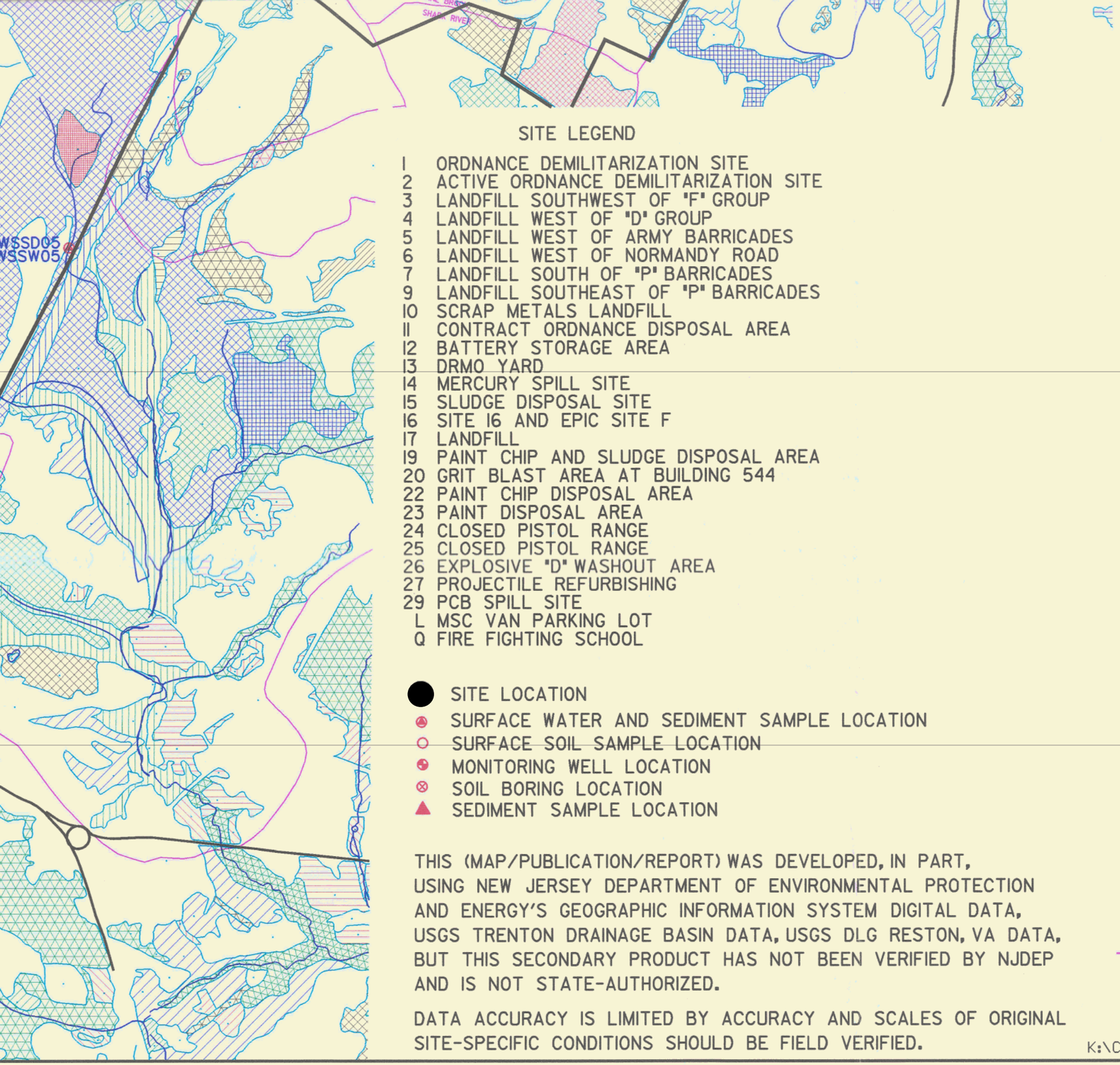
- (WS SW/SD10) - Marshy area northeast of Site 2 just upstream of railroad tie bridge. The stream was 3-feet wide and 4-inches deep, with a flow of approximately 15 gpm.

Hockhockson Brook Watershed

- (WS SW/SD11) - Wetlands drainage at 12-inch-diameter steel pipe under the perimeter road northwest of Site 2. The stream was 14-feet wide and 5-inches deep, with a flow of approximately 3 gpm.

- (WS SW/SD12) - The eastern branch of the junction of two branches of the Hockhockson Brook, east of Normandy Road near the security checkpoint. The stream was 3-feet wide and 4-inches deep, with a flow of approximately 150 gpm.

- (WS SW/SD13) - Near the confluence of both the eastern and western branches of the Hockhockson Brook, east of Normandy Road near the security checkpoint and near the Route 18 overpass. The stream was 12-feet wide and 6-inches deep, with a heavy flow.



SITE LEGEND

1 ORDNANCE DEMILITARIZATION SITE
2 ACTIVE ORDNANCE DEMILITARIZATION SITE
3 LANDFILL SOUTHWEST OF "F" GROUP
4 LANDFILL WEST OF "D" GROUP
5 LANDFILL WEST OF ARMY BARRICADES
6 LANDFILL WEST OF NORMANDY ROAD
7 LANDFILL SOUTH OF "P" BARRICADES
9 LANDFILL SOUTHEAST OF "P" BARRICADES
10 SCRAP METALS LANDFILL
11 CONTRACT ORDNANCE DISPOSAL AREA
12 BATTERY STORAGE AREA
13 DRMO YARD
14 MERCURY SPILL SITE
15 SLUDGE DISPOSAL SITE
16 SITE 16 AND EPIC SITE F
17 LANDFILL
19 PAINT CHIP AND SLUDGE DISPOSAL AREA
20 GRIT BLAST AREA AT BUILDING 544
22 PAINT CHIP DISPOSAL AREA
23 PAINT DISPOSAL AREA
24 CLOSED PISTOL RANGE
25 CLOSED PISTOL RANGE
26 EXPLOSIVE "D" WASHOUT AREA
27 PROJECTILE REFURBISHING
29 PCB SPILL SITE
L MSC VAN PARKING LOT
Q FIRE FIGHTING SCHOOL

SITE LOCATION
SURFACE WATER AND SEDIMENT SAMPLE LOCATION
SURFACE SOIL SAMPLE LOCATION
MONITORING WELL LOCATION
SOIL BORING LOCATION
SEDIMENT SAMPLE LOCATION

THIS (MAP/PUBLICATION/REPORT) WAS DEVELOPED, IN PART, USING NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION AND ENERGY'S GEOGRAPHIC INFORMATION SYSTEM DIGITAL DATA, USGS TRENTON DRAINAGE BASIN DATA, USGS DLG RESTON, VA DATA, BUT THIS SECONDARY PRODUCT HAS NOT BEEN VERIFIED BY NJDEP AND IS NOT STATE-AUTHORIZED.

DATA ACCURACY IS LIMITED BY ACCURACY AND SCALES OF ORIGINAL SITE-SPECIFIC CONDITIONS SHOULD BE FIELD VERIFIED.

MODD
PSS1E/PEM1E
PEM1E/PSS1E
PEM1E
PF08C
PF04B
PF01/4C
PF04C
PF04/1B
PF04/1C
PF04/1E
PF04/1A
PSS4E
PF01E/PEM1E
PSS4B/PF04B
PF01Bn
PEM1C/PSS1C
PF01C/PEM1C
PSS1E
DRAINAGE DIVIDE

0 1500 3000
SCALE IN FEET

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APPROV
ACTIV
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FOR EFD

SEAL

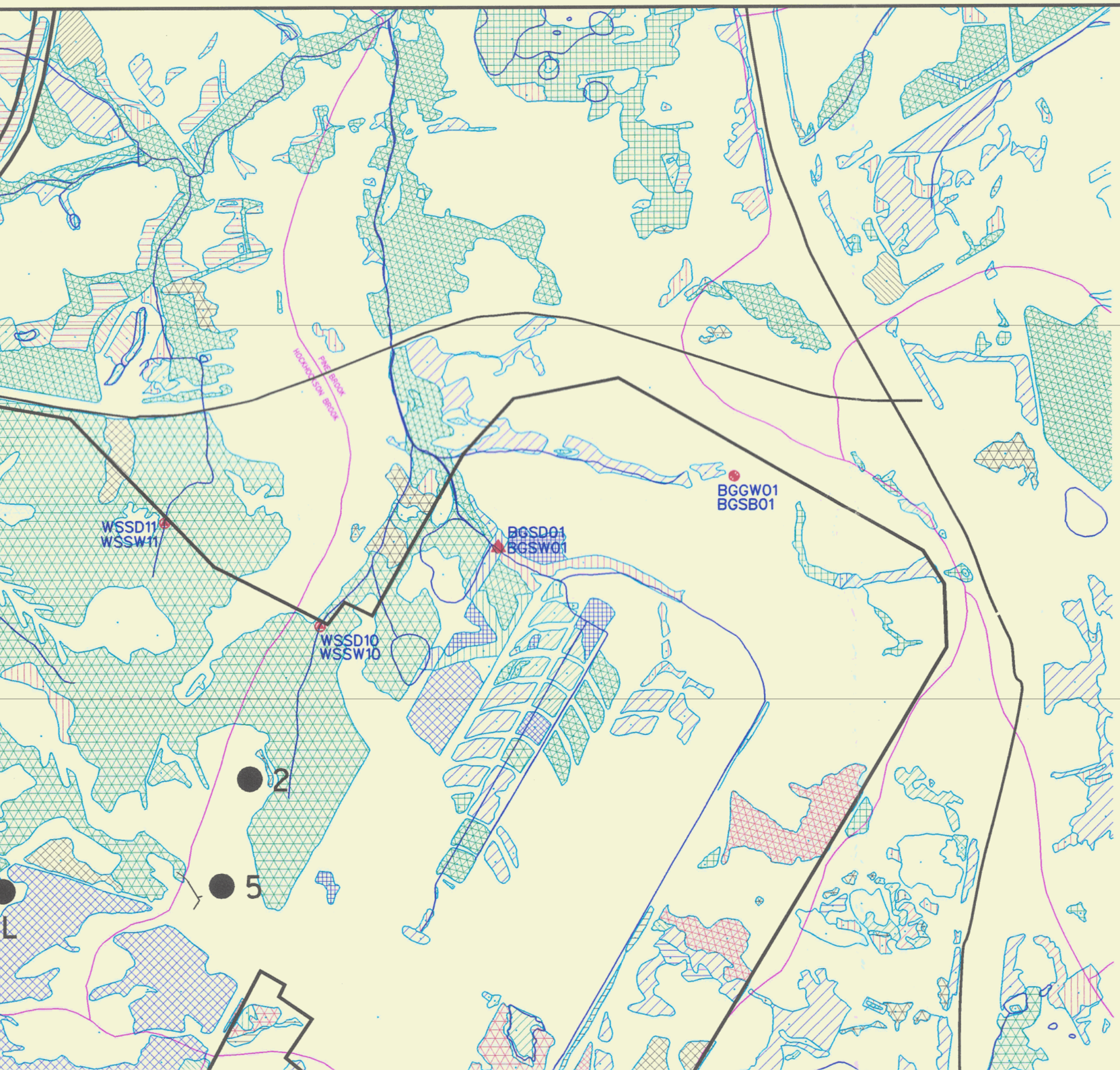
DEPARTMENT OF THE NAVY
NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
PHILADELPHIA, PENNSYLVANIA

NWS EARLE
COLTS NECK, NEW JERSEY

MAINSIDE
WETLANDS AND DRAINAGE BASINS MAP

CODE ID. NO. 80091 SIZE D
SCALE:
EFD NO.
STA. PROJ. NO.
SPEC. NO.
CONSTR. CONTR. NO.
NAVFAC DRAWING NO.
SHEET OF

FIGURE 30-1



LEGEND

- UPLAND
- PFØ1A
- PEM1C
- POWHh
- PFØ1B
- R2ØW
- PFØ1C
- PEM1B
- PSS1B
- MODAg
- PEM1B/PFØ1B
- PEM1B/PSS1B
- PSS1C
- PFØ1E
- PEM1F
- MODR
- POWHx
- MODL
- PFØ1/4B

N

SYM.	DESCRIPTION	DATE	APPROVED

REVISIONS

A/E EFD

DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

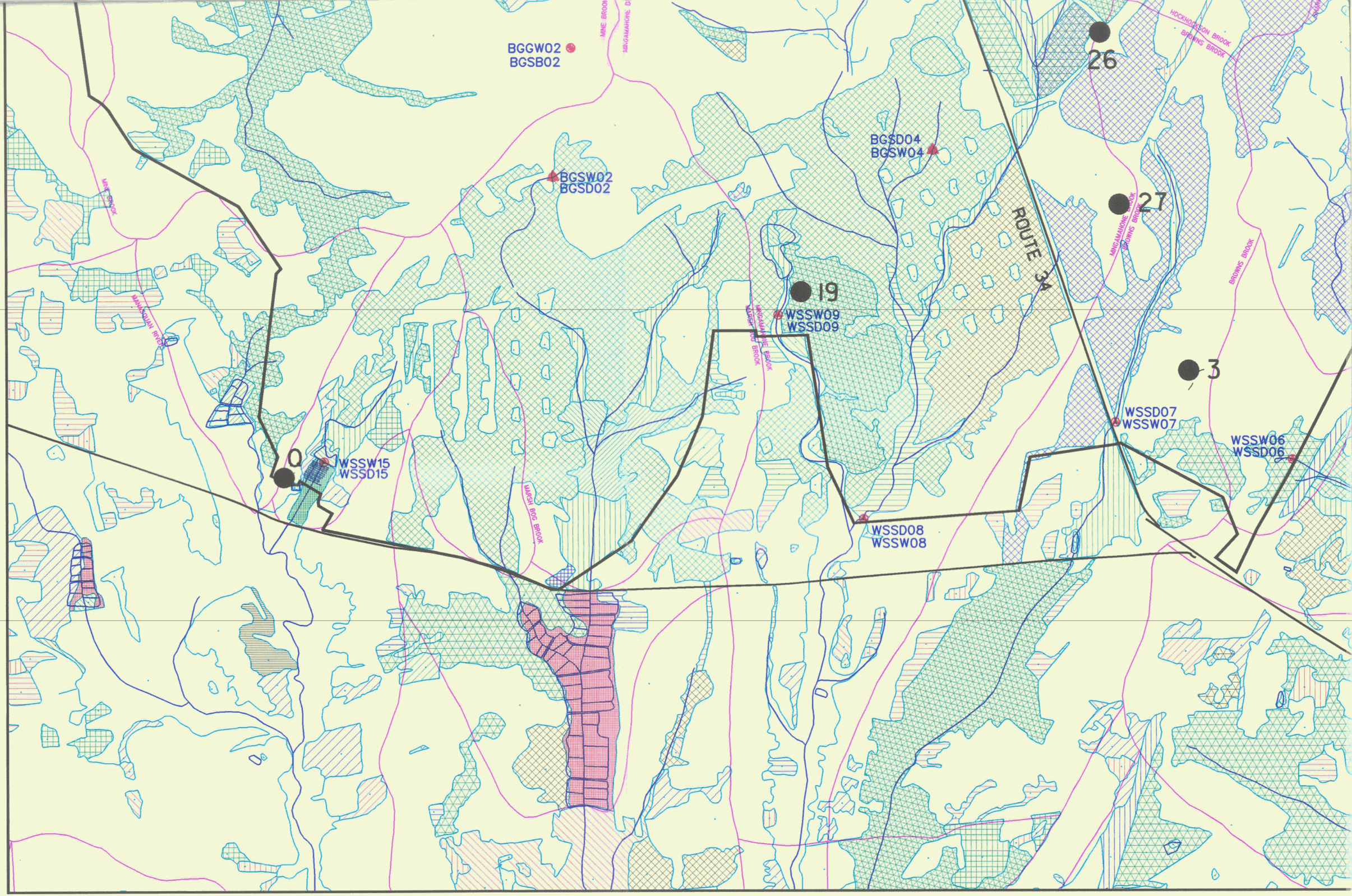
Brown & Root Environmental
FOSTER PLAZA VII
661 ANDERSEN DRIVE
PITTSBURGH, PA 15220

DATE

TY - SATISFACTORY TO

DATE

COMMANDER NAVFAC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BGSB02
BGSW02
BGSD02
BGSD04
BGSW04
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27
19
WSSW09
WSSD09
3
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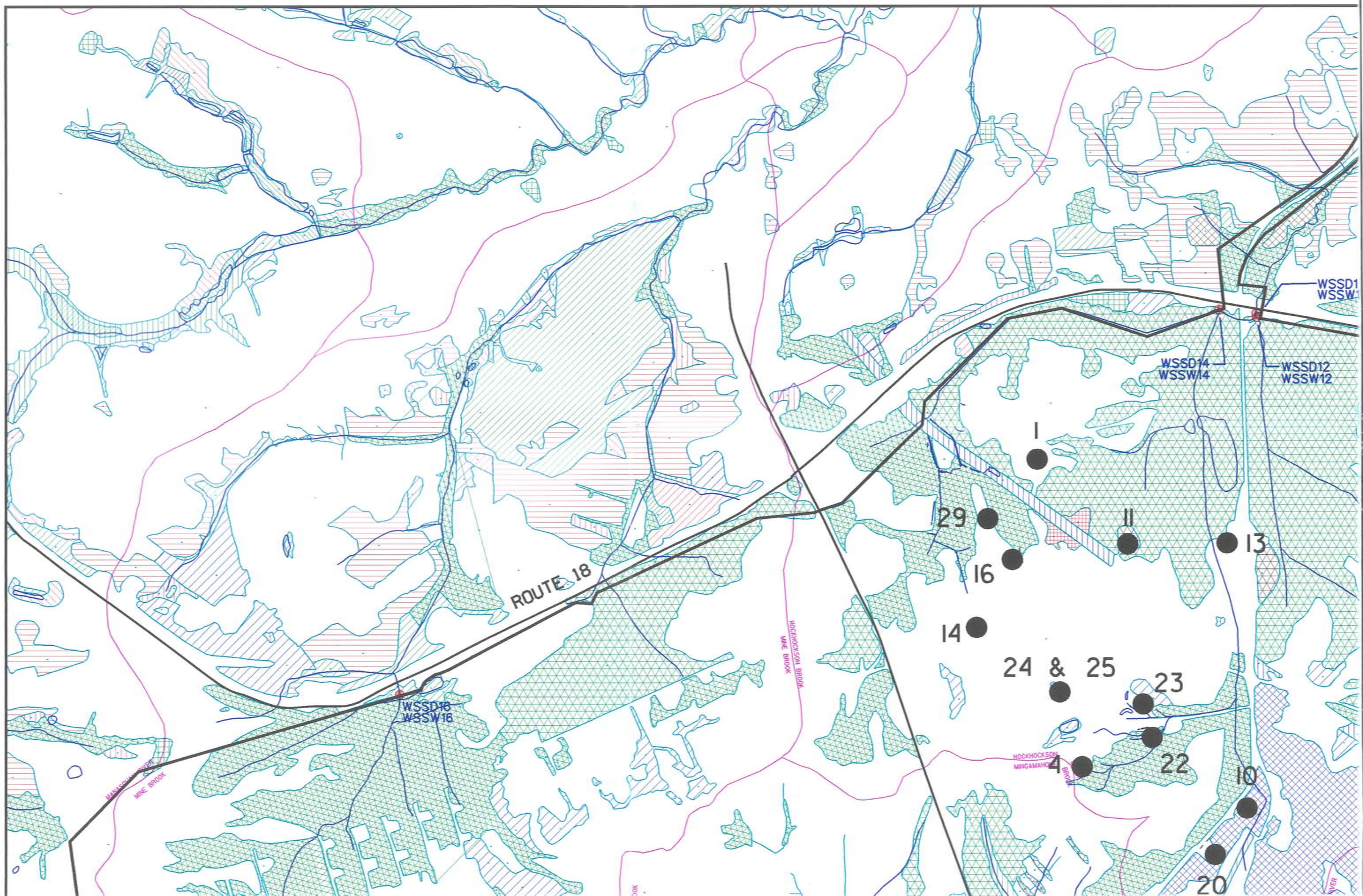
WSSW07
WSSW06
WSSD06
WSSD08
WSSW08
WSSW15
WSSD15
ROUTE 34
MINE BROOK
MINGAMAHONE BROOK
HOCKHOMSON BROOK
BROWNS BROOK
MARSH BOG BROOK
MANALOUAN RIVER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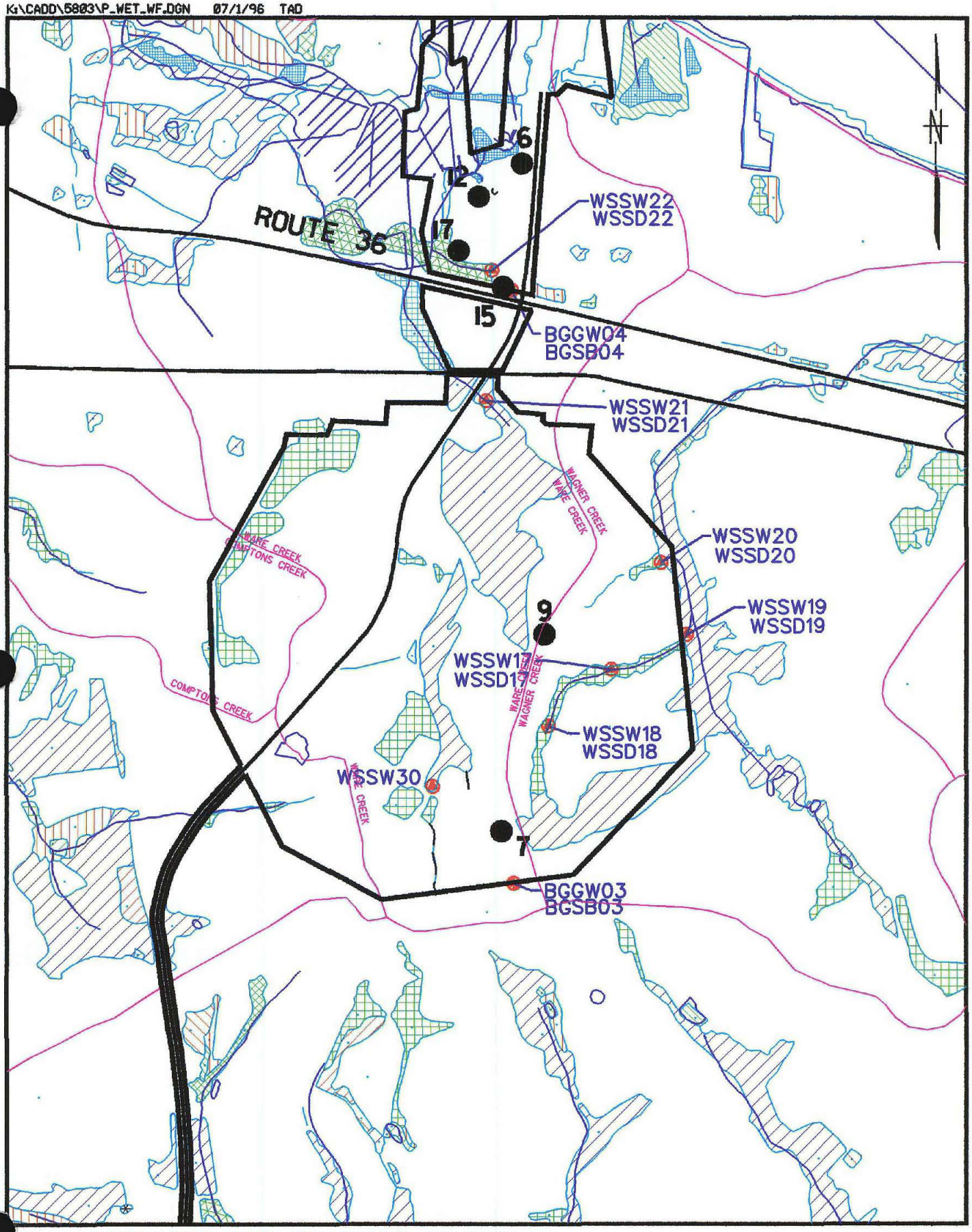


WETLANDS AND DRAINAGE BASINS

NWS EARLE, COLTS NECK, NEW JERSEY

FIGURE 30-2

0 1500 3000

SCALE IN FEET

Brown & Root Environmental

Table 30-1
Watershed Surface Water and Sediment Sampling Summary
NWS Earle Colts Neck, New Jersey

Sample Number	Watershed	Analytical Parameters
WS SW 05	Shark River	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 05	Shark River	TCL VOC, TCL pesticides/PCBs, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 06	Shark River	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 06	Shark River	TCL VOC, TCL pesticides/PCBs, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 07	Mingamahone Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 07	Mingamahone Brook	TCL VOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 08	Mingamahone Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 08	Mingamahone Brook	TCL VOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 09 (Dup-01)	Mingamahone Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 09 (Dup-01)	Mingamahone Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 10	Pine Brook	TCL VOC, TCL SVOC, TAL metals, explosives, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 10	Pine Brook	TCL VOC, TAL metals, explosives, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 11	Hockhockson Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 11	Hockhockson Brook	TCL VOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 12	Hockhockson Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 12	Hockhockson Brook	TCL VOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphate

Table 30-1
Watershed Surface Water and Sediment Sampling Summary
NWS Earle Colts Neck, New Jersey
Page 2 of 3

Sample Number	Watershed	Analytical Parameters
WS SW 13	Hockhockson Brook	TCL VOC, TCL SVOC, TAL metals, explosives, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 13	Hockhockson Brook	TCL VOC, TAL metals, explosives, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 14	Hockhockson Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 14	Hockhockson Brook	TCL VOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 15	Mingamahone Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 15	Mingamahone Brook	TCL VOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 16	Mine Brook	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 16	Mine Brook	TCL VOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 17 (Dup-02)	Wagner Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, TOC, phosphate, and turbidity
WS SD 17 (Dup-02)	Wagner Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, TOC, and phosphates
WS SW 18	Wagner Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, phosphate, and turbidity
WS SD 18	Wagner Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, and phosphates
WS SW 19	Wagner Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, phosphate, and turbidity
WS SD 19	Wagner Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, and phosphates
WS SW 20	Wagner Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, phosphate, and turbidity
WS SD 20	Wagner Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, and phosphates

Table 30-1
Watershed Surface Water and Sediment Sampling Summary
NWS Earle Colts Neck, New Jersey
Page 3 of 3

Sample Number	Watershed	Analytical Parameters
WS SW 21	Ware Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, BOD, COD, chloride, nitrite, nitrate, hardness, phosphate, and turbidity
WS SD 21	Ware Creek	TCL VOC, TCL SVOC, TAL metals, ammonia, chloride, moisture, nitrite, nitrate, and phosphate
WS SW 22	Ware Creek	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, explosives, ammonia, BOD, COD, chloride, nitrite, nitrate, TPH, hardness, TOC, phosphates, and turbidity
WS SD 22	Ware Creek	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, explosives, ammonia, COD, chloride, moisture, nitrite, nitrate, TPH, pH, and TOC
WS SW 30	Wagner Creek	TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, explosives, ammonia, BOD, COD, chloride, nitrite, nitrate, TPH, sulfates, hardness, TOC, and phosphates

- (WS SW/SD14) - West of Normandy Road at the station boundary, upstream along the western branch and upstream of drainage from Site 13, south of Route 18. The stream was 30 inches wide and 6 inches deep, with a low flow.

Shark River Watershed

- (WS SW/SD05) - Located along the southeastern boundary where a tributary of the Shark River passes beneath the northeastern end of the railroad storage yard. The stream was 3 feet wide and 6 inches deep.

- (WS SW/SD06) - Located along the southeastern boundary where a tributary of the Shark River passes beneath the southwestern end of the railroad storage yard. The stream was 3 feet wide and 8 inches deep, with a very low flow.

Mingamahone Brook Watershed

- (WS SW/SD07) - East Branch of Mingamahone Brook, where it crosses beneath Route 34, southwest of Site 3. The stream was approximately 20 inches deep where it enters a 2-foot- diameter concrete pipe to pass under the perimeter fence.

- (WS SW/SD08) - Southeast of Site 19, where the middle branch crosses beneath the southern perimeter road, west of the trailer park. The sample was collected at the point where a ponded area flows into a drainage pipe. The flow was estimated at 80 gpm.

- (WS SW/SD09) - South of Site 19 at southern perimeter fence, east of Guadalcanal Road. The stream was 3 feet wide and 4 inches deep.

- (WS SW/SD15) - Flooded marsh at southwestern perimeter road, east of Site Q, along Yellow Brook. The stream was 18 inches wide and 4 inches deep, with a very low flow. Yellow Brook flows southward 2.1 miles to the confluence of the Manasquan River, which flows 4.2 miles southeastward to the confluence of the Mingamahone River.

Mine Brook Watershed

- (WS SW/SD16) - Near the pond at the northwestern boundary, north of Tarawa Road, south of Route 18. The stream was 4 feet wide and 30 inches deep, with a good flow.

30.1.2 Waterfront

Wagner Creek Watershed

- (WS SW/SD17) - Drainage ditch, east of Site 9 spring, where it ponds at the fire road.
- (WS SW/SD18) - Stream near the spring south of Site 9.
- (WS SW/SD19) - Drainage ditch east of the Site 9 spring, where it passes beneath perimeter road.
- (WS SW/SD20) - Wetlands drainage at pipe under perimeter road (north of WS SW/SD19).
- (WS SW30) - Stream located west of Site 7 in the Chapel Hill area. The stream was 1 foot wide and 3 inches deep, with a flow of less than 1 gpm.

Ware Creek Watershed

- (WS SW/SD21) - Where the creek passes beneath Normandy Road, north of Garrett Hill.
- (WS SW/SD22) - Drainage ditch southeast of Site 15. The stream was 4 feet wide and 1 inch deep, with a very low flow.

30.2 NATURE AND EXTENT OF CONTAMINATION - WATERSHED SAMPLES

30.2.1 Sediment

Eighteen sediment samples were collected from the watershed study locations. Figure 30-1 shows Mainside background and watershed sampling locations. Figure 30-2 shows Waterfront background and watershed sampling locations. Tables 30-2 and 30-3 present the occurrence and distribution of inorganic and organic chemicals detected in background (see Section 31) and watershed samples, respectively. Table 30-2a and 30-2b present a comparison of detected compounds to ARARs. Figures 30-3 and 30-4 shows sample locations and concentrations of compounds which exceed ARARs.

TABLE 30-2
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN WATERSHED SAMPLES (SEDIMENT)
NWS EARLE, COLTS NECK, NEW JERSEY
(mg/kg)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	839 - 3940	5492.67	18 / 18	1320 - 10400	3772.22	NO	4912.38
ARSENIC	2 / 3	2.4 - 6.2	5.95	17 / 18	0.96 - 192	18.30	YES	36.34
BARIUM	3 / 3	3.9 - 10.6	14.07	18 / 18	3.2 - 81.05	29.55	YES	39.30
BERYLLIUM	1 / 3	0.57	0.67	11 / 18	0.35 - 6	0.83	YES	1.39
CADMIUM	NOT DETECTED	-	-	2 / 18	3.2 - 7.1	1.03	YES	1.72
CALCIUM	3 / 3	179 - 518	685.33	18 / 18	122 - 9970	1326.61	YES	2292.21
CHROMIUM	3 / 3	4.3 - 56	43.13	17 / 18	4.4 - 63.4	20.74	NO	28.33
COBALT	1 / 3	2.1	3.30	5 / 18	1.5 - 29.7	3.37	YES	6.16
COPPER	3 / 3	1.5 - 13	12.47	16 / 18	1.4 - 21.1	5.92	NO	8.20
CYANIDE	NOT DETECTED	-	-	2 / 18	0.47 - 1.7	0.37	YES	0.53
IRON	3 / 3	228 - 7650	6578.67	18 / 18	1795 - 505000	44564.72	YES	92099.82
LEAD	3 / 3	4.6 - 34.3	30.60	18 / 18	4.6 - 64.8	20.33	NO	27.99
MAGNESIUM	3 / 3	60.7 - 256	306.47	18 / 18	68.1 - 1780	465.11	YES	683.68
MANGANESE	3 / 3	4.6 - 9.2	13.80	13 / 18	1.4 - 231	37.48	YES	64.22
MERCURY	1 / 3	0.068	0.05	10 / 18	0.0135 - 0.19	0.04	NO	0.06
NICKEL	2 / 3	2.1 - 6	7.93	7 / 18	2.9 - 28.7	5.04	NO	7.84
POTASSIUM	2 / 3	86.1 - 681	589.40	16 / 18	122 - 3850	885.80	YES	1389.61
SELENIUM	NOT DETECTED	-	-	5 / 18	1.4 - 32.7	2.85	YES	5.95
SILVER	NOT DETECTED	-	-	1 / 18	4.1	1.11	YES	1.50
SODIUM	3 / 3	26.6 - 116	115.27	18 / 18	13.9 - 673	104.96	NO	166.97
THALLIUM	NOT DETECTED	-	-	2 / 18	2.65 - 23.4	2.04	YES	4.25
VANADIUM	3 / 3	5.9 - 42.7	36.93	18 / 18	6.5 - 84	26.27	NO	34.87
ZINC	3 / 3	14.2 - 26.9	37.33	9 / 18	1.8 - 65.55	25.32	NO	34.38

TABLE 30-3
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN WATERSHED AREA (SEDIMENT SAMPLES)
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/kg)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
2-BUTANONE	-	-	-	7 / 18	6 - 270	64.05
2-METHYLNAPHTHALENE	-	-	-	1 / 18	220	220
4,4'-DDD	2 / 3	4.9 - 21	21	2 / 3	30 - 85	85
4,4'-DDE	1 / 3	1.7	1.7	2 / 3	6 - 26	26
4,4'-DDT	1 / 3	19	19	2 / 3	7.7 - 770	770
ACENAPHTHENE	-	-	-	1 / 18	310	310
ACENAPHTHYLENE	-	-	-	1 / 18	74	74
ALPHA-CHLORDANE	-	-	-	1 / 3	2.4	2.4
ANTHRACENE	-	-	-	1 / 18	160	160
BENZO(A)ANTHRACENE	2 / 3	140 - 560	560	5 / 18	49 - 440	440
BENZO(A)PYRENE	2 / 3	160 - 590	590	5 / 18	69 - 280	280
BENZO(B)FLUORANTHENE	2 / 3	150 - 490	490	6 / 18	88 - 610	453.09
BENZO(G,H,I)PERYLENE	2 / 3	130 - 380	380	2 / 18	61 - 140	140
BENZO(K)FLUORANTHENE	2 / 3	150 - 470	470	5 / 18	65 - 480	458.59
BUTYLBENZYLPHTHALATE	-	-	-	1 / 18	97	97
CARBAZOLE	-	-	-	1 / 18	300	300
CHRYSENE	2 / 3	250 - 940	940	6 / 18	82 - 1200	531.03
DI-N-BUTYLPHTHALATE	-	-	-	2 / 18	66 - 1300	596.37
DI-N-OCTYLPHTHALATE	-	-	-	1 / 18	71	71
DIBENZOFURAN	-	-	-	1 / 18	220	220
DIETHYLPHTHALATE	1 / 3	44	44	7 / 18	45 - 250	250
ENDOSULFAN SULFATE	-	-	-	2 / 3	6 - 63	63
ENDRIN	-	-	-	2 / 3	0.85 - 16	16
ENDRIN KETONE	1 / 3	1.6	1.6	1 / 3	9.7	9.7
ETHYLBENZENE	-	-	-	1 / 18	3	3
FLUORANTHENE	2 / 3	300 - 1800	1800	7 / 18	130 - 3400	831.59
FLUORENE	1 / 3	190	190	2 / 18	260 - 310	310
HEXACHLOROETHANE	-	-	-	1 / 18	55	55
INDENO(1,2,3-CD)PYRENE	2 / 3	110 - 310	310	3 / 18	52 - 110	110
METHOXYCHLOR	-	-	-	1 / 3	77	77
METHYLENE CHLORIDE	-	-	-	6 / 18	2 - 9	9
NAPHTHALENE	-	-	-	2 / 18	110 - 360	360
PHENANTHRENE	2 / 3	200 - 1900	1900	4 / 18	52 - 2300	759.83
PHENOL	-	-	-	1 / 18	120	120
PYRENE	2 / 3	350 - 1900	1900	8 / 18	98 - 2400	690.71
TETRACHLOROETHENE	2 / 3	3 - 50	50	3 / 18	18 - 46	20.25
TOLUENE	1 / 3	480	480	6 / 18	2 - 71	22.98
XYLENE (TOTAL)	-	-	-	1 / 18	17	14.96

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD05		WSSD06		WSSD07		WSSD08		WSSD09		WSSD09-DUP		WSSD10		ARARS & TBCs	
LOCATION:	WSSD05		WSSD06		WSSD07		WSSD08		WSSD09		WSSD09		WSSD10		Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI			
INORGANICS	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
aluminum	2970	J	1820		2210		3170	J	1010		1750		3500	J	-	
arsenic	2.6	J	1.4		1.2		5.2	J	0.92	U	1.0		3.2	J	8.20	L
barium	16.4	J	3.2		8.1		23.4	J	10.5		16.4		51.3	E J	40.0	B
beryllium	0.35	UJ	0.26	U	0.20	U	0.54	J	0.26	U	0.27	U	1.3	J	-	
cadmium	1.2	UJ	0.91	U	0.72	U	1.1	UJ	0.92	U	1.0	U	3.2	E J	1.20	L
calcium	627	J	124		122		1710	J	418		680		10000	J	-	
chromium, total	5.3	J	5.4		6.5		9.9	J	4.1		5.7		63.4	J	81.0	L
cobalt	2.3	UJ	1.7	U	1.4	U	2.1	UJ	1.7	U	1.8	U	4.8	UJ	50.0	T
copper	5.3	J	4.3		5.4		5.3	J	3.0		3.4		14.7	J	34.0	L
cyanide	0.59	UJ	0.41	UJ	0.36	UJ	0.54	UJ	0.45	UJ	0.47	UJ	1.2	UJ	0.100	S
iron	5580	J	2580		3380		32800	J	1350		2240		6970	J	-	
lead	16.3	J	10.4		23.4		23.0	J	9.2		12.7		61.1	E J	47.0	L
magnesium	100	J	109		222		105	J	92.0		152		293	J	-	
manganese	5.1		1.6		7.2	R	10.1	R	3.9		7.5		20.5	R	460	O
mercury	0.044	J	0.016		0.017		0.026	J	0.014		0.013		0.075	J	0.150	L
nickel	3.9	UJ	2.9		2.3	U	3.5	UJ	2.9	U	3.0	U	9.4	J	21.0	L
potassium	191	J	88.8	U	170		164	J	112		243		291	J	-	
selenium	1.2	UJ	0.91	UJ	0.72	UJ	1.1	UJ	0.92	UJ	1.0	UJ	2.6	UJ	-	
silver	2.0	UJ	1.5	U	1.2	U	1.8	UJ	1.5	U	1.6	U	4.2	UJ	1.00	M
sodium	74.7	J	60.7		54.6		58.9	J	68.2		40.8		153	J	-	
thallium	1.5	UJ	1.1	UJ	0.86	UJ	1.3	UJ	1.1	UJ	1.1	UJ	3.1	UJ	-	
vanadium	13.2	J	8.9		9.2		31.0	J	5.6		7.4		29.1	J	-	
zinc	22.8	R	11.9		22.4	R	39.0	R	15.0	R	20.3	R	130	R	150	L
SEMIVOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
2-methylnaphthalene	820	UJ	600	U	470	U	220	J	610	U	620	U	1600	UJ	330	F
acenaphthene	820	UJ	600	U	470	U	730	UJ	610	U	620	U	310	J	620	Q
acenaphthylene	820	UJ	600	U	470	U	74.0	E J	610	U	620	U	1600	UJ	44.0	L
anthracene	820	UJ	600	U	470	U	160	J	610	U	620	U	1600	UJ	330	F

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD05		WSSD06		WSSD07		WSSD08		WSSD09		WSSD09-DUP		WSSD10		ARARS & TBCs	
LOCATION:	WSSD05		WSSD06		WSSD07		WSSD08		WSSD09		WSSD09		WSSD10		Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI			
SEMIVOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
benzo(a)anthracene	820	UJ	67.0	J	49.0	J	400	E J	120	J	86.0	J	440	E J	330	F
benzo(a)pyrene	820	UJ	77.0	J	69.0	J	280	J	120	J	93.0	J	240	J	430	L
benzo(b)fluoranthene	89.0	J	93.0	J	88.0	J	170	J	120	J	88.0	J	610	E J	330	F
benzo(g,h,i)perylene	820	UJ	600	U	61.0	J	140	J	610	U	620	U	1600	UJ	330	F
benzo(k)fluoranthene	820	UJ	86.0	J	65.0	J	180	J	120	J	90.0	J	480	E J	330	F
butylbenzylphthalate	820	UJ	600	U	470	U	730	UJ	610	U	620	U	1600	UJ	11000	Q
carbazole	820	UJ	600	U	470	U	730	UJ	610	U	620	U	300	J	330	F
chrysene	95.0	J	99.0	J	82.0	J	510	E J	190	J	150	J	1200	E J	330	F
di-n-butylphthalate	820	UJ	600	U	470	U	730	UJ	610	U	620	U	1600	UJ	11000	P
di-n-octylphthalate	820	UJ	600	U	71.0	J	730	UJ	610	U	620	U	1600	UJ	-	
dibenzofuran	820	UJ	600	U	470	U	730	UJ	610	U	620	U	220	J	2000	P
diethylphthalate	820	UJ	83.0	J	470	U	82.0	J	610	U	620	U	1600	UJ	630000	P
fluoranthene	140	J	160	J	140	J	670	J	270	J	210	J	3400	E J	2900	Q
fluorene	820	UJ	600	U	470	U	260	J	610	U	620	U	310	J	540	P
hexachloroethane	820	UJ	600	U	470	U	730	UJ	610	U	620	U	1600	UJ	1000	P
indeno(1,2,3-cd)pyrene	820	UJ	600	U	52.0	J	110	J	66.0	J	620	U	1600	UJ	330	F
naphthalene	820	UJ	600	U	470	U	110	J	610	U	620	U	360	J	480	P
phenanthrene	820	UJ	600	U	52.0	J	1400	E J	170	J	140	J	2300	E J	850	Q
phenol	820	UJ	600	U	470	U	730	UJ	610	U	620	U	1600	UJ	-	
pyrene	120	J	110	J	110	J	940	E J	270	J	230	J	2400	E J	660	L
VOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
2-butanone	25.0	UJ	18.0	U	11.0	J	70.0	J	33.0		72.0		110	J	-	
ethylbenzene	25.0	UJ	18.0	U	14.0	U	22.0	UJ	18.0	U	19.0	U	50.0	UJ	3600	P
methylene chloride	3.0	J	2.0	J	14.0	U	4.0	J	2.0	J	2.0	J	50.0	UJ	427	S
tetrachloroethene	25.0	UJ	18.0	U	14.0	U	22.0	UJ	18.0	U	19.0	U	50.0	UJ	-	
toluene	25.0	UJ	4.0	J	14.0	U	22.0	UJ	22.0		120		22.0	J	670	P
xylene (total)	25.0	UJ	18.0	U	14.0	U	22.0	UJ	18.0	U	19.0	U	17.0	J	25.0	P

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD05	WSSD06	WSSD07	WSSD08	WSSD09	WSSD09-DUP	WSSD10	ARARS & TBCs
LOCATION:	WSSD05	WSSD06	WSSD07	WSSD08	WSSD09	WSSD09	WSSD10	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
4,4'-DDD	85.0 E J	30.0 E	n/a	n/a	n/a	n/a	n/a	1.60 L
4,4'-DDE	5.6 U	6.0 E J	n/a	n/a	n/a	n/a	n/a	2.20 L
4,4'-DDT	770 E	7.7 E	n/a	n/a	n/a	n/a	n/a	1.60 L
alpha-chlordane	2.9 U	3.2 U	n/a	n/a	n/a	n/a	n/a	7.00 O
beta-BHC	2.9 U	3.2 U	n/a	n/a	n/a	n/a	n/a	-
endosulfan sulfate	63.0 E	6.0 E J	n/a	n/a	n/a	n/a	n/a	5.40 P
endrin	16.0	0.85 J	n/a	n/a	n/a	n/a	n/a	20.0 Q
endrin ketone	9.7	6.3 U	n/a	n/a	n/a	n/a	n/a	20.0 Q
methoxychlor	77.0 E	32.0 U	n/a	n/a	n/a	n/a	n/a	19.0 P

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD11	WSSD12	WSSD13	WSSD14	WSSD15	WSSD16	WSSD17	ARARS & TBCs
LOCATION:	WSSD11	WSSD12	WSSD13	WSSD14	WSSD15	WSSD16	WSSD17	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	
INORGANICS	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
aluminum	6130 J	1320	2530	1650	3440 J	1570	10300 J	-
arsenic	3.6 UJ	14.1 E	13.6 E	5.0	2.9 J	17.3 E	32.9 E J	8.20 L
barium	77.9 E J	9.6	15.6	55.3 E	9.0 J	25.3	69.9 E J	40.0 B
beryllium	1.0 UJ	0.40	0.58	0.56	0.32 UJ	0.35	1.2 J	-
cadmium	3.6 UJ	0.71 U	0.78 U	0.71 U	1.1 UJ	0.70 U	1.3 UJ	1.20 L
calcium	4070 J	203	374	825	194 J	295	765 J	-
chromium, total	59.8 J	21.7	32.4	19.8	21.7 J	17.0	47.5 J	81.0 L
cobalt	6.8 UJ	1.3 U	1.5 U	1.3 U	2.1 UJ	1.3 U	4.2 J	50.0 T
copper	13.8 J	1.3 U	2.7	2.3	5.0 J	1.3 U	20.7 J	34.0 L
cyanide	1.8 UJ	0.35 UJ	0.47 E J	0.35 UJ	0.56 UJ	0.32 UJ	0.65 UJ	0.100 S
iron	5330 J	14400	20700	21900	4850 J	18600	61500 J	-
lead	64.8 E J	7.0	10.1	8.1	14.1 J	12.2	46.3 J	47.0 L
magnesium	882 J	68.1	137	261	362 J	117	1780 J	-
manganese	21.2 R	1.4	4.0	18.9 R	3.0	1.5	56.9 J	460 O
mercury	0.047 UJ	0.0092 U	0.010 U	0.0093 U	0.045 J	0.0090 U	0.11 J	0.150 L
nickel	11.4 UJ	2.2 U	2.5 U	2.3 U	3.6 UJ	2.2 U	8.3 J	21.0 L
potassium	852 J	122	351	452	862 J	272	3960 J	-
selenium	3.6 UJ	0.71 UJ	0.78 UJ	0.71 UJ	1.1 UJ	0.70 UJ	5.4 J	-
silver	5.9 UJ	1.2 U	1.3 U	1.2 U	1.9 UJ	1.1 U	2.2 UJ	1.00 M
sodium	243 J	30.1	65.3	57.5	78.4 J	24.2	120 J	-
thallium	4.3 UJ	0.85 UJ	0.94 UJ	0.85 UJ	1.4 UJ	0.83 UJ	3.4 J	-
vanadium	84.0 J	22.5	27.1	12.8	41.3 J	12.7	57.7 J	-
zinc	118 R	13.2 R	21.8 R	61.0 R	9.8	9.1	58.0 J	150 L
SEMIVOLATILES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**
2-methylnaphthalene	2400 UJ	460 U	520 U	470 U	750 UJ	460 U	900 UJ	330 F
acenaphthene	2400 UJ	460 U	520 U	470 U	750 UJ	460 U	900 UJ	620 Q
acenaphthylene	2400 UJ	460 U	520 U	470 U	750 UJ	460 U	900 UJ	44.0 L
anthracene	2400 UJ	460 U	520 U	470 U	750 UJ	460 U	900 UJ	330 F

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD11		WSSD12		WSSD13		WSSD14		WSSD15		WSSD16		WSSD17		ARARS & TBCs	
LOCATION:	WSSD11		WSSD12		WSSD13		WSSD14		WSSD15		WSSD16		WSSD17		Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI			
SEMIVOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
benzo(a)anthracene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	330	F
benzo(a)pyrene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	430	L
benzo(b)fluoranthene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	330	F
benzo(g,h,i)perylene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	330	F
benzo(k)fluoranthene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	330	F
butylbenzylphthalate	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	11000	Q
carbazole	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	330	F
chrysene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	330	F
di-n-butylphthalate	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	11000	P
di-n-octylphthalate	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	-	
dibenzofuran	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	2000	P
diethylphthalate	250	J	460	U	520	U	470	U	750	UJ	64.0	J	900	UJ	630000	P
fluoranthene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	130	J	2900	Q
fluorene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	540	P
hexachloroethane	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	1000	P
indeno(1,2,3-cd)pyrene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	330	F
naphthalene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	480	P
phenanthrene	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	850	Q
phenol	2400	UJ	460	U	520	U	470	U	750	UJ	460	U	900	UJ	-	
pyrene	2400	UJ	460	U	520	U	470	U	98.0	J	460	U	900	UJ	660	L
VOLATILES	ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg		ug/kg	
2-butanone	71.0	UJ	14.0	U	6.0	J	14.0	U	30.0	J	14.0	U	45.0	UJ	-	
ethylbenzene	71.0	UJ	14.0	U	16.0	U	14.0	U	3.0	J	14.0	U	27.0	UJ	3600	P
methylene chloride	9.0	J	2.0	J	16.0	U	14.0	U	23.0	UJ	14.0	U	27.0	UJ	427	S
tetrachloroethene	71.0	UJ	14.0	U	16.0	U	14.0	U	23.0	UJ	14.0	U	27.0	UJ	-	
toluene	54.0	J	14.0	U	16.0	U	14.0	U	2.0	J	14.0	U	27.0	UJ	670	P
xylene (total)	71.0	UJ	14.0	U	16.0	U	14.0	U	23.0	UJ	14.0	U	27.0	UJ	25.0	P

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD11	WSSD12	WSSD13	WSSD14	WSSD15	WSSD16	WSSD17	ARARS & TBCs	
LOCATION:	WSSD11	WSSD12	WSSD13	WSSD14	WSSD15	WSSD16	WSSD17	Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI		
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	
4,4'-DDD	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.60	L
4,4'-DDE	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.20	L
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1.60	L
alpha-chlordane	n/a	n/a	n/a	n/a	n/a	n/a	n/a	7.00	O
beta-BHC	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	
endosulfan sulfate	n/a	n/a	n/a	n/a	n/a	n/a	n/a	5.40	P
endrin	n/a	n/a	n/a	n/a	n/a	n/a	n/a	20.0	Q
endrin ketone	n/a	n/a	n/a	n/a	n/a	n/a	n/a	20.0	Q
methoxychlor	n/a	n/a	n/a	n/a	n/a	n/a	n/a	19.0	P

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD17-DUP			WSSD18			WSSD19			WSSD20			WSSD21			WSSD22			---		ARARS & TBCs	
LOCATION:	WSSD17			WSSD18			WSSD19			WSSD20			WSSD21			WSSD22			---		Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI			1995 RI			1995 RI			1995 RI			1995 RI			1995 RI						
INORGANICS	**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**			**mg/kg**					**mg/kg**	
aluminum	10500		J	1530			3010			8680			4120			8470		J			-	
arsenic	26.2	E	J	3.2			12.2	E		11.7	E		11.5	E		192	E	J			8.20	L
barium	92.2	E	J	7.4			40.9	E		42.7	E		24.8			26.5		J			40.0	B
beryllium	1.3		J	0.21		U	0.64			1.3			0.77			6.0		J			-	
cadmium	1.4		UJ	0.73		U	0.66		U	0.77		U	0.64		U	7.1	E	J			1.20	L
calcium	927		J	143			638			821			578			1790		J			-	
chromium, total	41.2		J	4.4			7.9			25.8			18.3			9.6		UJ			81.0	L
cobalt	5.1		J	1.4		U	1.5			7.2			2.8			29.7		J			50.0	T
copper	21.5		J	2.4			1.5			7.6			1.4			9.2		J			34.0	L
cyanide	0.71		UJ	0.36		UJ	0.33		UJ	0.37		UJ	0.32		UJ	1.7	E	J			0.100	S
iron	52600		J	3130			37200			28200			32700			505000		J			-	
lead	55.9	E	J	9.6		J	6.6		J	19.3		J	4.6		J	13.2		J			47.0	L
magnesium	1470		J	182			504			1780		J	1140		J	363		J			-	
manganese	73.8		J	4.7			74.6		J	172		J	65.8		J	231		J			460	O
mercury	0.14		J	0.0094		U	0.0086		U	0.032			0.0083		U	0.19	E	J			0.150	L
nickel	10.9		J	2.3		U	2.9			12.0			5.7			28.7	E	J			21.0	L
potassium	2620		J	317			1140			3850			3260			277		UJ			-	
selenium	5.6		J	0.73		U	1.8		J	1.4		J	2.0		J	32.7		J			-	
silver	2.3		UJ	1.2		U	1.1		U	1.3		U	1.0		U	4.1	E	J			1.00	M
sodium	79.8		J	13.9			36.8			63.2			47.6			673		J			-	
thallium	1.9		J	0.87		U	0.79		U	0.92		U	0.77		U	23.4		J			-	
vanadium	54.9		J	8.0			11.2			28.3			16.4			54.4		J			-	
zinc	73.1		J	6.0		J	38.7		J	49.5		J	41.8		J	1.8		J			150	L
SEMIVOLATILES	**ug/kg**			**ug/kg**			**ug/kg**			**ug/kg**			**ug/kg**			**ug/kg**					**ug/kg**	
2-methylnaphthalene	950		UJ	480		U	440		U	510		U	430		U	1800		U			330	F
acenaphthene	950		UJ	480		U	440		U	510		U	430		U	1800		U			620	Q
acenaphthylene	950		UJ	480		U	440		U	510		U	430		U	1800		U			44.0	L
anthracene	950		UJ	480		U	440		U	510		U	430		U	1800		U			330	F

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD17-DUP		WSSD18		WSSD19		WSSD20		WSSD21		WSSD22		---	ARARS & TBCs	
LOCATION:	WSSD17		WSSD18		WSSD19		WSSD20		WSSD21		WSSD22		---	Sediment Ecological Toxicity Threshold Values	
DATA SOURCE:	1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI				
SEMIVOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**			**ug/kg**	
benzo(a)anthracene	950	UJ	480	U	440	U	510	U	430	U	1800	U		330	F
benzo(a)pyrene	950	UJ	480	U	440	U	510	U	430	U	1800	U		430	L
benzo(b)fluoranthene	950	UJ	480	U	440	U	510	U	430	U	1800	U		330	F
benzo(g,h,i)perylene	950	UJ	480	U	440	U	510	U	430	U	1800	U		330	F
benzo(k)fluoranthene	950	UJ	480	U	440	U	510	U	430	U	1800	U		330	F
butylbenzylphthalate	97.0	J	480	U	440	U	510	U	430	UJ	1800	U		11000	Q
carbazole	950	UJ	480	U	440	U	510	U	430	U	1800	U		330	F
chrysene	950	UJ	480	U	440	U	510	U	430	U	1800	U		330	F
di-n-butylphthalate	950	UJ	480	U	66.0	J	1300		430	U	1800	U		11000	P
di-n-octylphthalate	950	UJ	480	U	440	U	510	U	430	U	1800	U		-	
dibenzofuran	950	UJ	480	U	440	U	510	U	430	U	1800	U		2000	P
diethylphthalate	110	J	480	U	45.0	J	52.0	J	430	U	1800	U		630000	P
fluoranthene	130	J	480	U	440	U	510	U	430	U	1800	U		2900	Q
fluorene	950	UJ	480	U	440	U	510	U	430	U	1800	U		540	P
hexachloroethane	950	UJ	480	U	440	U	55.0	J	430	U	1800	U		1000	P
indeno(1,2,3-cd)pyrene	950	UJ	480	U	440	U	510	U	430	U	1800	U		330	F
naphthalene	950	UJ	480	U	440	U	510	U	430	U	1800	U		480	P
phenanthrene	950	UJ	480	U	440	U	510	U	430	U	1800	U		850	Q
phenol	950	UJ	480	U	440	U	120	J	430	U	1800	UJ		-	
pyrene	110	J	480	UJ	440	UJ	510	UJ	430	UJ	1800	U		660	L
VOLATILES	**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**		**ug/kg**			**ug/kg**	
2-butanone	51.0	UJ	14.0	U	13.0	U	15.0	U	13.0	U	270	J		-	
ethylbenzene	28.0	UJ	14.0	U	13.0	U	15.0	U	13.0	U	56.0	UJ		3600	P
methylene chloride	28.0	UJ	14.0	U	13.0	U	15.0	U	13.0	U	56.0	UJ		427	S
tetrachloroethene	24.0	J	14.0	U	13.0	U	46.0		18.0		56.0	UJ		-	
toluene	28.0	UJ	2.0	J	13.0	U	15.0	U	13.0	U	56.0	UJ		670	P
xylene (total)	28.0	UJ	14.0	U	13.0	U	15.0	U	13.0	U	56.0	UJ		25.0	P

TABLE 30-2a

COMPARISON OF SEDIMENT ANALYTICAL DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSD17-DUP	WSSD18	WSSD19	WSSD20	WSSD21	WSSD22	---	ARARS & TBCs
LOCATION:	WSSD17	WSSD18	WSSD19	WSSD20	WSSD21	WSSD22	---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI		
PESTICIDES	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**	**ug/kg**		**ug/kg**
4,4'-DDD	n/a	n/a	n/a	n/a	n/a	18.0 U		1.60 L
4,4'-DDE	n/a	n/a	n/a	n/a	n/a	26.0 E		2.20 L
4,4'-DDT	n/a	n/a	n/a	n/a	n/a	18.0 U		1.60 L
alpha-chlordane	n/a	n/a	n/a	n/a	n/a	2.4 J		7.00 O
beta-BHC	n/a	n/a	n/a	n/a	n/a	0.41 R		-
endosulfan sulfate	n/a	n/a	n/a	n/a	n/a	18.0 U		5.40 P
endrin	n/a	n/a	n/a	n/a	n/a	3.1 R		20.0 Q
endrin ketone	n/a	n/a	n/a	n/a	n/a	18.0 U		20.0 Q
methoxychlor	n/a	n/a	n/a	n/a	n/a	94.0 U		19.0 P

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

- No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

TABLE 30-2b

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSD05		WSSD06		WSSD07		WSSD08		WSSD09		WSSD09-DUP		WSSD10		ARARS & TBCs
LOCATION:		WSSD05		WSSD06		WSSD07		WSSD08		WSSD09		WSSD09		WSSD10		Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		
MISCELLANEOUS																
ammonia nitrogen	mg/kg	100	UJ	70.0	U	60.0	U	120	J	90.0	J	200	U	400	J	-
chemical oxygen demand	mg/kg	n/a		n/a		n/a		n/a		n/a		n/a		n/a		-
chloride	mg/kg	14.0	J	12.0		6.0		15.0	J	12.0		20.0		40.0	J	-
moisture	%	59.7		44.8		30.4		55.1		45.5		47.3		80.4		-
nitrate nitrogen	mg/kg	1.3	J	0.90	J	0.70	J	1.1	J	0.60	J	1.4		2.0	J	-
pH		n/a		n/a		n/a		n/a		n/a		n/a		n/a		-
petroleum hydrocarbons	mg/kg	n/a		n/a		n/a		n/a		n/a		n/a		n/a		-
total organic carbon	mg/kg	16000	J	8400	J	8300	J	16000	J	7000	J	7400	J	54000	J	-
total phosphorus as PO4	mg/kg	280	J	430		280		1200	J	270		290		1200	J	-

TABLE 30-2b

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSD11	WSSD12	WSSD13	WSSD14	WSSD15	WSSD16	WSSD17	ARARS & TBCs
LOCATION:		WSSD11	WSSD12	WSSD13	WSSD14	WSSD15	WSSD16	WSSD17	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	1995 RI	
MISCELLANEOUS									
ammonia nitrogen	mg/kg	300 J	100 U	70.0	100 U	200 J	100 U	300 J	-
chemical oxygen demand	mg/kg	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
chloride	mg/kg	30.0 J	7.0	15.0	12.0	19.0 J	6.0	22.0 J	-
moisture	%	86.1	29.3	36.0	29.8	56.1	28.1	62.8	-
nitrate nitrogen	mg/kg	3.5 J	0.30	0.60 J	0.30 J	1.0 J	0.40 J	1.2 J	-
pH		n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
petroleum hydrocarbons	mg/kg	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-
total organic carbon	mg/kg	23000 J	10000 J	12000 J	5300 J	38000 J	9500 J	27000 J	-
total phosphorus as PO4	mg/kg	1600 J	2000	3300 J	5200	740 J	4600	13000 J	-

TABLE 30-2b

COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - WATERSHED AREA

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSD17-DUP		WSSD18		WSSD19		WSSD20		WSSD21		WSSD22		---	ARARS & TBCs
LOCATION:		WSSD17		WSSD18		WSSD19		WSSD20		WSSD21		WSSD22		---	Sediment Ecological Toxicity Threshold Values
DATA SOURCE:		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI		1995 RI			
MISCELLANEOUS															
ammonia nitrogen	mg/kg	400	J	100	U	100	U	100	J	100	U	200	J		-
chemical oxygen demand	mg/kg	n/a		n/a		n/a		n/a		n/a		250000	J		-
chloride	mg/kg	25.0	J	24.0	J	4.0	J	9.0	J	7.0	J	1000	J		-
moisture	%	64.9		31.3		24.3		34.9		21.6		82.3	J		-
nitrate nitrogen	mg/kg	1.5	J	0.90	J	1.2	J	0.80	J	1.0		2.3	J		-
pH		n/a		n/a		n/a		n/a		n/a		6.0	J		-
petroleum hydrocarbons	mg/kg	n/a		n/a		n/a		n/a		n/a		1300	J		-
total organic carbon	mg/kg	47000	J	n/a		n/a		n/a		n/a		40000	J		-
total phosphorus as PO4	mg/kg	13000	J	1800		6900		5500		4300		2500	J		-

TABLE 30-2b
COMPARISON OF SEDIMENT MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCS - SITE WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to sediment ecological toxicity criteria:

. - No standard is available for this chemical in this classification.

B - Source: Baudo, R., J. Geisy and H. Muntau. eds. 1990. Sediments: Chemistry and Toxicity of In-Place Pollutants. Lewis Publishers, Inc. Ann Arbor, MI.

F - Source: USEPA. 1994c. Draft Region IV Waste Management Division Sediment Screeing Values for Hazardous Waste Sites. 2/16/94 Revision.

L - Effects Range-Low. Source: Long E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management. 19:81-97.

M - Effects Range-Low. Source: Long, E. R. and L. G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52, National Oceanic and Atmospheric Administration, Seattle, WA.

O - Ontario screening level. Source: Ontario Ministry of the Environment (OME). 1992. Guidelines for the Protection and Management of the Aquatic Sediment Quality in Ontario. Log 92-2309-067, PIBS 1962.

P - Sediment quality benchmark using equipartition. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

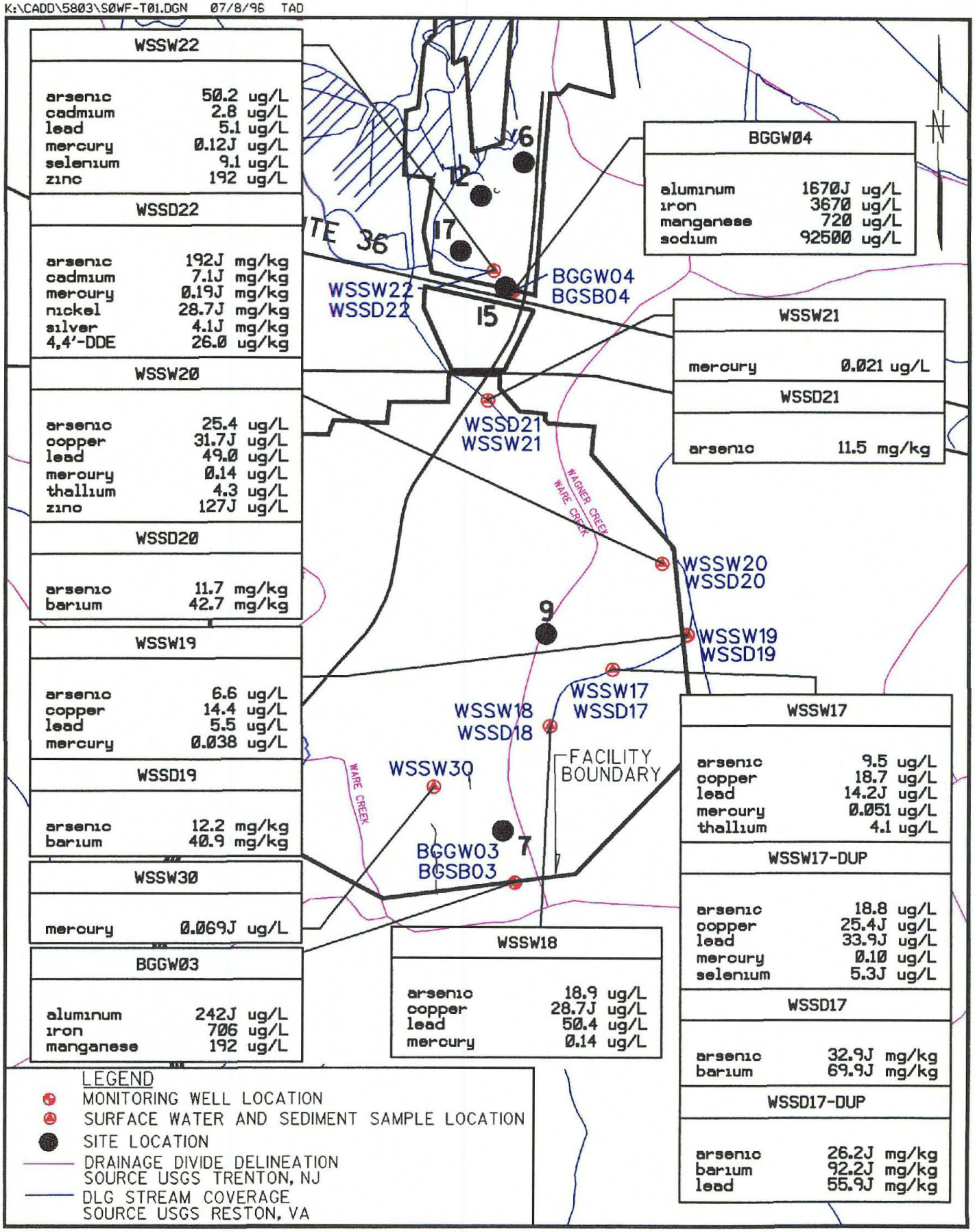
Q - Sediment quality criterion. Source: USEPA. 1996. ECO Update. Volume 3: Number 2. EPA 540/F-95/038.

S - Sediment screening benchmark. Source: Suter, G. W., and J. B. Mabrey. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Oak Ridge National Laboratory, Oak Ridge, TN.

T - Threshold for soils. Source: Direction des Substances Dangereuses. 1988. Contaminated Sites Rehabilitation Policy. Gouvernement du Quebec. Ministere de L'Environment. Sainte-Foy, Quebec, Canada. In: R.L. Siegrist. 1989. International Review of Approaches for Establishing Cleanup Goals for Hazardos Waste Contaminated Land. Institute for Georesearch and Pollution Research. Norway.

W - Screening value for wet soil. Source: Will, M.E., and G.W. Suter. 1994. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1994 Revision. Oak Ridge National Laboratory.

K:\CADD\5803\S0WF-T01.DGN 07/8/96 TAD



CONCENTRATIONS ABOVE SCREENING LEVELS

CHAPEL HILL AREA

FIGURE 30-3

Brown & Root Environmental

WSSD05
WSSW05

WSSW05	
mercury	0.077 ug/L
heptachlor	0.0010NJ ug/L
WSSD05	
4,4'-DDD	85.0J ug/kg
4,4'-DDT	770 ug/kg
methoxychlor	77.0 ug/kg

WSSW06	
mercury	0.090 ug/L
WSSD06	
4,4'-DDD	30.0 ug/kg
4,4'-DDE	6.0J ug/kg
4,4'-DDT	7.7 ug/kg

SITE LEGEND

1 ORDNANCE DEMILITARIZATION SITE
2 ACTIVE ORDNANCE DEMILITARIZATION SITE
3 LANDFILL SOUTHWEST OF "F" GROUP
4 LANDFILL WEST OF "D" GROUP
5 LANDFILL WEST OF ARMY BARRICADES
6 LANDFILL WEST OF NORMANDY ROAD
7 LANDFILL SOUTH OF "P" BARRICADES
9 LANDFILL SOUTHEAST OF "P" BARRICADES
10 SCRAP METALS LANDFILL
11 CONTRACT ORDNANCE DISPOSAL AREA
12 BATTERY STORAGE AREA
13 DRMO YARD
14 MERCURY SPILL SITE
15 SLUDGE DISPOSAL SITE
16 SITE 16 AND EPIC SITE F
17 LANDFILL
19 PAINT CHIP AND SLUDGE DISPOSAL AREA
20 GRIT BLAST AREA AT BUILDING 544
22 PAINT CHIP DISPOSAL AREA
23 PAINT DISPOSAL AREA
24 CLOSED PISTOL RANGE
25 CLOSED PISTOL RANGE
26 EXPLOSIVE "D" WASHOUT AREA
27 PROJECTILE REFURBISHING
29 PCB SPILL SITE
L MSC VAN PARKING LOT
O FIRE FIGHTING SCHOOL
SITE LOCATION

SURFACE WATER AND SEDIMENT SAMPLE LOCATION
SEDIMENT SAMPLE LOCATION
MONITORINGW WELL LOCATION
SURFACE SOIL SAMPLE LOCATION
SOIL BORING LOCATION

0 1500 3000
SCALE IN FEET

K:\CADD\5803\S0MS-T01.DGN 07/10/96 TAD

APPROVED
ACTIV
APPROVED
FOR EFD F
SEAL

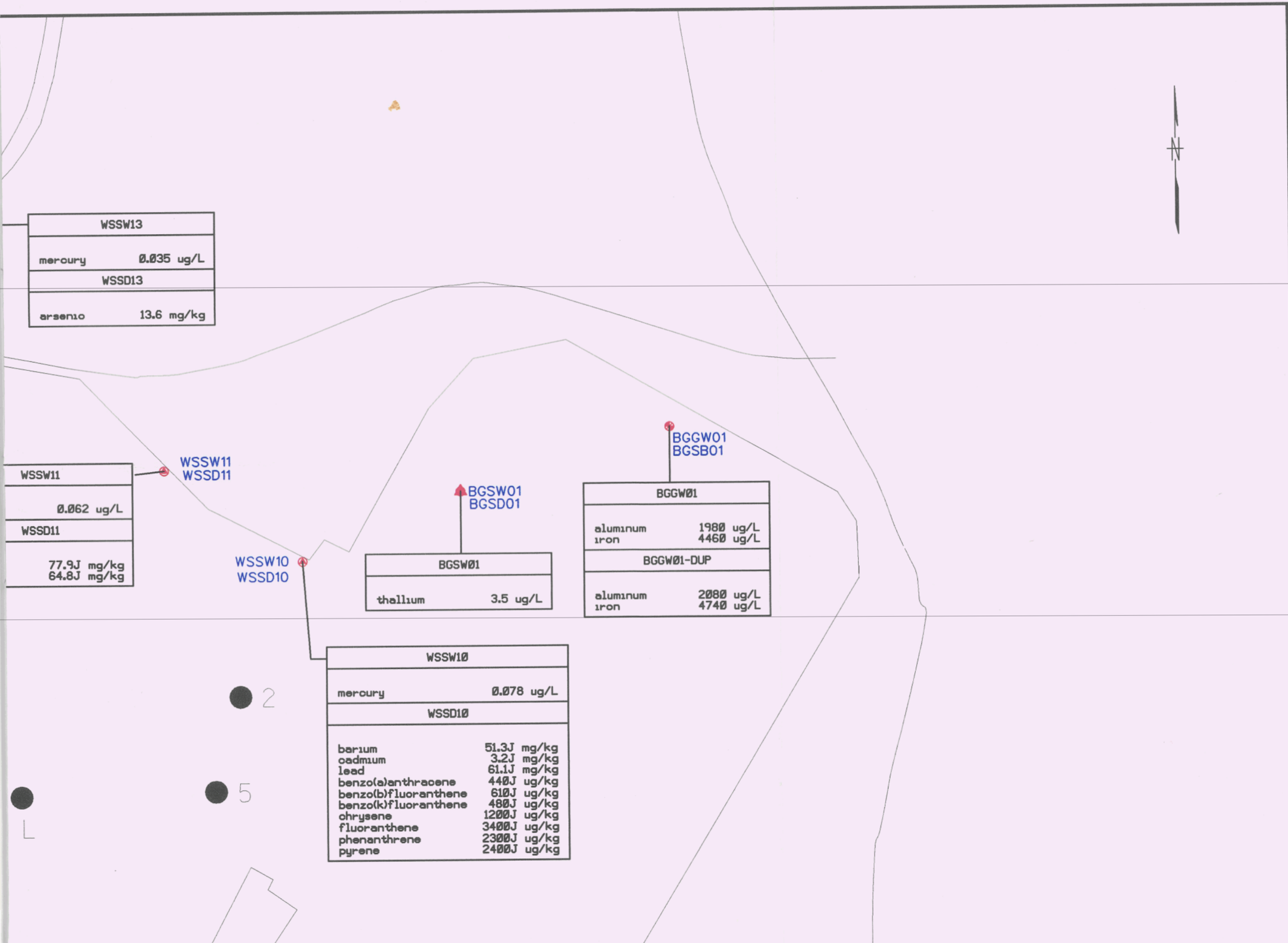
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
NORTHERN DIVISION
PHILADELPHIA, PENNSYLVANIA

NWS EARLE
COLTS NECK, NEW JERSEY

CONCENTRATIONS ABOVE SCREENING LEVELS
MAINSIDE FACILITY

CODE ID. NO. 80091	SIZE D
SCALE:	
EFD NO.	1" = 1500 Feet
STA. PROJ. NO.	
SPEC. NO.	
CONSTR. CONTR. NO.	
NAVFAC DRAWING NO.	
SHEET	OF

FIGURE 30-4



REVISIONS

SYM.	DESCRIPTION	DATE	APPROVED

A/E EFD

DESIGN
DRAWN
REVIEW
CHIEF ARCH./ ENGR.
PROJECT MANAGER
FIRE PROTECTION
QUALITY CONTROL
BRANCH MANAGER
DESIGN DIRECTOR

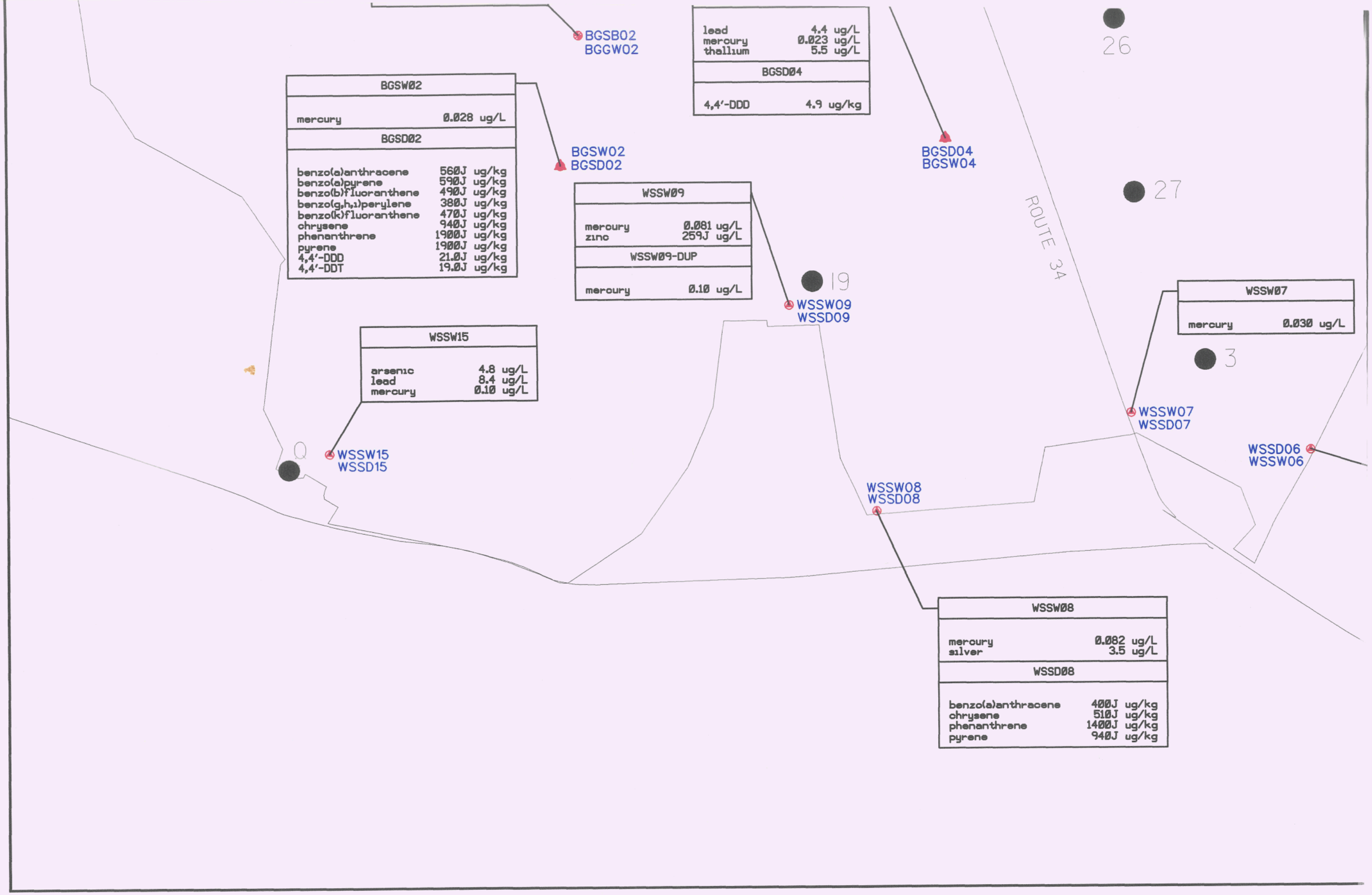
Brown & Root Environmental
FOSTER PLAZA VII
661 ANDERSEN DRIVE
PITTSBURGH, PA 15220

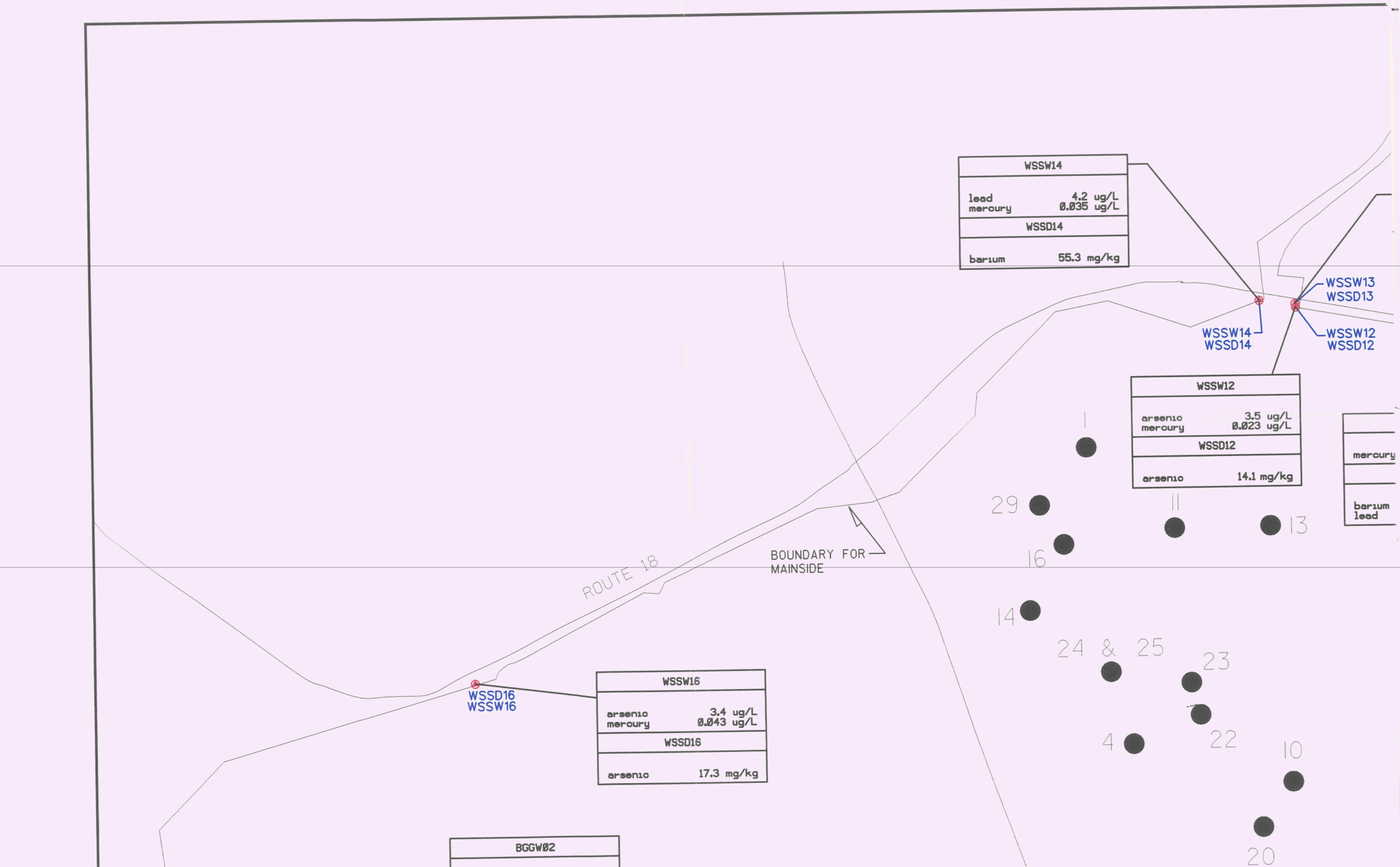
DATE

Y - SATISFACTORY TO

DATE

COMMANDER NAVFAC


BGSB02
BGGW02
lead 4.4 ug/L
mercury 0.023 ug/L
thallium 5.5 ug/L
BGSD04
4,4'-DDD 4.9 ug/kg
26
BGSW02
mercury 0.028 ug/L
BGSD02
benzo(a)anthracene 560J ug/kg
benzo(a)pyrene 590J ug/kg
benzo(b)fluoranthene 490J ug/kg
benzo(g,h,i)perylene 380J ug/kg
benzo(k)fluoranthene 470J ug/kg
chrysene 940J ug/kg
phenanthrene 1900J ug/kg
pyrene 1900J ug/kg
4,4'-DDD 21.0J ug/kg
4,4'-DDT 19.0J ug/kg
BGSW02
BGSD02
BGSD04
BGSW04
27
ROUTE 34
WSSW09
mercury 0.081 ug/L
zinc 259J ug/L
WSSW09-DUP
mercury 0.10 ug/L
19
WSSW09
WSSD09
WSSW07
mercury 0.030 ug/L
3
WSSW15
arsenic 4.8 ug/L
lead 8.4 ug/L
mercury 0.10 ug/L
WSSW07
WSSD07
Q
WSSW15
WSSD15
WSSD06
WSSW06
WSSW08
WSSD08
WSSW08
mercury 0.082 ug/L
silver 3.5 ug/L
WSSD08
benzo(a)anthracene 400J ug/kg
chrysene 510J ug/kg
phenanthrene 1400J ug/kg
pyrene 940J ug/kg


WSSW14
lead 4.2 ug/L
mercury 0.035 ug/L
WSSD14
barium 55.3 mg/kg
WSSW13
WSSD13
WSSW14
WSSD14
WSSW12
WSSD12
WSSW12
arsenic 3.5 ug/L
mercury 0.023 ug/L
WSSD12
arsenic 14.1 mg/kg
mercury
barium
lead
1
29
11
13
16
14
24 & 25
23
4
22
10
20
BOUNDARY FOR
MAINSIDE
ROUTE 18
WSSD16
WSSW16
WSSW16
arsenic 3.4 ug/L
mercury 0.043 ug/L
WSSD16
arsenic 17.3 mg/kg
BGGW02

30.2.1.1 Inorganic

Sediment sample WS SD 22, which was collected from the Ware Creek Watershed, south of Site 15, revealed several metals at levels substantially greater than the ranges found in background samples. Arsenic (192 mg/kg), beryllium (6 mg/kg), cadmium (7 mg/kg), cobalt (29.7 mg/kg), iron (505,000 mg/kg), manganese (231 mg/kg), selenium (32.7 mg/kg), silver (4.1 mg/kg), and thallium (23.4 mg/kg) were detected at notable levels. Other watershed sediment sample results were slightly greater than the ranges found in background samples. Elevated metals in the Wagner Creek Watershed, which is located north and east of Site 9, include arsenic in sample WS SD 17 (29.5 mg/kg), manganese in WS SD 20 (172 mg/kg), and iron in WS SD 20 (28,200 mg/kg). WS SD 21, which was collected in Ware Creek, north of the crossing at Normandy Road, revealed the presence of iron (32,700 mg/kg) and cadmium (65.8 mg/kg). Northeast of Site 2 in the Pine Brook Watershed, cadmium (3.2 mg/kg) was detected in WS SD 10. Iron (32,800 mg/kg) was detected in WS SD 08 (collected from the middle branch of Mingamahone Brook, south-southwest from Site 26).

30.2.1.2 Organics

PAHs including benz(a)anthracene, benzo(a)pyrene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, fluoranthene, phenanthrene, fluorene, and pyrene were detected in the watershed sediment samples at concentrations in the same range as background (49.0 ug/kg to 3,400 ug/kg). Sample WS SD 10, which was collected in the Pine Brook Watershed, in a marshy area northeast of Site 2, displayed the highest levels of PAHs. Generally, the remaining PAH results in other watershed samples were similar to the range found in background sediment samples.

Several VOCs were detected at low concentrations in the watershed samples that were also found at similar concentration ranges in background sediment samples. VOCs detected in the Wagner Creek Watershed, which is located north and east of Site 9, include PCE (46 ug/kg in WS SD 20 and 12 ug/kg in WS SD 17) and toluene (2 ug/kg in WS SD 18). In the Ware Creek Watershed, PCE was detected at 18 ug/kg in WS SD 21 (along Ware Creek, where it crosses Normandy Road) and 2-butanone was detected at 270 ug/kg in WS SD 22 (collected in a drainage ditch south of Site 15).

2-Butanone, toluene, and ethylbenzene were detected in other watershed areas at concentrations generally less than a maximum detected level of 110 ug/kg. In the Mingamahone Brook Watershed, detections include toluene and 2-butanone in WS SD 09 (collected south of Site 19); toluene, ethyl benzene, and 2-butanone in WS SD 15 (collected east of Site Q, along Yellow Brook); 2-butanone in WS SD 07 (collected along the East Branch of Mingamahone Brook); and 2-butanone in WS SD 08 (collected southeast of Site 19). 2-Butanone, toluene, and xylenes were detected in WS SD 10 (collected from the marshy area northeast of Site 2 in the Pine Brook Watershed). In the Hockhockson Brook Watershed, toluene was detected in WS SD 11 (collected from a wetlands drainage area northeast of Site 2) and 2-butanone was

detected in WS SD 13 (collected near the confluence of eastern and western branches of Hockhockson Brook). Toluene was also detected in WS SD 06 (Shark River Watershed, near a tributary along the southeastern boundary of NWS Earle).

In six watershed samples (WS SD 05, WS SD 06, WS SD 08, WS SD 09, WS SD 11, and WS SD 12), methylene chloride was detected at trace levels, below quantitation limits (2.0 ug/kg to 9.0 ug/kg). Methylene chloride is also considered a common laboratory contaminant; however, the application of data validation protocols did not eliminate this compound from consideration in these cases.

Phthalate esters were detected in several watershed sediment samples, including diethyl phthalate in WS SD 06, WS SD 08, WS SD 11, WS SD 16, WS SD 17, WS SD 19, and WS SD 20, butylbenzyl phthalate in WS SD 17, di-n-octyl phthalate in WS SD 07, and di-n-butyl phthalate in WS SD 19 and WS SD 20. These compounds are associated with plastics from many different sources.

Other semivolatiles detected in watershed sediments include phenol (120 ug/kg) and hexachloroethane (55 ug/kg) in WS SD 20 (Wagner Creek Watershed).

In the Shark River Watershed, pesticides detected in sediment samples at concentrations greater than background include the following: 4,4'-DDT, 4,4'-DDD, 4,4'-DDE, endosulfan sulfate, endrin ketone, endrin, and methoxychlor. In the Ware Creek watershed, 4,4'-DDE and alpha-chlordane were detected in one sediment sample at levels greater than background.

30.2.1.3 Miscellaneous Parameters

Miscellaneous parameter analyses for eighteen sediment samples collected at Watershed locations were ammonia, COD, TPH, pH, TOC, chlorides, moisture phosphates, and nitrates. Sample WS SD 22 contained a TPH concentration (1,300 mg/kg) exceeding the maximum background level. Fourteen watershed samples contained phosphate concentrations (1,200 mg/kg to 13,000 mg/kg) above maximum background levels. Ammonia was detected in ten samples (70 mg/kg to 400 mg/kg) exceeding maximum background levels. Samples WS SD 10 (40 mg/kg) and WS SD 22 (1,000 mg/kg) contained chloride concentrations above background. TOC and nitrate nitrogen were detected in separate samples exceeding background. Table 30-2b presents the comparison of miscellaneous parameters detected in sediments to ARARs and TBCs. Miscellaneous parameter results are presented in Appendix A.

30.2.2 Surface Water

Nineteen surface water samples were collected from the watershed study locations. Figure 30-1 shows Mainside background and watershed sampling locations. Figure 30-2 shows Waterfront background and watershed sampling locations. Tables 30-4 and 30-5 present the occurrence and distribution of inorganic and organic chemicals detected in background (see Section 31) and watershed surface water samples,

TABLE 30-4
OCCURRENCE AND DISTRIBUTION OF INORGANICS IN WATERSHED SAMPLES (SURFACE WATER)
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED				
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	2 X AVERAGE BKGD CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	AVERAGE CONCENTRATION	MEAN > 2 X BKGD	REPRESENTATIVE CONCENTRATION
ALUMINUM	3 / 3	265 - 409	705.33	19 / 19	67.7 - 16600	1921.97	YES	3509.31
ANTIMONY	NOT DETECTED	-	-	1 / 19	3.6	1.38	YES	1.59
ARSENIC	NOT DETECTED	-	-	8 / 19	3.4 - 50.2	7.43	YES	12.37
BARIUM	3 / 3	16.3 - 34	53.73	19 / 19	9.3 - 202.35	46.72	NO	65.98
BERYLLIUM	2 / 3	0.22 - 0.33	0.41	10 / 19	0.15 - 4.6	0.56	YES	1.00
CADMIUM	1 / 3	0.18	0.23	7 / 19	0.22 - 2.8	0.32	YES	0.57
CALCIUM	3 / 3	462 - 10100	9128.00	19 / 19	1280 - 33900	7450.26	NO	10411.50
CHROMIUM	3 / 3	0.72 - 2.6	2.71	6 / 19	2.1 - 44.5	8.32	YES	13.09
COBALT	3 / 3	0.81 - 1.9	2.54	15 / 19	0.63 - 22.2	3.36	YES	5.75
COPPER	2 / 3	1.1 - 9.8	7.40	15 / 19	0.44 - 31.7	7.28	NO	11.06
IRON	3 / 3	160 - 702	1040.00	19 / 19	502 - 145000	15818.68	YES	29353.69
LEAD	1 / 3	4.4	3.43	13 / 19	0.87 - 50.4	8.32	YES	14.52
MAGNESIUM	3 / 3	369 - 2770	2525.33	19 / 19	564 - 10700	2524.21	NO	3506.95
MANGANESE	3 / 3	14 - 55.5	59.93	11 / 11	7.6 - 1690	301.66	YES	602.34
MERCURY	2 / 3	0.023 - 0.028	0.04	19 / 19	0.021 - 0.14	0.07	YES	0.10
NICKEL	3 / 3	2.1 - 7.1	8.60	19 / 19	0.85 - 39.8	12.37	YES	17.45
POTASSIUM	2 / 3	251 - 1850	1482.33	19 / 19	681 - 6470	2338.53	YES	3003.06
SELENIUM	1 / 3	3.5	4.00	6 / 19	2.6 - 9.1	2.40	NO	3.22
SILVER	1 / 3	0.86	0.99	3 / 19	0.74 - 3.5	0.55	NO	0.84
SODIUM	3 / 3	3060 - 3890	7033.33	14 / 14	2820 - 93400	12862.14	YES	24066.16
THALLIUM	2 / 3	3.5 - 5.5	7.00	2 / 19	4.1 - 4.3	1.80	NO	2.14
VANADIUM	2 / 3	0.89 - 0.9	1.32	16 / 19	0.45 - 45.2	8.01	YES	13.35
ZINC	3 / 3	7.6 - 29.4	32.67	18 / 19	5.5 - 192	44.28	YES	65.44

TABLE 30-5
OCCURRENCE AND DISTRIBUTION OF ORGANICS IN WATERSHED SAMPLES (SURFACE WATER)
NWS EARLE, COLTS NECK, NEW JERSEY
(ug/L)

	BACKGROUND			SITE-RELATED		
SUBSTANCE	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION	FREQUENCY OF DETECTION	RANGE OF POSITIVE DETECTION	REPRESENTATIVE CONCENTRATION
4,4'-DDD	NOT DETECTED	-	-	1 / 3	0	0.0006
HEPTACHLOR	NOT DETECTED	-	-	1 / 3	0	0.001
PHENOL	NOT DETECTED	-	-	1 / 19	1	1

respectively. Table 30-4a and 30-4b presents a comparison of detected compounds to ARARs. Figure 30-3 shows sample locations and concentrations of compounds which exceed ARARs.

30.2.2.1 Inorganics

Several surface water samples exhibited elevated levels of aluminum, which suggests the presence of suspended solids. Metals were detected in surface water at levels greater than background in conjunction with elevated levels of aluminum in the following instances. In the Wagner Creek Watershed, detections include WS SW 17 (antimony, arsenic, iron, lead, selenium, thallium, and vanadium); WS SW 18 (arsenic, chromium, copper, lead, selenium, and vanadium); and WS SW 20 (arsenic, barium, chromium, copper, iron, manganese, selenium, vanadium, and zinc). In the Ware Creek Watershed, WS SW 22 contained elevated levels of arsenic, beryllium, cadmium, cobalt, manganese, and zinc.

A limited number of watershed surface water samples displayed levels of metals greater than background but did not contain elevated levels of aluminum to suggest suspended solids. These results include chromium and zinc in WS SW 06 (collected from the southern boundary of NWS Earle along a tributary of the Shark River), silver in WS SW 08 (collected southeast of Site 19 in the middle branch of Mingamahone Brook), barium in WS SW 09 (collected South of Site 19 at the NWS perimeter fence), vanadium in WS SW 15 (collected in a flooded marsh east of Site Q, along Yellow Brook), and arsenic in WS SW 12 (collected at the eastern branch near the junction of two branches of Hockhockson Brook), WS SW 15 (collected in a flooded marsh east of Site Q, along Yellow Brook), and WS SW 16 (collected near the pond at the northwestern NWS boundary, in the Mine Brook Watershed).

30.2.2.2 Organics

Three organic compounds were each detected in a surface water watershed sample. 4,4'-DDD was detected in WS SW 22 (collected in a drainage ditch north of Site 15 in the Ware Creek Watershed), heptachlor was detected in WS SW 05 (collected in a tributary of the Shark River along the southeastern boundary of NWS Earle), and phenol was detected in WS SW 21 (collected in Ware Creek, where the creek passes underneath Normandy Road).

30.2.2.3 Miscellaneous Parameters

Miscellaneous parameter analyses nineteen samples collected at Watershed locations consisted of the following parameters: ammonia, BOD, COD, chlorides, nitrates, TPH, hardness, TOC, phosphates, sulfates, and turbidity. TPH was detected in one watershed sample, WS SW 22, at 0.2 mg/L or above maximum background. Ammonia (0.10 mg/L to 0.70 mg/L) and BOD (0.40 mg/L to 5.0 mg/L)

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW05	WSSW06	WSSW07	WSSW08	ARARS & TBCs				
LOCATION:	WSSW05	WSSW06	WSSW07	WSSW08	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	373 J	490 J	516 J	234 J	-	-	-	-	-
antimony	2.5 U	2.5 U	2.5 U	2.5 U	-	14.0	4300	-	12.2
arsenic	2.5 U	2.5 U	2.5 U	2.5 U	189	0.0180	0.140	-	0.0170
barium	24.4	21.4	25.4	23.1	-	-	-	-	2000
beryllium	0.13 U	0.69	0.25	0.13 U	-	-	-	-	-
cadmium	0.17 U	0.22	0.17 U	0.17 U	1.10 +	-	-	-	-
calcium	3420	3740	1440	4990	-	-	-	-	-
chromium, total	8.5 U	44.5	8.5 U	8.5 U	209 +	-	-	-	160
cobalt	1.2	1.5	1.1	0.60 U	-	-	-	-	-
copper	1.9	1.9	0.83	0.39 U	11.0 +	-	-	-	-
iron	854	5030	815	2560	-	-	-	-	-
lead	0.74 U	0.87	1.2	0.74 U	3.20 +	-	-	-	5.00
magnesium	834	1020	713	1220	-	-	-	-	-
manganese	19.7 R	24.3 R	35.4 R	17.5 R	-	-	-	-	-
mercury	0.077 E	0.090 E	0.030 E	0.082 E	0.0120	0.140	0.150	-	-
nickel	39.8	30.0	1.8	1.8	160 +	610	4600	-	516
potassium	897	1070	724	1390	-	-	-	-	-
selenium	2.5 U	2.5 U	2.5 U	2.5 U	5.00	-	-	-	10.0
silver	0.63 U	0.63 U	0.63 U	3.5 E	1.90	-	-	-	164
sodium	4710 J	4980 J	4870 J	4820 J	-	-	-	-	-
thallium	3.0 U	3.0 U	3.0 U	3.0 U	-	1.70	6.30	-	1.70
vanadium	0.73	0.78	0.38 U	0.78	-	-	-	-	-
zinc	15.1	80.7 J	22.4 J	10.4	101 +	-	-	-	-
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
phenol	10.0 U	10.0 U	10.0 U	10.0 U	-	21000	4600000	-	20900
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDD	0.10 U	n/a	n/a	n/a	-			-	-
alpha-BHC	0.0005 R	n/a	n/a	n/a	-	0.00390	0.0130	-	-

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW05	WSSW06	WSSW07	WSSW08	ARARS & TBCs				
LOCATION:	WSSW05	WSSW06	WSSW07	WSSW08	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
gamma-BHC (Lindane)	0.0020 R	n/a	n/a	n/a	0.0800	0.0190	0.0630	0.0800	-
heptachlor	0.0010 E NJ	n/a	n/a	n/a	0.00380			0.00380	

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW09	WSSW09-DUP	WSSW10	WSSW11	ARARS & TBCs				
LOCATION:	WSSW09	WSSW09	WSSW10	WSSW11	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	328 J	336 J	195	252 J	-	-	-	-	-
antimony	2.5 U	2.5 U	2.5 U	2.5 U	-	14.0	4300	-	12.2
arsenic	2.5 U	2.5 U	2.5 U	2.5 U	189	0.0180	0.140	-	0.0170
barium	386 J	18.7 J	17.0	21.0	-	-	-	-	2000
beryllium	0.13 U	0.13 U	0.13 U	0.20	-	-	-	-	-
cadmium	0.17 U	0.17 U	0.17 U	0.17 U	1.10 +	-	-	-	-
calcium	3620	3210	16500	6210	-	-	-	-	-
chromium, total	8.5 U	8.5 U	8.5 U	8.5 U	209 +	-	-	-	160
cobalt	0.60 U	0.60 U	0.60 U	0.63	-	-	-	-	-
copper	8.5	1.6	5.6	0.44	11.0 +	-	-	-	-
iron	1010	1040	502	848	-	-	-	-	-
lead	2.8	0.74 U	2.0	1.0	3.20 +	-	-	-	5.00
magnesium	1420	1400	974	1080	-	-	-	-	-
manganese	14.3	14.3	7.6	10.0	-	-	-	-	-
mercury	0.081 E	0.10 E	0.078 E	0.062 E	0.0120	0.140	0.150	-	-
nickel	0.90	0.80	3.0	2.8	160 +	610	4600	-	516
potassium	681	681	1500	1400	-	-	-	-	-
selenium	2.5 U	2.5 U	2.5 U	2.5 U	5.00	-	-	-	10.0
silver	0.63 U	0.63 U	0.63 U	0.63 U	1.90	-	-	-	164
sodium	6640 J	6700 J	4550 J	3840 J	-	-	-	-	-
thallium	3.0 U	3.0 U	3.0 U	3.0 U	-	1.70	6.30	-	1.70
vanadium	0.55	1.0	2.2	2.0	-	-	-	-	-
zinc	259 E J	5.9 J	10.6	5.5	101 +	-	-	-	-
SEMIVOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
phenol	10.0 U	10.0 U	10.0 U	10.0 U	-	21000	4600000	-	20900
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
4,4'-DDD	n/a	n/a	n/a	n/a	-			-	-
alpha-BHC	n/a	n/a	n/a	n/a	-	0.00390	0.0130	-	-

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW09	WSSW09-DUP	WSSW10	WSSW11	ARARS & TBCs				
LOCATION:	WSSW09	WSSW09	WSSW10	WSSW11	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
gamma-BHC (Lindane)	n/a	n/a	n/a	n/a	0.0800	0.0190	0.0630	0.0800	-
heptachlor	n/a	n/a	n/a	n/a	0.00380			0.00380	

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW12	WSSW13	WSSW14	WSSW15	ARARS & TBCs				
LOCATION:	WSSW12	WSSW13	WSSW14	WSSW15	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	271 J	1290 J	384 J	1020 J	-	-	-	-	-
antimony	2.5 U	2.5 U	2.5 U	2.5 U	-	14.0	4300	-	12.2
arsenic	3.5 E	2.5 U	2.5 U	4.8 E	189	0.0180	0.140	-	0.0170
barium	22.3	26.6	29.8	9.3	-	-	-	-	2000
beryllium	0.15	0.34	0.13 U	0.13 U	-	-	-	-	-
cadmium	0.27	0.39	0.37	0.58	1.10 +	-	-	-	-
calcium	4120	7020	7170	1280	-	-	-	-	-
chromium, total	8.5 U	8.5 U	9.6 J	8.5 U	209 +	-	-	-	160
cobalt	2.5	2.5	1.8	0.60 U	-	-	-	-	-
copper	0.39 U	1.9	6.4	7.1	11.0 +	-	-	-	-
iron	4810	3440	6260	14700	-	-	-	-	-
lead	0.74 U	1.0	4.2 E	8.4 E	3.20 +	-	-	-	5.00
magnesium	1260	2000	1850	564	-	-	-	-	-
manganese	26.5 R	33.4 R	45.1 R	13.7	-	-	-	-	-
mercury	0.023 E	0.035 E	0.035 E	0.10 E	0.0120	0.140	0.150	-	-
nickel	9.8	10.1	28.4	4.1	160 +	610	4600	-	516
potassium	2150	3490	3590	1390	-	-	-	-	-
selenium	2.5 U	2.5 U	2.5 U	2.5 U	5.00	-	-	-	10.0
silver	0.63 U	0.63 U	0.94	0.63 U	1.90	-	-	-	164
sodium	4810 J	15900 J	19300 J	2820 J	-	-	-	-	-
thallium	3.0 U	3.0 U	3.0 U	3.0 U	-	1.70	6.30	-	1.70
vanadium	1.8	0.45	1.8	27.4	-	-	-	-	-
zinc	14.4	26.0 J	31.7 J	6.9	101 +	-	-	-	-
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
phenol	10.0 U	10.0 U	10.0 U	10.0 U	-	21000	4600000	-	20900
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDD	n/a	n/a	n/a	n/a	-			-	-
alpha-BHC	n/a	n/a	n/a	n/a	-	0.00390	0.0130	-	-

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW12	WSSW13	WSSW14	WSSW15	ARARS & TBCs				
LOCATION:	WSSW12	WSSW13	WSSW14	WSSW15	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
gamma-BHC (Lindane)	n/a	n/a	n/a	n/a	0.0800	0.0190	0.0630	0.0800	-
heptachlor	n/a	n/a	n/a	n/a	0.00380			0.00380	

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW16	WSSW17	WSSW17-DUP	WSSW18	ARARS & TBCs				
LOCATION:	WSSW16	WSSW17	WSSW17	WSSW18	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
aluminum	373 J	1480 J	4570 J	7880 J	-	-	-	-	-
antimony	2.5 U	2.8	4.4	2.5 U	-	14.0	4300	-	12.2
arsenic	3.4 E	9.5 E	18.8 E	18.9 E	189	0.0180	0.140	-	0.0170
barium	33.7	39.0	79.9	89.0	-	-	-	-	2000
beryllium	0.13 U	0.40	0.79	0.84	-	-	-	-	-
cadmium	0.17 U	0.17 U	0.17 U	0.34	1.10 +	-	-	-	-
calcium	2740	5970	6490	4640	-	-	-	-	-
chromium, total	8.5 U	3.4	10.1	14.0	209 +	-	-	-	160
cobalt	0.63	2.5	4.0	4.2	-	-	-	-	-
copper	5.3	18.7 E	25.4 E J	28.7 E J	11.0 +	-	-	-	-
iron	2370	14200 J	36100 J	11000	-	-	-	-	-
lead	0.74 U	14.2 E J	33.9 E J	50.4 E	3.20 +	-	-	-	5.00
magnesium	1670	2770	3500	3020	-	-	-	-	-
manganese	18.3 R	106	150	68.3	-	-	-	-	-
mercury	0.043 E	0.051 E	0.10 E	0.14 E	0.0120	0.140	0.150	-	-
nickel	3.5	9.3	16.3	13.5	160 +	610	4600	-	516
potassium	1700	3040	4350	1710	-	-	-	-	-
selenium	2.5 U	2.5 UJ	5.3 E J	3.2 J	5.00	-	-	-	10.0
silver	0.63 U	0.63 U	0.63 U	0.74	1.90	-	-	-	164
sodium	3510 J	11900 R	13100 R	10500 R	-	-	-	-	-
thallium	3.0 U	4.1 E	3.0 U	3.0 U	-	1.70	6.30	-	1.70
vanadium	1.4	7.2	20.2	35.4	-	-	-	-	-
zinc	15.1	33.2 J	64.3 J	70.4 J	101 +	-	-	-	-
SEMIVOLATILES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
phenol	10.0 U	10.0 U	10.0 U	10.0 U	-	21000	4600000	-	20900
PESTICIDES	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
4,4'-DDD	n/a	n/a	n/a	n/a	-			-	-
alpha-BHC	n/a	n/a	n/a	n/a	-	0.00390	0.0130	-	-

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW16	WSSW17	WSSW17-DUP	WSSW18	ARARS & TBCs				
LOCATION:	WSSW16	WSSW17	WSSW17	WSSW18	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
gamma-BHC (Lindane)	n/a	n/a	n/a	n/a	0.0800	0.0190	0.0630	0.0800	-
heptachlor	n/a	n/a	n/a	n/a	0.00380			0.00380	

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW19	WSSW20	WSSW21	WSSW22	ARARS & TBCs				
LOCATION:	WSSW19	WSSW20	WSSW21	WSSW22	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI					
INORGANICS	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	820 J	16600 J	67.7	2300 J	-	-	-	-	-
antimony	2.5 U	2.5 U	2.5 U	2.5 U	-	14.0	4300	-	12.2
arsenic	6.6 E	25.4 E	2.5 U	50.2 E	189	0.0180	0.140	-	0.0170
barium	41.1	133	24.1	69.2	-	-	-	-	2000
beryllium	0.19	2.2	0.13 U	4.6	-	-	-	-	-
cadmium	0.17 U	0.17 U	0.17 U	2.8 E	1.10 +	-	-	-	-
calcium	9930	9640	11700	33900	-	-	-	-	-
chromium, total	2.1	37.5	0.67 U	0.67 U	209 +	-	-	-	160
cobalt	1.6	17.8	0.84	22.2	-	-	-	-	-
copper	14.4 E	31.7 E J	0.39 U	7.5	11.0 +	-	-	-	-
iron	17200	56400	1790	145000 J	-	-	-	-	-
lead	5.5 E	49.0 E	0.74 U	5.1 E	3.20 +	-	-	-	5.00
magnesium	2750	6720	3590	10700 J	-	-	-	-	-
manganese	185	1050	110	1690 J	-	-	-	-	-
mercury	0.038 E	0.14 E	0.021 E	0.12 E J	0.0120	0.140	0.150	-	-
nickel	6.6	29.7	3.3	31.9	160 +	610	4600	-	516
potassium	3630	6470	2640	5610	-	-	-	-	-
selenium	4.9 J	3.3 J	2.6 J	9.1 E	5.00	-	-	-	10.0
silver	0.63 U	0.63 U	0.63 U	0.63 U	1.90	-	-	-	164
sodium	11900 R	15100 R	9740 R	93400 J	-	-	-	-	-
thallium	3.0 U	4.3 E	3.0 U	3.0 U	-	1.70	6.30	-	1.70
vanadium	3.5	45.2	0.38 U	13.7	-	-	-	-	-
zinc	25.2 J	127 E J	0.94 U	192 E	101 +	-	-	-	-
SEMIVOLATILES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
phenol	10.0 U	10.0 U	1.0 J	10.0 U	-	21000	4600000	-	20900
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
4,4'-DDD	n/a	n/a	n/a	0.0006 J	-			-	-
alpha-BHC	n/a	n/a	n/a	0.050 U	-	0.00390	0.0130	-	-

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW19	WSSW20	WSSW21	WSSW22		ARARS & TBCs				
LOCATION:	WSSW19	WSSW20	WSSW21	WSSW22		AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI	1995 RI	1995 RI	1995 RI						
PESTICIDES	**ug/L**	**ug/L**	**ug/L**	**ug/L**		**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
gamma-BHC (Lindane)	n/a	n/a	n/a	0.050	U	0.0800	0.0190	0.0630	0.0800	-
heptachlor	n/a	n/a	n/a	0.050	U	0.00380			0.00380	

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW30	---	---	---	ARARS & TBCs				
LOCATION:	WSSW30	---	---	---					
DATA SOURCE:	1995 RI				AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
INORGANICS	**ug/L**				**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
aluminum	94.8				-	-	-	-	-
antimony	2.7 U				-	14.0	4300	-	12.2
arsenic	3.3 U				189	0.0180	0.140	-	0.0170
barium	15.4				-	-	-	-	2000
beryllium	0.11 U				-	-	-	-	-
cadmium	0.38 U				1.10 +	-	-	-	-
calcium	3470				-	-	-	-	-
chromium, total	1.0 U				209 +	-	-	-	160
cobalt	0.93				-	-	-	-	-
copper	0.77 U				11.0 +	-	-	-	-
iron	801				-	-	-	-	-
lead	1.5 U				3.20 +	-	-	-	5.00
magnesium	3450				-	-	-	-	-
manganese	41.4				-	-	-	-	-
mercury	0.069 E J				0.0120	0.140	0.150	-	-
nickel	1.2				160 +	610	4600	-	516
potassium	695				-	-	-	-	-
selenium	4.4 U				5.00	-	-	-	10.0
silver	0.94 U				1.90	-	-	-	164
sodium	5890				-	-	-	-	-
thallium	3.6 U				-	1.70	6.30	-	1.70
vanadium	0.61 U				-	-	-	-	-
zinc	6.2				101 +	-	-	-	-
SEMIVOLATILES	**ug/L**				**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
phenol	10.0 U				-	21000	4600000	-	20900
PESTICIDES	**ug/L**				**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
4,4'-DDD	0.10 U				-			-	-
alpha-BHC	0.050 U				-	0.00390	0.0130	-	-

TABLE 30-4a

COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCs - SITE WATERSHED

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:	WSSW30		---	---	---	ARARS & TBCs				
LOCATION:	WSSW30		---	---	---	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Criteria Freshwater Chronic Aquatic Life	NJDEP Surface Water Criteria for Protection of Human Health
DATA SOURCE:	1995 RI									
PESTICIDES	**ug/L**					**ug/L**	**ug/L**	**ug/L**	**ug/L**	**ug/L**
gamma-BHC (Lindane)	0.050	U				0.0800	0.0190	0.0630	0.0800	-
heptachlor	0.050	U				0.00380			0.00380	

TABLE 30-4a
COMPARISON OF SURFACE WATER ANALYTICAL DATA TO ARARS AND TBCS - SITE WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

- - No standard is available for this chemical in this classification.

+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L.

TABLE 30-4b

COMPARISON OF SURFACE WATER EXPLOSIVES AND MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE WS

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSW05		WSSW06		WSSW07		ARARS & TBCs				
LOCATION:		WSSW05		WSSW06		WSSW07		AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1995 RI		1995 RI		1995 RI						
MISCELLANEOUS												
ammonia nitrogen	mg/L	1.0	U	1.0	U	1.0	U	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	0.40		1.8		0.90		-	-	-	-	-
chemical oxygen demand	mg/L	16.0		14.0		20.0		-	-	-	-	-
chloride	mg/L	8.0		9.0		8.0		-	-	-	230	230
nitrate nitrogen	mg/L	0.50	U	0.50	U	0.50	U	-	10.0	-	-	10.0
petroleum hydrocarbons	mg/L	n/a		n/a		n/a		-	-	-	-	-
sulfate	mg/L	n/a		n/a		n/a		-	-	-	-	-
total hardness	mg/L	13.0		15.0		10.0		-	-	-	-	-
total organic carbon	mg/L	7.0	J	1.0	U	7.0	J	-	-	-	-	-
total phosphorus as PO4	mg/L	0.20	U	0.20	U	0.20	U	-	-	-	-	-
turbidity	ntu	2.5		4.6		0.90		-	-	-	-	-
EXPLOSIVES												
RDX	ug/L	n/a		n/a		n/a		-	-	-	-	-

TABLE 30-4b

COMPARISON OF SURFACE WATER EXPLOSIVES AND MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE WS

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSW08		WSSW09		WSSW09-DUP		ARARS & TBCs				
LOCATION:		WSSW08		WSSW09		WSSW09		AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1995 RI		1995 RI		1995 RI						
MISCELLANEOUS												
ammonia nitrogen	mg/L	1.0	U	1.0	U	1.0	U	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	3.0		3.0		3.0		-	-	-	-	-
chemical oxygen demand	mg/L	12.0		27.0		28.0		-	-	-	-	-
chloride	mg/L	11.0		11.0		12.0		-	-	-	230	230
nitrate nitrogen	mg/L	0.50	U	0.50	U	0.16		-	10.0	-	-	10.0
petroleum hydrocarbons	mg/L	n/a		n/a		n/a		-	-	-	-	-
sulfate	mg/L	n/a		n/a		n/a		-	-	-	-	-
total hardness	mg/L	18.0		19.0		16.0		-	-	-	-	-
total organic carbon	mg/L	13.0	J	8.0	J	8.0	J	-	-	-	-	-
total phosphorus as PO4	mg/L	0.20	U	0.20	U	0.20	U	-	-	-	-	-
turbidity	ntu	7.2		5.9		5.9		-	-	-	-	-
EXPLOSIVES												
RDX	ug/L	n/a		n/a		n/a		-	-	-	-	-

TABLE 30-4b

COMPARISON OF SURFACE WATER EXPLOSIVES AND MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE WS

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSW10		WSSW11		WSSW12		ARARS & TBCs				
LOCATION:		WSSW10		WSSW11		WSSW12		AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1995 RI		1995 RI		1995 RI						
MISCELLANEOUS												
ammonia nitrogen	mg/L	1.0	U	1.0	U	1.0	U	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	3.0		4.0		2.0		-	-	-	-	-
chemical oxygen demand	mg/L	15.0		21.0		11.0		-	-	-	-	-
chloride	mg/L	9.0		7.0		9.0		-	-	-	230	230
nitrate nitrogen	mg/L	0.18		0.25		0.50	U	-	10.0	-	-	10.0
petroleum hydrocarbons	mg/L	n/a		n/a		n/a		-	-	-	-	-
sulfate	mg/L	n/a		n/a		n/a		-	-	-	-	-
total hardness	mg/L	44.0		22.0		17.0		-	-	-	-	-
total organic carbon	mg/L	3.0	J	8.0	J	4.0	J	-	-	-	-	-
total phosphorus as PO4	mg/L	0.20	U	0.20	U	0.40		-	-	-	-	-
turbidity	ntu	3.2		1.4		11.8		-	-	-	-	-
EXPLOSIVES												
RDX	ug/L	0.30	J	n/a		n/a		-	-	-	-	-

TABLE 30-4b

COMPARISON OF SURFACE WATER EXPLOSIVES AND MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE WS

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSW13	WSSW14	WSSW15	ARARS & TBCs				
LOCATION:		WSSW13	WSSW14	WSSW15					
DATA SOURCE:		1995 RI	1995 RI	1995 RI	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
MISCELLANEOUS									
ammonia nitrogen	mg/L	1.0 U	0.10 E	0.60 E	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	2.0	4.0	4.0	-	-	-	-	-
chemical oxygen demand	mg/L	11.0	25.0	100	-	-	-	-	-
chloride	mg/L	23.0	26.0	6.0	-	-	-	230	230
nitrate nitrogen	mg/L	1.4	2.0	0.50 U	-	10.0	-	-	10.0
petroleum hydrocarbons	mg/L	n/a	n/a	n/a	-	-	-	-	-
sulfate	mg/L	n/a	n/a	n/a	-	-	-	-	-
total hardness	mg/L	27.0	29.0	22.0	-	-	-	-	-
total organic carbon	mg/L	4.0 J	8.0 J	25.0 J	-	-	-	-	-
total phosphorus as PO4	mg/L	0.70	1.9	0.60	-	-	-	-	-
turbidity	ntu	12.5	18.8	6.6	-	-	-	-	-
EXPLOSIVES									
RDX	ug/L	1.0 U	n/a	n/a	-	-	-	-	-

TABLE 30-4b

COMPARISON OF SURFACE WATER EXPLOSIVES AND MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE WS

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSW16	WSSW17	WSSW17-DUP	ARARS & TBCs				
LOCATION:		WSSW16	WSSW17	WSSW17	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1995 RI	1995 RI	1995 RI					
MISCELLANEOUS									
ammonia nitrogen	mg/L	1.0 U	0.30 E J	0.40 E J	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	0.60	4.0	4.0	-	-	-	-	-
chemical oxygen demand	mg/L	22.0	56.0 J	150 J	-	-	-	-	-
chloride	mg/L	7.0	13.0	13.0	-	-	-	230	230
nitrate nitrogen	mg/L	0.70	0.50 U	0.26 J	-	10.0	-	-	10.0
petroleum hydrocarbons	mg/L	n/a	n/a	n/a	-	-	-	-	-
sulfate	mg/L	n/a	n/a	n/a	-	-	-	-	-
total hardness	mg/L	13.0	18.0	17.0	-	-	-	-	-
total organic carbon	mg/L	8.0 J	9.0	10.0	-	-	-	-	-
total phosphorus as PO4	mg/L	0.30	6.3 J	2.9 J	-	-	-	-	-
turbidity	ntu	3.7	15.3	22.0	-	-	-	-	-
EXPLOSIVES									
RDX	ug/L	n/a	n/a	n/a	-	-	-	-	-

TABLE 30-4b

COMPARISON OF SURFACE WATER EXPLOSIVES AND MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE WS

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSW18	WSSW19	WSSW20	ARARS & TBCs				
LOCATION:		WSSW18	WSSW19	WSSW20					
DATA SOURCE:		1995 RI	1995 RI	1995 RI	AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
MISCELLANEOUS									
ammonia nitrogen	mg/L	0.70 E J	1.0 U	0.30 E J	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	5.0	1.8 J	3.0	-	-	-	-	-
chemical oxygen demand	mg/L	390	32.0	70.0	-	-	-	-	-
chloride	mg/L	11.0	12.0	17.0	-	-	-	230	230
nitrate nitrogen	mg/L	0.32 J	0.38 J	0.43 J	-	10.0	-	-	10.0
petroleum hydrocarbons	mg/L	n/a	n/a	n/a	-	-	-	-	-
sulfate	mg/L	n/a	n/a	n/a	-	-	-	-	-
total hardness	mg/L	19.0	6.0	27.0	-	-	-	-	-
total organic carbon	mg/L	n/a	n/a	n/a	-	-	-	-	-
total phosphorus as PO4	mg/L	3.8	3.1	3.4	-	-	-	-	-
turbidity	ntu	66.0	37.0	175	-	-	-	-	-
EXPLOSIVES									
RDX	ug/L	n/a	n/a	n/a	-	-	-	-	-

TABLE 30-4b

COMPARISON OF SURFACE WATER EXPLOSIVES AND MISCELLANEOUS PARAMETERS DATA TO ARARS AND TBCs - SITE WS

NWS EARLE, COLTS NECK, NEW JERSEY

SAMPLE NUMBER:		WSSW21		WSSW22		WSSW30		ARARS & TBCs				
LOCATION:		WSSW21		WSSW22		WSSW30		AWQC Freshwater Chronic Aquatic Life	AWQC Ingestion of Water and Fish	AWQC Ingestion of Fish Only	NJDEP Freshwater Chronic Aquatic Life	NJDEP Surface Water Protection of Human Health
DATA SOURCE:		1995 RI		1995 RI		1995 RI						
MISCELLANEOUS												
ammonia nitrogen	mg/L	1.0	U	0.60	E J	1.0	U	-	-	-	0.0200 &	-
biochemical oxygen demand	mg/L	1.4	J	5.0	R	3.0		-	-	-	-	-
chemical oxygen demand	mg/L	7.0	J	21.0		4.0	J	-	-	-	-	-
chloride	mg/L	20.0		200	J	11.0		-	-	-	230	230
nitrate nitrogen	mg/L	0.32	J	0.50	U	0.50	U	-	10.0	-	-	10.0
petroleum hydrocarbons	mg/L	n/a		0.20	J	0.30	U	-	-	-	-	-
sulfate	mg/L	n/a		n/a		16.0		-	-	-	-	-
total hardness	mg/L	42.0		111		25.0		-	-	-	-	-
total organic carbon	mg/L	n/a		3.0		0.90	J	-	-	-	-	-
total phosphorus as PO4	mg/L	0.60	R	0.50	R	0.20	U	-	-	-	-	-
turbidity	ntu	8.7		79.0		n/a		-	-	-	-	-
EXPLOSIVES												
RDX	ug/L	n/a		1.0	U	0.79	U	-	-	-	-	-

TABLE 30-4b
COMPARISON OF SURFACE WATER EXPLOSIVES AND MISC. DATA TO ARARS AND TBCS - SITE WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Footnotes to sample results:

U - Compound or element was not detected. Value is the detection limit (inorganics) or quantitation limit (organics).

UJ - Not detected. Detection limit or quantitation limit shown is considered estimated due to exceedance of data validation quality control criteria.

No Value - Constituent was not analyzed for in this sample.

UR - Nondetected result is considered rejected based on exceedance of data validation quality control criteria.

J - Value is estimated because concentration is below the quantitation limit or because of exceedance of data validation quality control criteria.

R - Positive result is considered rejected based on exceedance of data validation quality control criteria.

N - Compound is considered to be tentatively identified based on exceedance of QC criteria for compound identification.

E - Result exceeds one or more of the selected ARARs.

Footnotes to Ambient Water Quality Criteria:

. - No standard is available for this chemical in this classification.

+ - Criterion is hardness dependent and is generated based upon an assumed hardness of 100 mg/L

& - Value represents the more stringent of criteria for freshwaters classified as FW2-NT, FW2-TP, and FW2-TM

concentrations exceeding maximum background levels were each detected in seven samples. Six samples contained COD concentrations (32.0 mg/L to 90 mg/L) above maximum background levels. Chloride (8.0 mg/L to 200 mg/L) and nitrate nitrogen (0.16 mg/L to 2.0 mg/L) were detected in eighteen and eleven samples, respectively, above maximum background levels. Hardness (42 mg/L to 111 mg/L) and TOC (10mg/L to 25 mg/L) concentrations above maximum background Turbidity levels exceeded maximum background concentrations in nineteen samples. Indicator parameter results are below the range associated with concentration landfill leachate (Chian and DeWalle, 1976; ASCE, 1976; Brunner and Keller, 1972). Miscellaneous parameter results are presented in Appendix A.

This is less than the required detection limit for TPH in aqueous samples of 0.3 mg/L. No TPH result greater than the detection limit Table 30-4a was reported for the background samples associated with these surface water samples. Miscellaneous parameter results are presented in Appendix A.

30.3 CONTAMINANT FATE AND TRANSPORT - WATERSHED SAMPLES

Various aspects of contaminant fate and transport at watershed locations are discussed in this section. Various chemicals detected and their transport potential in the environment are discussed in Section 30.3.1. Persistence of detected chemicals in the environment is discussed in Section 30.3.2. Section 30.3.3 presents a brief discussion of contaminant trends.

30.3.1 Detected Chemicals and Transport Potential

Fewer compounds, at lower concentrations, were found in surface water than in the corresponding sediment sample. Phenol, two pesticides, and a few metals were present at low concentrations in surface water samples. The physical transport data for the detected contaminants are presented in Table 2-10. Additional discussion with respect to chemical and physical properties, contaminant persistence, and contaminant migration pathways is presented in Section 2.3.

PAHs, pesticides, and metals were generally more frequently detected in sediments than in surface water samples. The disproportionate number of organics detected in the sediments compared to the surface water may be attributable to the tendency for these substances to adsorb onto naturally occurring organic carbon present in the sediments. Only two pesticides were detected in surface water samples. 4,4'-DDD and heptachlor have relatively low solubilities compared to other classes of compounds. 4,4'-DDD has a high soil-water distribution coefficient (K_d), which is characteristic of compounds that are readily bound to sediment in the environment. Neither pesticide was detected in any sediment samples from the same watersheds (Ware Creek or Shark River Watersheds).

Most of the detected organic contaminants in sediment fall into four classes: PAHs (which are considered relatively immobile), pesticides (most of which also exhibit relatively low mobility), phthalates (which sorb to sediment or humic material in water), and volatiles (which are considered mobile). Of these classes, the detected levels of PAHs are the highest, although the overall potential for PAH migration impacts is low due to the organic carbon present in most sediments. PAHs and pesticides present in sediment are likely to have originated through erosional dispersion from surface water runoff. Limited additional migration of these substances could possibly occur after precipitation events through sediment resuspension and surface water transport.

Phthalate esters were detected at low concentrations in a number of sediment samples. Members of this class of compounds generally exhibit a high soil-water distribution constant (K_d) and fairly low solubility. Adsorption onto suspended solids and particulate matter and complexation with natural organic substances are probably the most important environmental transport processes for phthalates. Phthalate esters are commonly found in freshwater and saltwater sediment samples and they readily interact with the fulvic acid present in humic substances in water and soil, forming a complex that is readily soluble in water (Clement Associates, 1985).

Low levels of PCE were detected at two sediment locations in the Wagner Creek Watershed and one location in the Ware Creek Watershed. PCE in sediment may migrate through dissolution in surface water, volatilization to air, or transport along with resuspended sediment. Similar migration potential exists for the other VOCs (2-butanone, toluene, ethylbenzene, xylenes, and methylene chloride) that were detected at low levels in sediments from various watersheds. Significant impacts to groundwater from the observed low levels of PCE and other VOCs in sediment are not expected, based on the fact that no localized high-level sources of VOC-contaminated surface soil, sediment, or surface water were identified in or near watershed locations.

Phenol, which was detected at a low concentration in one surface water and one watershed sediment sample, is considered moderately soluble and possesses a relatively low soil-water distribution coefficient. This compound may migrate by dissolution in surface water or transport within suspended solids and organic matter. Hexachloroethane, which was detected at a low level in one sediment, exhibits a solubility in between that of typical volatiles and semivolatiles. Because of its relatively high soil-water distribution coefficient, this compound is expected to bind to organics in sediment. This compound exhibits a Henry's Law constant that is within the range of typical VOCs; however, volatilization from surface water in contact with sediment is expected to proceed slowly.

Levels of several metals were considerably greater than background in one site-related sediment sample (WS SD 22, collected from a drainage ditch in the Wagner Creek Watershed) and in the corresponding

surface water sample. Concentrations of these metals in solution (mobile) may actually be lower than measured in surface water because the surface water sample exhibited several minerals that are normally insoluble (indicating metals in suspended solids). Suspended solids were also apparent in four additional surface water samples (see Section 30.2.2.1) where aluminum was detected at elevated levels. Surface water transport through sediment resuspension is the principal mechanism for migration of the detected metals in sediment. Metals present in sediment may tend to remain in the sorbed state; however, heavy precipitation events may increase the rate of erosional dispersion and lead to further migration of sediments along these surface water pathways.

30.3.2 Contaminant Persistence

For the classes of detected chemicals, environmental persistence varies widely. Chemical transformation of a chemical to its degradation by-product(s) can be the result of numerous processes including biotransformation and uptake, photolysis, acid- or base-catalyzed reaction, or hydrolysis. The by-product chemical(s) may or may not be significantly different toxicologically or from a physical transport perspective.

Because of more frequent contact with reactive dissolved species and catalysts when compared to unsaturated conditions, the contaminants found in sediments and surface water are more likely to be transformed in the environment.

PAHs can be biodegraded but the rate of degradation is slower for the higher molecular weight compounds. The rate of degradation depends on a number of factors including oxygen, carbon sources, nutrients, pH, moisture, and appropriate acclimatized organisms.

A variety of unicellular and multicellular organisms take up and accumulate phthalate esters, and bioaccumulation is considered an important fate process (Clement Associates, 1985). Biodegradation is also considered an important fate process. Because phthalate esters are degraded under most conditions and can be metabolized by multicellular organisms, it is unlikely that long-term bioaccumulation or biomagnification occurs.

Biodegradation of toluene, ethylbenzene, xylenes, and 2-butanone, which were detected in sediment, is considered an important fate process for these VOCs. Degradation products of PCE were not detected in sediment, although, under aneorobic conditions, dehydrohalogenation to form dichlorinated and monochlorinated ethenes is known to occur. All the detected VOCs are considered to exhibit low persistence in sediment due to high solubilities and potential for volatilization.

Phenol is susceptible to a variety of degradative processes, including photo-oxidation from water, metal-catalyzed oxidation, or biodegradation (Clements Associates, 1985). Degradation products typically first involve hydroxylation of the aromatic ring, followed by oxidation to benzoquinone and cleavage of the ring structure.

30.3.3 Observed Chemical Contaminant Trends

Organic compounds detected in sediment are likely the result of runoff and erosional dispersion from sources that were not specifically identified during the watershed investigation. Most of the organic contaminants in sediment fall into four classes, three of which are considered relatively immobile (PAHs, pesticides, and phthalates), plus volatiles (which are considered mobile). Of these classes, the detected levels of PAHs are the highest, although the overall potential for PAH migration impacts is low due to the organic carbon present in most sediments. The location where the highest levels of PAHs were detected, WS SD 10, is associated with a marshy area approximately 1/2 mile north of the nearest NWS Earle site (Site 2). No association between the detected PAHs and specific NWS Earle sites/activities is apparent. PAHs are ubiquitous in urban environments and are associated with combustion products from wood burning and other activities.

Phthalate esters are also considered ubiquitous in the urban environment and were detected at low concentrations in eight watershed sediment locations. They are present in most plastics and can leach slowly from plastics discarded in the environment.

Pesticides were detected in surface water and sediment samples from the Shark River Watershed and the Ware Creek Watershed. Thirteen detections were reported in sediment versus only three in surface water. Most pesticides are typically strongly bound to organic matter in sediment and are not expected to migrate significantly except in conjunction with surface water erosional patterns. No association between the detected pesticides and specific NWS Earle sites/activities is apparent.

VOCs were detected in several sediment samples but not in surface water. PCE was observed in two samples in the Wagner Creek Watershed and one sample in the Ware Creek Watershed. The associated surface water pathways where PCE was detected might be influenced by either on-base or off-base sources; however, no relationship with nearby NWS Earle sites is apparent. Other VOCs (toluene, 2-butanone, ethylbenzene, and xylenes) were detected at seven unrelated locations within the Mingamahone Brook Watershed, the Pine Brook Watershed, the Hockhockson Brook Watershed, and the Shark River Watershed. The low levels of all VOCs do not indicate significant potential for groundwater impacts or long-distance downstream migration. No medium- or high-level samples were identified that could be considered close to any potential VOC source area responsible for sediment contamination.

Low levels of phenol were noted in one surface water sample in the Ware Creek Watershed and in an unrelated sediment sample from the Wagner Creek Watershed. This compound was not identified at any nearby NWS Earle site and is expected to exhibit limited persistence in the environment. Hexachloroethane was detected in one watershed sample. This compound was not detected at nearby NWS Earle sites.

Four surface water samples (obtained from the Wagner Creek Watershed and Ware Creek Watershed) displayed elevated levels of metals, including aluminum, which is not soluble in most forms. This suggests that suspended solids, rather than dissolved metals, represent a significant portion of the total metals in these samples. Six surface water samples (from the Shark River Watershed, the Mingamahone Brook Watershed, the Mine Brook Watershed, and the Hockhockson Brook Watershed) did not contain elevated levels of aluminum (an indication of suspended solids) but displayed selected metals at levels slightly greater than background (chromium, zinc, silver, barium, vanadium, and arsenic). In a few cases, the metals present in surface water were associated with elevated metals in sediment from the same location. In watershed samples WS SD 22 and WS SW 22 (from the Ware Creek Watershed), substantially elevated levels of iron and arsenic were detected, along with notable levels of beryllium, cadmium, cobalt, and manganese. In the Wagner Creek Watershed, arsenic was elevated in samples WS SD 17 and WS SW 17.

30.3.4 Conclusions

PAHs, phthalates, pesticides, and metals detected in sediments at watershed locations have low potential for migration. Runoff, erosional dispersion, and sediment resuspension may facilitate limited continued accumulation and migration of contaminated sediments. VOCs detected in sediments generally exhibited low concentrations and are expected to migrate through volatilization, dissolution, and sediment resuspension. Most of the detected VOCs are considered to have low persistence. Detected chemicals in the surface water indicate the possibility of limited surface water migration impacts for certain metals and possibly two pesticides. Metals detected in surface water were frequently associated with suspected suspended solids, which suggests that a portion of detected metals may not represent dissolved species.

None of the substances detected in specific watershed samples are considered related to upgradient RI sites. The sources of the detected VOCs are not apparent, based upon the distances from the watershed locations to various NWS Earle sites. Two classes of compounds (PAHs and phthalates) are ubiquitous in urban environments. The detected PAHs, phthalates, pesticides, and metals may be associated with non-point sources unrelated to specific NWS Earle sites/activities.

30.4 BASELINE RISK ASSESSMENT - WATERSHED SAMPLES

No risk assessment was performed on the watershed samples because the sampling locations are spread throughout the site and no logical grouping for the samples could be made.

30.5 ECOLOGICAL RISK ASSESSMENT

As stated in Section 30.1, the hydrological setting at NWS Earle is extensive and complex. Several different waterways exist in both the Mainside area and in the Waterfront complex. Most of the larger waterways found on the base are fed by several smaller tributaries, as well as by groundwater discharge. For this RI, five areas were designated as watersheds in the Mainside area, and two areas were designated as watersheds in the Waterfront area. Areas designated as watersheds in the Mainside area include the Hockhockson Brook, Pine Brook, Shark River, Mingamahone Brook, and Mine Brook watersheds. Areas designated as watersheds in the Waterfront area include the Wagner Creek and Ware Creek watersheds. Watersheds were chosen based on the presence of waterways (drainage ditches, streams, creeks, ponds) in a given area and the associated topography as it relates to drainage; topographic maps and on-site inspection(ground-truthing) were used to determine the direction of drainage in different areas on the base and to define the waterways to which most or all drainage flows in a given area, i.e., a watershed.

Many of the RI sites that were assessed in previous sections are located within these individual watersheds and are in close proximity to surface waters. However, the previous assessments alone are not sufficient to characterize potential ecological risks in entire watersheds since many watersheds receive contaminant inputs from more than one source. Although many of the RI sites make insignificant contributions to a watershed, the presence of small contaminant contributions to a specific watershed may result in significant potential risk in downstream areas. In addition, most of the individual RI sites assessed are relatively small and constitute only a small portion of the home ranges of many ecological receptors found on the base. Thus, assessments of limited, discrete sites may be insufficient to fully characterize potential risk to ecological receptors on the base, especially receptors that utilize aquatic and semi-aquatic environments.

For these reasons, ecological risk assessments were performed for individual watersheds on NWS Earle. Although contaminant contributions from RI sites were the focus of watershed assessment, it should be noted that other potential contaminant sources are present in all of the designated watersheds, including highly developed areas on the base not related to RI sites; roadways, bunker complexes, and nearby civilian housing and commercial development. In addition, habitat types in each watershed are presented in Figure 30-1. Mapping of habitats on Figure 30-1 was conducted using Geographic Information System and other aerial data, which should only be used for approximation. On-site inspection on and near

several RI sites indicated that wetlands were not present as depicted by aerial data. The assessments described above are presented on a watershed-specific basis in the following sections.

30.5.1 Pine Brook Watershed Assessment

30.5.1.1 Preliminary Problem Formulation and Ecological Effects Characterization

Habitat Types and Ecological Receptors

The Pine Brook watershed is located in the northeast corner of the Mainside area (Figure 30-1). This watershed contains several different habitat types, including wetland and upland areas. As a result, most species of wildlife found on the Mainside area are expected to inhabit these areas, and most aquatic and semi-aquatic species found on the Mainside most likely inhabit the waterways present in this watershed. Habitat types in the watershed are presented in Figure 30-1. Several roadways and developed areas are located within the watershed, such as Route 18 and several bunker complexes. Pine Brook, portions of Hockhockson Brook, and several small ditches and streams are present in the northern portion of the watershed, and most drainage in the watershed is towards these waterways. RI sites 2 and 5 are located on the Hockhockson Brook/Pine Brook watershed border.

Contaminant Sources, Release Mechanisms, and Migration Pathways

RI Sites 2 and 5 are located on the western edge of this watershed. The major contaminant release pathways from these two sites is overland runoff. Overland runoff from precipitation may carry constituents to off-site surface waters, sediments, and soils. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. However, the lack of surface water near Sites 2 and 5, and limited groundwater contamination at Site 2, which is closest to surface water, limits potential groundwater to surface water contaminant migration in the watershed.

Exposure Routes

Terrestrial receptors may come into contact with contaminants present in surface water by using it for drinking, although this pathway is generally insignificant. Aquatic and terrestrial organisms inhabiting waterways and other wetlands may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this watershed. In particular, contaminants detected in watershed surface water and sediments were considered preliminary COPCs.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminants in surface water and sediments. Surface water and sediment ET values are presented in Tables 2-26 and 2-27, respectively.

30.5.1.2 Preliminary Exposure Assessment and Risk Characterization

Preliminary Exposure Assessment

Contaminant concentrations in surface water and sediment used for this initial screening were obtained from data generated during 1995 RI activities. Data were obtained from surface water and sediment samples collected during the summer and fall of 1995. A watershed sample (WSSW10/WSSD10) was taken in a small waterway downstream of Sites 2 and 5 to investigate potential contaminant contributions into the watershed for these two sites. The sample was taken in the closest waterway downstream of the two sites. The maximum detected contaminant concentrations in the surface water and sediment sample were used as representative exposure point concentrations. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

Risk Characterization

In Pine Brook watershed surface water, the inorganics aluminum (HQ = 2.24) and barium (HQ = 4.36) exceeded ETs and were retained as final COPCs (Table 30-6). In sediments, the inorganic barium (HQ = 1.28) exceeded the only ET value available and was retained as a final COPC (Table 30-7). Cadmium and lead exceeded most conservative ET values and were, therefore, retained as final COPCs, but did not exceed less conservative values. Aluminum and beryllium were conservatively retained as final COPCs since no suitable ET values were available. For organics in sediments, fluoranthene (HQ = 1.17) exceeded the only ET value and was retained as a final COPC. Phenanthrene exceeded the most conservative ET value and slightly exceeded a less conservative value. Several PAHs exceeded most conservative ET values and were retained as final COPCs but did not exceed less conservative ETs. One organic, 2-Butanone, was conservatively retained as a COPC since no suitable threshold was available.

The toxicological properties of all final COPCs in sediment are summarized in Appendix M.

30.5.1.3 Summary and Conclusions

Pine Brook watershed is located in the northeast section of the Mainside area. Both upland and wetland habitats are located in the watershed and are utilized by a wide variety of ecological receptors. RI Sites 2 and 5 are located on the western edge of this watershed, and various roadways and other developed areas are also present in the watershed. HQs for inorganics in Pine Brook watershed surface water and sediment were indicative of low potential risk. Furthermore, HQ values for organics in sediments were indicative of low potential risk, with the exception of phenanthrene. Nonetheless, phenanthrene only slightly exceeded a less conservative ET, and is not expected to cause adverse ecological effects by itself, especially since the concentration detected was not significantly elevated. Aluminum, beryllium, and 2-Butanone were retained as final COPCs since no suitable ET values were available, but all were detected in relatively low concentrations.

Potential risks to aquatic and semi-aquatic ecological receptors from contaminants in the Pine Brook watershed appear to be low. Although several PAHs were detected in the watershed sample taken downgradient of Sites 2 and 5, a cumulative toxic effect is unlikely given the relatively low concentrations detected. Also, PAHs were not detected in elevated concentrations in any medium at Sites 2 or 5. For these reasons, potential ecological risks in the Pine Brook watershed appear to be low, and further ecological study in the area based on ecological concerns appears to be unwarranted.

TABLE 30-6
SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - PINE BROOK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentation (μg/L)	Maximum Concentration (μg/L)	Ecotox Threshold (μg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	1/1	409	195	87	2.24	Retained-HQ > 1
Barium	1/1	34	17.0	3.9	4.36	Retained-HQ > 1
Copper	1/1	9.8	5.6	11	0.51	Eliminated-Does not exceed threshold
Lead	1/1	4.4	2.0	2.5	0.80	Eliminated-Does not exceed threshold
Manganese	1/1	55.5	7.6	80	0.10	Eliminated-Does not exceed threshold
Mercury	1/1	0.028	0.078	1.3	0.06	Eliminated-Does not exceed threshold
Nickel	1/1	7.1	3.0	160	0.02	Eliminated-Does not exceed threshold
Vanadium	1/1	0.9	2.2	19	0.12	Eliminated-Does not exceed threshold
Zinc	1/1	29.4	10.6	100	0.11	Eliminated-Does not exceed threshold

TABLE 30-7
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - PINE BROOK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	1/1	3940	3500	NA		Retained-No suitable threshold available
Arsenic	1/1	6.2	3.2	8.2	0.39	Eliminated-Does not exceed threshold
Barium	1/1	10.6	51.3	40	1.28	Retained-HQ > 1
Beryllium	1/1	0.57	1.3	NA		Retained-No suitable threshold available
Cadmium	1/1	ND	3.2	1.2/9.6	2.67/0.33	Retained-HQ > 1
Chromium	1/1	56.0	63.4	81	0.78	Eliminated-Does not exceed threshold
Copper	1/1	13.0	14.7	34	0.43	Eliminated-Does not exceed threshold
Lead	1/1	34.3	61.1	47/218	1.3/0.28	Retained-HQ > 1
Manganese	1/1	9.2	20.5	460	0.04	Eliminated-Does not exceed threshold
Mercury	1/1	0.068	0.075	0.15	0.50	Eliminated-Does not exceed threshold
Nickel	1/1	6.0	9.4	21	0.45	Eliminated-Does not exceed threshold
Vanadium	1/1	42.7	29.1	NA		Retained-No suitable threshold available
Zinc	1/1	26.9	130	150	0.87	Eliminated-Does not exceed threshold
Organics[3]						
2-Butanone	1/1	ND	110	NA		Retained-No suitable threshold available
Acenapthene	1/1	ND	310	620	0.50	Eliminated-Does not exceed threshold
Benzo(a)anthracene	1/1	560.0	440	330/1600	1.3/0.28	Retained-HQ > 1
Benzo(a)pyrene	1/1	590.0	240	430	0.56	Eliminated-Does not exceed threshold
Benzo(b)fluoranthene	1/1	490.0	610	330/1700	1.85/0.36	Retained-HQ > 1
Benzo(k)fluoranthene	1/1	470.0	480	330/1700	1.45/0.28	Retained-HQ > 1
Carbazole	1/1	ND	300	330	0.91	Eliminated-Does not exceed threshold
Chrysene	1/1	940.0	1200	330/2800	3.64/0.43	Retained-HQ > 1
Dibenzofuran	1/1	ND	220	2000	0.11	Eliminated-Does not exceed threshold
Fluoranthene	1/1	1800.0	3400	2900	1.17	Retained-HQ > 1
Fluorene	1/1	190	310	540	0.57	Eliminated-Does not exceed threshold
Napthalene	1/1	ND	360	480	0.75	Eliminated-Does not exceed threshold
Phenanthrene	1/1	1900	2300	850/1500	2.71/1.53	Retained-HQ > 1
Pyrene	1/1	1900.0	2400	660/2600	3.64/0.92	Retained-HQ > 1
Toluene	1/1	480.0	22.0	670	0.03	Eliminated-Does not exceed threshold
Xylene	1/1	ND	17.0	25	0.68	Eliminated-Does not exceed threshold

ND = None detected
NA = No suitable benchmark was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

30.5.2 Shark River Watershed Assessment

30.5.2.1 Preliminary Problem Formulation and Ecological Effects Characterization

Preliminary Problem Formulation

Habitat Types and Ecological Receptors

The Shark River watershed is located in the southeast corner of the Mainside area. This watershed contains several different habitat types, including wetland and upland areas. Most terrestrial receptors found in the Mainside area are expected to use the forested areas in the watershed, and most aquatic and semi-aquatic receptors most likely use the waterways in the Shark River watershed, especially in the lower, downstream reaches of Shark River. Habitat types in the watershed are presented in Figure 30-1. Several roadways and developed areas exist within the watershed, including the railroad storage yard. The Shark River and several small tributaries are located in the watershed, and most drainage is toward these waterways. RI site 3 is located off the western edge of the Shark River watershed, in Mingamahone Brook watershed. Drainage at Site 3 flows to the southeast, but potential contaminant inputs into the Shark River system may still be possible via groundwater flow and subsequent groundwater to surface water discharge.

Contaminant Sources, Release Mechanisms, and Migration Pathways

No RI sites are located directly in this watershed, although Site 3 is located to the west. However, various roadways and developed areas may release contaminants into the watershed, including the railroad storage yard. The major contaminant release pathways from these sites and other sources are overland runoff and infiltration of contaminants. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and soils, particularly to surface water and sediments in Shark River and associated tributaries. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Groundwater may eventually discharge to surface water; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. Aquatic contaminant migration pathways are the primary focus of this assessment.

Exposure Routes

Terrestrial receptors may come into contact with contaminants present in surface water by using it for drinking, although this pathway is generally insignificant. Aquatic and terrestrial organisms inhabiting waterways and other wetlands may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food

items. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this watershed. In particular, contaminants detected in watershed surface water and sediments were considered preliminary COPCs.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminants in surface water and sediments. Surface water and sediment ET values are presented in Tables 2-26 and 2-27, respectively.

30.5.2.2 Preliminary Exposure Assessment and Risk Characterization

Preliminary Exposure Assessment

Contaminant concentrations used for this initial screening were obtained from data generated during 1995 RI activities. Data were obtained from surface water and sediment samples collected during the summer and fall of 1995. Two Shark River watershed samples were collected; one sample (WSSW05/WSSD05) was collected from a tributary of Shark River where it passes beneath the northeastern end of the railroad storage yard, and one sample (WSSW06/WSSD06) was collected where a tributary of Shark River passes beneath the southwestern end of the railroad storage yard (Figure 30-1). The maximum detected contaminant concentrations in surface water and sediment were used as conservative representative exposure point concentrations. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

Risk Characterization

In Shark River watershed surface water, aluminum (HQ = 5.6), barium (HQ = 6.26), and chromium (HQ = 4.45) exceeded ET values and were retained as final COPCs (Table 30-8). In sediments, no inorganics exceeded ETs, but vanadium was conservatively retained as a final COPC since no suitable ET value was available (Table 30-9). For organics in sediments, endosulfan sulfate (HQ = 11.7) and methoxychlor (HQ = 4.05) exceeded the only ETs available for those two pesticides and were retained as final COPCs. The organochlorines 4,4'-DDD and 4,4'-DDT exceeded most conservative ET values and also exceeded less conservative ETs. Also, 4,4'-DDE exceeded the most conservative ET value and was retained as a final COPC, but did not exceed the less conservative ET value.

The toxicological properties of all final COPCs in surface water and sediment are summarized in Appendix M.

30.5.2.3 Summary and Conclusions

The Shark River watershed is located in the southeast corner of the Mainside area. Upland and wetland habitats are present in this watershed and a wide variety of terrestrial and aquatic receptors most likely use the habitats available in the watershed. Although no RI sites are located in this watershed, roadways and other developed areas are present, including the railroad storage yard.

Aluminum, barium, and chromium exceeded ETs in surface water but their HQ values were indicative of low potential risk. No inorganics in sediments exceeded ET values, but vanadium was conservatively retained as a final COPC since no suitable ET value was available. Endosulfan sulfate and methoxychlor were detected in sediments, but HQ values were indicative of relatively low potential risk. Concentrations of 4,4'-DDD and 4,4'-DDT slightly and moderately exceeded less conservative ETs, respectively. As a result, they may pose moderately high potential risk to aquatic and semi-aquatic receptors. In addition, they tend to bioaccumulate and biomagnify. However, these organochlorine pesticides were probably used in the past for base-wide pest control and are not related to a discrete source. Therefore, they may be relatively ubiquitous in the watershed. They may also stem from railroad storage yard activities rather than from RI site-related activities, but are not known to have been disposed of at the railroad yard. Groundwater from Site 3 may potentially migrate into the Shark River watershed, but organochlorine pesticides were not detected in elevated concentrations in Site 3 groundwater. As a result, their presence in elevated concentrations is noted, but further study or remediation of Shark River sediments based on potential contaminant contributions from RI sites does not appear to be warranted.

TABLE 30-8
SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - SHARK RIVER WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentation (μg/L)	Maximum Concentration (μg/L)	Ecotox Threshold (μg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	2/2	409	490	87	5.63	Retained-HQ > 1
Barium	2/2	34	24.4	3.9	6.26	Retained-HQ > 1
Beryllium	1/2	0.33	0.69	5.1	0.14	Eliminated-Does not exceed threshold
Cadmium	1/2	0.18	0.22	1.0	0.22	Eliminated-Does not exceed threshold
Chromium	1/2	2.6	44.5	10	4.45	Retained-HQ > 1
Cobalt	2/2	1.9	1.5	3	0.5	Eliminated-Does not exceed threshold
Copper	2/2	9.8	1.9	11	0.17	Eliminated-Does not exceed threshold
Lead	1/2	4.4	0.87	2.5	0.35	Eliminated-Does not exceed threshold
Mercury	2/2	0.028	0.09	1.3	0.07	Eliminated-Does not exceed threshold
Nickel	2/2	7.1	39.8	160	0.25	Eliminated-Does not exceed threshold
Vanadium	2/2	0.9	0.78	19	0.04	Eliminated-Does not exceed threshold
Zinc	2/2	29.4	80.7	100	0.81	Eliminated-Does not exceed threshold
Organics						
Heptachlor	1/2	ND	0.001	0.007	0.14	Eliminated-Does not exceed threshold

ND = Not Detected

TABLE 30-9
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - SHARK RIVER WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	2/2	3940	2970	NA		Retained-No suitable threshold available
Arsenic	2/2	6.2	2.6	8.20	0.32	Eliminated-Does not exceed threshold
Barium	2/2	10.6	16.4	40	0.41	Eliminated-Does not exceed threshold
Chromium	2/2	56.0	5.4	81	0.07	Eliminated-Does not exceed threshold
Copper	2/2	13.0	5.3	34	0.16	Eliminated-Does not exceed threshold
Lead	2/2	34.3	16.3	47	0.35	Eliminated-Does not exceed threshold
Manganese	2/2	9.2	5.1	460	0.01	Eliminated-Does not exceed threshold
Mercury	2/2	0.068	0.044	0.15	0.29	Eliminated-Does not exceed threshold
Nickel	1/2	6.0	2.9	21	0.14	Eliminated-Does not exceed threshold
Vanadium	2/2	42.7	13.2	NA		Retained-No suitable threshold available
Zinc	1/2	11.9	22.8	150	0.15	Eliminated-Does not exceed threshold
Organics[3]						
4,4'-DDD	2/2	21.0	85.0	1.6/46	53.1/1.85	Retained-HQ > 1
4,4'-DDE	1/2	1.7	6.0	2.2/27	2.73/0.22	Retained-HQ > 1
4,4'-DDT	2/2	19.0	770	1.6/46	481.3/16.7	Retained-HQ > 1
Benzo(a)anthracene	1/2	560.0	67.0	330	0.20	Eliminated-Does not exceed threshold
Benzo(a)pyrene	1/2	590.0	77.0	430	0.18	Eliminated-Does not exceed threshold
Benzo(b)fluoranthene	2/2	490.0	93.0	330	0.28	Eliminated-Does not exceed threshold
Benzo(k)fluoranthene	1/2	470.0	86.0	330	0.26	Eliminated-Does not exceed threshold
Chrysene	2/2	940.0	99.0	330	0.30	Eliminated-Does not exceed threshold
Diethylphthalate	1/2	44.0	83.0	630	0.13	Eliminated-Does not exceed threshold
Endosulfan Sulfate	2/2	ND	63.0	5.4	11.7	Retained-HQ > 1
Endrin	2/2	ND	16.0	20	0.80	Eliminated-Does not exceed threshold
Endrin ketone	1/2	1.6	9.7	20	0.49	Eliminated-Does not exceed threshold
Fluoranthene	2/2	1800.0	160	2900	0.06	Eliminated-Does not exceed threshold
Methoxychlor	1/2	ND	77.0	19	4.05	Retained-HQ > 1
Methylene Chloride	2/2	ND	3.0	427	0.01	Eliminated-Does not exceed threshold
Pyrene	2/2	1900.0	120	660	0.18	Eliminated-Does not exceed threshold
Toluene	1/2	480.0	4.0	670	0.01	Eliminated-Does not exceed threshold

ND = None detected
NA = No suitable threshold available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

30.5.3 Hockhockson Brook Watershed Assessment

30.5.3.1 Preliminary Problem Formulation and Ecological Effects Characterization

Habitat Types and Ecological Receptors

The Hockhockson Brook watershed is located in the north-central section of the Mainside area (Figure 30-1). This watershed contains several different habitat types, including several wetland types and upland areas. Most of these habitats are forested. Habitat types in the watershed are presented in Figure 30-1. This diversity of habitats is utilized by a wide variety of ecological receptors, including most, if not all, terrestrial, aquatic, and semi-aquatic receptors found on the Mainside area. Several roadways and developed areas exist within the watershed, including the installation administrative and support building complex. Hockhockson Brook and several small tributaries are found throughout the watershed, and most drainage is toward these waterways.

The majority of the RI sites found in the Mainside area are also located within the Hockhockson Brook watershed, primarily on the western half of the watershed (Figure 30-1). Sites 4, 22, 23, and 24/25 are all located in the same general area on and around a tributary to Hockhockson Brook. Sites 10 and 20 are located southeast of those RI sites, also close to an upper tributary of Hockhockson Brook. Several other RI sites, including Sites 1, 11, 16, and 29 are located in the northwest portion of the watershed, although none of these sites is located relatively close to surface water in the watershed. In addition, Sites 14 and Epic Site L are situated in the watershed, but are not located near any surface water. Site 13 is located adjacent to Hockhockson Brook, in the central portion of the watershed.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathways from the RI sites in the watershed are overland runoff and infiltration of contaminants. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and soils, particularly to surface water and sediments in the watershed. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Groundwater from the contaminant sources may eventually discharge to surface water in Hockhockson Brook and associated tributaries; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. For the most part, aquatic contamination migration pathways are the focus of this assessment.

Exposure Routes

Terrestrial receptors may come into contact with contaminants present in surface water by using it for drinking, although this pathway is generally insignificant. Aquatic and terrestrial organisms inhabiting

waterways and other wetlands may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this watershed. In particular, contaminants detected in watershed surface water and sediments were considered preliminary COPCs.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminants in surface water and sediments. Surface water and sediment ET values are presented in Tables 2-26 and 2-27, respectively.

30.5.3.2 Preliminary Exposure Assessment and Risk Characterization

Preliminary Exposure Assessment

Contaminant concentrations used for this initial screening were obtained from data generated during 1995 RI activities. Data were obtained from surface water and sediment samples collected during the summer and fall of 1995. Four surface water (WSSW11-WSSW14) and four sediment samples (WSSD11-WSSD14) were collected in the watershed (Figure 30-1). Three of these samples were taken on portions of Hockhockson Brook downstream of all RI sites, and one sample was taken on a branch of Hockhockson Brook in the northeast portion of the watershed. The maximum detected contaminant concentrations in surface water and sediment were used as conservative representative exposure point concentrations. Background concentrations presented for comparative purposes were obtained from facility-wide

background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

Risk Characterization

In Hockhockson Brook surface water, aluminum (HQ = 14.8), barium (HQ = 7.64), lead (HQ = 1.68), and silver (HQ = 94.0) exceeded ET values and were retained as final COPCs (Table 30-10). In sediments, barium (HQ = 1.95) exceeded the only ET value available and was retained as a final COPC (Table 30-11). Arsenic and lead exceeded the most conservative ETs available, and hence, were retained as final COPCs, but did not exceed less conservative ET values. In addition, cyanide exceeded the most conservative ET value and slightly exceeded a less conservative value. Aluminum, beryllium, and vanadium were conservatively retained as final COPCs since no suitable ET values were available. No organics in sediments exceeded ET values, although 2-butanone was conservatively retained as a final COPC since no suitable threshold was available.

The toxicological properties of all final COPCs in surface water and sediment are summarized in Appendix M.

30.5.3.3 Summary and Conclusions

The Hockhockson Brook watershed is located in the north-central section of the Mainside area. Several different habitat types are present in this watershed, including upland and wetland areas. A wide variety of ecological receptors most likely utilize these habitats. Also, several RI sites are located in the watershed, particularly in the south and southwest portion of the watershed. Several sites are situated in a portion of the watershed along a tributary of Hockhockson Brook.

Previous site-specific assessments indicated that potential risks from contaminants at most of the RI sites in the Hockhockson Brook watershed were low. In particular, the group of sites (4, 22, 23, 23/25) located in relative proximity to each other all possessed low potential ecological risks and limited off-site contaminant migration. Some of sites in the northwest portion of the watershed (1, 11, 14, 16, and 29) had slightly elevated potential risks, but none of these sites was situated near surface water and off-site migration, via overland runoff or groundwater flow, appears to be limited at those sites. Potential risks and off-site migration from Sites 10 and 20, located near the upper reach of a Hockhockson Brook tributary, were also low. Potential risks from silver and PCBs were moderately high at Site 13, which is located along Hockhockson Brook. In this watershed assessment, HQ values for surface water were indicative of relatively low risk, with the exception of silver. Nonetheless, silver was detected in only one sample and was present in a concentration only slightly above background; the high HQ for silver is most likely the result of the only ET value available, which is highly conservative. PCBs were not analyzed for in Hockhockson Brook watershed sediment samples, but are highly lipophilic and have strong affinities for

TABLE 30-10
SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - HOCKHOCKSON BROOK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentation (μg/L)	Maximum Concentration (μg/L)	Ecotox Threshold (μg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	4/4	409	1290	87	14.8	Retained-HQ > 1
Arsenic	1/4	ND	3.5	190	0.02	Eliminated-Does not exceed threshold
Barium	4/4	34	29.8	3.9	7.64	Retained-HQ > 1
Beryllium	3/4	0.33	0.34	5.1	0.07	Eliminated-Does not exceed threshold
Cadmium	3/4	0.18	0.39	1.0	0.39	Eliminated-Does not exceed threshold
Chromium	1/4	2.6	9.6	10	0.96	Eliminated-Does not exceed threshold
Cobalt	4/4	1.9	2.5	3	0.83	Eliminated-Does not exceed threshold
Copper	3/4	9.8	6.4	11	0.58	Eliminated-Does not exceed threshold
Lead	3/4	4.4	4.2	2.5	1.68	Retained-HQ > 1
Manganese	1/4	55.5	10.0	80	0.13	Eliminated-Does not exceed threshold
Mercury	4/4	0.028	0.062	1.3	0.05	Eliminated-Does not exceed threshold
Nickel	4/4	7.1	28.4	160	0.18	Eliminated-Does not exceed threshold
Silver	1/4	0.86	0.94	0.01	94.0	Retained-HQ > 1
Vanadium	4/4	0.9	2.0	19	0.11	Eliminated-Does not exceed threshold
Zinc	4/4	29.4	31.7	100	0.32	Eliminated-Does not exceed threshold

ND = Not Detected

TABLE 30-11
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - HOCKHOCKSON BROOK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	4/4	3940	6130	NA		Retained-No suitable threshold available
Arsenic	3/4	6.2	14.1	8.2/70	1.72/0.20	Retained-HQ > 1
Barium	4/4	10.6	77.9	40	1.95	Retained-HQ > 1
Beryllium	3/4	0.57	0.58	NA		Retained-No suitable threshold available
Chromium	4/4	56.0	59.8	81	0.74	Eliminated-Does not exceed threshold
Copper	3/4	13.0	13.8	34	0.41	Eliminated-Does not exceed threshold
Cyanide	1/4	ND	0.47	0.1/0.25	4.7/1.88	Retained-HQ > 1
Lead	4/4	34.3	64.8	47/218	1.38/0.30	Retained-HQ > 1
Manganese	2/4	9.2	4.0	460	0.01	Eliminated-Does not exceed threshold
Vanadium	4/4	42.7	84.0	NA		Retained-No suitable threshold available
Organics[3]						
2-Butanone	1/4	ND	6.0	NA		Retained-No suitable threshold available
Diethylphthalate	1/4	44.0	250.0	630	0.40	Eliminated-Does not exceed threshold
Methylene Chloride	2/4	ND	9.0	427	0.02	Eliminated-Does not exceed threshold
Toluene	1/4	480.0	54.0	670	0.08	Eliminated-Does not exceed threshold

ND = None detected
NA = No suitable benchmark was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

organic fractions in sediments. As a result, they are highly immobile in sediments and are not expected to migrate significantly.

In watershed sediments, HQ values for inorganics were indicative of low potential risk, with the exception of cyanide. Yet, cyanide was detected in only one sample, and was not a final COPC in any upstream sites. Aluminum, beryllium, and vanadium were conservatively retained as final COPCs in sediments since no suitable ET values were available. Beryllium was present only slightly above background, while aluminum and vanadium were present in concentrations moderately above background. Due to the physico-chemistry of Pine Barren soils, aluminum and vanadium may be naturally elevated. No organics in sediments exceeded ET values, though no SVOCs were analyzed for in Hockhockson Brook watershed sediment samples. Nonetheless, although some SVOCs, mainly PAHs, were final COPCs at some RI sites, no SVOCs appeared to be significantly migrating off-site at any RI sites located near sections of Hockhockson Brook and its tributary. Similar to PCBs, most PAHs have strong affinities for organic carbon in sediments and are usually fairly immobile in sediments. One organic, 2-Butanone, was retained as a final COPC since no suitable ET was available, but was detected in only one sample, and at a low concentration.

In summary, HQ values for most contaminants detected in Hockhockson Brook watershed samples are indicative of low potential risk. Aluminum was slightly elevated in surface water and sediment, but does not appear to be due to RI sites in the watershed. Cyanide slightly exceeded a less conservative ET value for sediments, but was not a final COPC at any RI site in the watershed, and was only detected in one watershed sample. More importantly, individual site assessments indicated that no RI sites in the watershed appear to be significantly contributing contaminants to the watershed, and cumulative contaminant contributions from multiple sites also does not appear to be occurring. For these reasons, additional ecological study in the Hockhockson Brook watershed does not appear to be warranted.

30.5.4 Mingamahone Brook Watershed Assessment

30.5.4.1 Preliminary Problem Formulation and Ecological Effects Characterization

Habitat Types and Ecological Receptors

The Mingamahone Brook watershed is located in the west-central section of the Mainside area. This watershed contains several different habitat types, including wetland, upland, and open water habitats. Most terrestrial receptors found on the base, including most mammals and birds, are expected to use the upland areas. The wetlands, including extensive marshland, and open water areas provide habitat for semi-aquatic and aquatic receptors, including wading birds, wetland mammals, small fish, gamefish, and amphibians. Habitat types in the watershed are presented in Figure 30-1. Several roadways and developed areas exist within the watershed, including a trailer park and the community of Farmingdale.

Mingamahone Brook and several small ditches and streams are present within the watershed and most drainage is towards these waterways. Mingamahone Brook and several small tributaries are situated in the middle of the watershed, and the East Branch of Mingamahone Brook and several smaller tributaries are located in the eastern portion of the watershed. Some small ponds and cranberry bogs are located in the upper reaches of Mingamahone Brook and some of its tributaries. RI Sites 26 and 27 are located on the eastern edge of the watershed, and Epic Site Q is located on the western edge of the watershed. In addition, Site 19 is located in the central portion of the watershed, adjacent to a tributary of Mingamahone Brook.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathways from the RI sites are overland runoff and infiltration of contaminants. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and soils, particularly to surface water and sediments in Mingamahone Brook and its tributaries. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Groundwater from the sites may eventually discharge to surface water in Mingamahone Brook and its tributaries; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. Aquatic contaminant migration pathways are the primary focus of this assessment.

Exposure Routes

Terrestrial receptors may come into contact with contaminants present in surface water by using it for drinking, although this pathway is generally insignificant. Aquatic and terrestrial organisms inhabiting waterways and other wetlands may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this watershed. In particular, contaminants detected in watershed surface water and sediments were considered preliminary COPCs.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminants in surface water and sediments. Surface water and sediment ET values are presented in Tables 2-26 and 2-27, respectively.

30.5.4.2 Preliminary Exposure Assessment and Risk Characterization

Preliminary Exposure Assessment

Contaminant concentrations in surface water and sediment used for this initial screening were obtained from data generated during 1995 RI activities. Data were obtained from surface water and sediment samples collected during the summer and fall of 1995. Four surface water and sediment samples were taken throughout the watershed to investigate potential contaminant inputs into the watershed. Sample WSSW/SD07 was taken in the East Branch of Mingamahone Brook, approximately 1,500 feet southeast of RI Site 3, and sample WSSW/SD09 was taken in a tributary of Mingamahone Brook near Site 19. Also, sample WSSW/SD08 was collected in the East Branch of Mingamahone Brook near the trailer park, and sample WSSW/SD15 was taken in a marsh immediately east of Epic Site Q. The maximum detected contaminant concentrations in these surface water and sediment samples were used as representative exposure point concentrations. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

Risk Characterization

In Mingamahone Brook watershed surface water, the inorganics aluminum (HQ = 11.7), barium (HQ = 98.6), lead (HQ = 3.36), silver (HQ = 350), vanadium (HQ = 1.44), and zinc (HQ = 2.59) exceeded ET values and were retained as final COPCs (Table 30-12). No organics were detected in surface water. In sediments, no inorganics exceeded ET values (Table 30-13). Some PAHs slightly exceeded most conservative ET values, but did not exceed less conservative values. Aluminum, beryllium, vanadium, and 2-Butanone were conservatively retained as final COPCs since no suitable ETs were available.

The toxicological properties of all final COPCs in surface water and sediment are summarized in Appendix M.

TABLE 30-12
SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - MINGAMAHONE BROOK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentation (μg/L)	Maximum Concentration (μg/L)	Ecotox Threshold (μg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	4/4	409	1020	87	11.7	Retained-HQ > 1
Arsenic	1/4	ND	4.8	190	0.03	Eliminated-Does not exceed threshold
Barium	4/4	34	386	3.9	98.9	Retained-HQ > 1
Beryllium	1/4	0.33	0.25	5.1	0.05	Eliminated-Does not exceed threshold
Cadmium	1/4	0.18	0.58	1.0	0.58	Eliminated-Does not exceed threshold
Cobalt	1/4	1.9	1.1	3	0.37	Eliminated-Does not exceed threshold
Copper	3/4	9.8	8.5	11	0.77	Eliminated-Does not exceed threshold
Lead	3/4	4.4	8.4	2.5	3.36	Retained-HQ > 1
Manganese	2/4	55.5	14.3	80	0.18	Eliminated-Does not exceed threshold
Mercury	4/4	0.028	0.1	1.3	0.08	Eliminated-Does not exceed threshold
Nickel	4/4	7.1	4.1	160	0.03	Eliminated-Does not exceed threshold
Silver	1/4	0.86	3.5	0.01	350.0	Retained-HQ > 1
Vanadium	3/4	0.9	27.4	19	1.44	Retained-HQ > 1
Zinc	4/4	29.4	259.0	100	2.59	Retained-HQ > 1

ND = Not Detected

TABLE 30-13
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - MINGAMAHONE BROOK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	4/4	3940	3440	NA		Retained-No suitable threshold available
Arsenic	4/4	6.2	5.2	8.2	0.63	Eliminated-Does not exceed threshold
Barium	4/4	10.6	23.4	40	0.59	Eliminated-Does not exceed threshold
Beryllium	1/4	0.57	0.54	NA		Retained-No suitable threshold available
Chromium	4/4	56.0	21.7	81	0.27	Eliminated-Does not exceed threshold
Copper	4/4	13.0	5.4	34	0.16	Eliminated-Does not exceed threshold
Lead	4/4	34.3	23.4	47	0.50	Eliminated-Does not exceed threshold
Manganese	2/4	9.2	7.5	460.00	0.02	Eliminated-Does not exceed threshold
Mercury	4/4	0.068	0.045	0.15	0.30	Eliminated-Does not exceed threshold
Vanadium	4/4	42.7	41.3	NA		Retained-No suitable threshold available
Zinc	1/4	26.9	9.8	150	0.07	Eliminated-Does not exceed threshold
Organics[3]						
2-Butanone	4/4	ND	72.0	NA		Retained-No suitable threshold available
2-Methylnapthalene	1/4	ND	220	330	0.67	Eliminated-Does not exceed threshold
Acenapthylene	1/4	ND	74	44/640	1.68/0.12	Retained-HQ > 1
Anthracene	1/4	ND	160	330	0.48	Eliminated-Does not exceed threshold
Benzo(a)anthracene	3/4	560	400	330/1600	1.21/0.25	Retained-HQ > 1
Benzo(a)pyrene	3/4	590	280	430	0.65	Eliminated-Does not exceed threshold
Benzo(b)fluoranthene	3/4	490	170	330	0.52	Eliminated-Does not exceed threshold
Benzo(g,h,i)perylene	2/4	380	140	330	0.42	Eliminated-Does not exceed threshold
Benzo(k)fluoranthene	3/4	470	180	330	0.55	Eliminated-Does not exceed threshold
Chrysene	3/4	940	510	330/2800	1.55/0.18	Retained-HQ > 1
Di-n-octylphthalate	1/4	ND	71.0	11,000	0.01	Eliminated-Does not exceed threshold
Diethylphthalate	1/4	44	82.0	630	0.13	Eliminated-Does not exceed threshold
Ethylbenzene	1/4	ND	3.0	3600	0.00	Eliminated-Does not exceed threshold
Fluoranthene	3/4	1800	670	2900	0.23	Eliminated-Does not exceed threshold
Fluorene	1/4	190	260	540	0.48	Eliminated-Does not exceed threshold
Indeno(1,2,3-cd)pyrene	3/4	310	110	330	0.33	Eliminated-Does not exceed threshold
Methylene Chloride	2/4	ND	4	427	0.01	Eliminated-Does not exceed threshold
Napthalene	1/4	ND	110	480	0.23	Eliminated-Does not exceed threshold
Phenanthrene	3/4	1900	1400	850/1500	1.65/0.93	Retained-HQ > 1
Pyrene	4/4	1900	940	660/2600	1.42/0.36	Retained-HQ > 1
Toluene	2/4	480	120	670	0.18	Eliminated-Does not exceed threshold

ND = None detected
NA = No suitable benchmark was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

30.5.4.3 Summary and Conclusions

The Mingamahone Brook watershed is located in the west-central portion of the base. RI sites 19, 26, 27, and EPIC site Q are located in the watershed. Several different habitat types are present in the watershed, including wetland, upland, and open water habitats. HQ values for inorganics in watershed surface water were indicative of low potential risk, with the exception of barium and silver. However, silver was detected in only one sample, and the only ETs available for barium and silver were highly conservative, likely contributing to the high HQs. More importantly, barium was not a final COPC in sediments, and therefore, may not be accumulating in the watershed. The only high concentration of barium was detected in sample WSSW/SD09, which was collected south of Site 19. Barium was a final COPC in Site 19 sediments, but was only detected in a relatively low concentration and its HQ was indicative of low potential risk at the site. Silver was only detected in sample SW08. This sample could potentially receive contaminant inputs from RI sites 19, 26, and 27, but silver was not detected or only present in low concentrations at all of these sites, and it was not a final COPC at these sites. No inorganics exceeded ET values in watershed sediments, and organic HQs were indicative of low potential risk. Aluminum, beryllium, and vanadium were conservatively retained as final COPCs since no suitable ETs were available but were detected in concentrations comparable to background. One organic, 2-Butanone, was retained as a final COPC since no suitable ET was available, but was present in only a low concentration.

Although concentrations of barium and silver were elevated in one surface water sample, they do not appear to originate from any RI sites in the watershed, and were not final COPCs in watershed sediments. Although some of the sites in the watershed appeared to have the potential for off-site contaminant migration in individual site assessments, particularly Site 19, it does not appear that any of those sites are affecting the watershed. Further ecological study based on ecological concerns from RI sites in the watershed does not appear to be warranted.

30.5.5 Mine Brook Watershed Assessment

30.5.5.1 Preliminary Problem Formulation and Ecological Effects Characterization

Preliminary Problem Formulation

Habitat Types and Ecological Receptors

The Mine Brook watershed is located in the western section of the Mainside area (Figure 30-1). This watershed contains several different habitat types, including wetland and upland areas. Habitats in the watershed, both wetlands and uplands, are mostly forested. Habitat types in the watershed are presented in Figure 30-1. Most terrestrial receptors found in the Mainside area are expected to inhabit the

watershed. Several roadways and developed areas are located in the in the watershed, including Route 18, Asbury Avenue, and several bunker areas. The upper reaches of Mine Brook and several of its tributaries are located in the watershed, mainly in the north-central section and most drainage in the area is towards these waterways. Mine Brook and associated waterways are fairly shallow on the base and water flows only after periods of heavy rainfall, but some aquatic and semi-aquatic receptors, such as small fish, amphibians, and wading birds probably use these areas. A small pond is located along a Mine Brook tributary close to Tarawa Road, and is utilized by most aquatic receptors found in the Mainside area. Although no RI sites are located directly in the watershed, Epic Site Q is located at the southern tip of this watershed, and again, other base-related activities are conducted in the area.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathways from potential contaminant sources, such as the bunker area, are overland runoff and infiltration of contaminants. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and soils, particularly to surface water and sediment in Mine Brook and associated tributaries. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, contaminants may be carried with the flow of groundwater to downgradient locations. Groundwater from the site may eventually discharge to surface water in the Mine Brook and associated tributaries; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. Aquatic contaminant migration pathways are the primary focus of this assessment.

Exposure Routes

Terrestrial receptors may come into contact with contaminants present in surface water by using it for drinking, although this pathway is generally insignificant. Aquatic and terrestrial organisms inhabiting waterways and other wetlands may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this watershed. In particular, contaminants detected in watershed surface water and sediments were considered preliminary COPCs.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminants in surface water and sediments. Surface water and sediment ET values are presented in Tables 2-26 and 2-27, respectively.

30.5.5.2 Preliminary Exposure Assessment and Risk Characterization

Preliminary Exposure Assessment

Contaminant concentrations in surface water and sediment used for this initial screening were obtained from data generated during 1995 RI activities. Data were obtained from a surface water and sediment sample collected in Mine Brook near a pond at the northwestern base boundary, north of Tarawa Road. This sample should contain any contaminants that could potentially exit the base from base-related activities in the northwestern section of the installation. The maximum detected contaminant concentrations in the surface water and sediment sample were used as conservative representative exposure point concentrations. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

Risk Characterization

In Mine Brook watershed surface water, aluminum (HQ = 4.29) and barium (HQ = 8.64) exceeded ETs and were retained as final COPCs (Table 30-14). In sediments, arsenic exceeded the most conservative ET value available and was retained as a final COPC, but did not exceed a less conservative value (Table 30-15). Aluminum, beryllium, and vanadium were conservatively retained as final sediment COPCs since no suitable ETs were available.

TABLE 30-14
SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - MINE BROOK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentation (μg/L)	Maximum Concentration (μg/L)	Ecotox Threshold (μg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	1/1	409	373	87	4.29	Retained-HQ > 1
Arsenic	1/1	ND	3.4	190	0.02	Eliminated-Does not exceed threshold
Barium	1/1	34	33.7	3.9	8.64	Retained-HQ > 1
Cobalt	1/1	1.9	0.63	3	0.21	Eliminated-Does not exceed threshold
Copper	1/1	9.8	5.3	11	0.48	Eliminated-Does not exceed threshold
Mercury	1/1	0.028	0.043	1.3	0.03	Eliminated-Does not exceed threshold
Nickel	1/1	7.1	3.5	160	0.02	Eliminated-Does not exceed threshold
Vanadium	1/1	0.9	1.4	19	0.07	Eliminated-Does not exceed threshold
Zinc	1/1	29.4	15.1	100	0.15	Eliminated-Does not exceed threshold

ND = Not Detected

TABLE 30-15
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - MINE BROOK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	1/1	3940	1570	NA		Retained-No suitable threshold available
Arsenic	1/1	6.2	17.3	8.2/70	2.11/0.25	Retained- HQ > 1
Barium	1/1	10.6	25.3	40	0.63	Eliminated-Does not exceed threshold
Beryllium	1/1	0.57	0.35	NA		Retained-No suitable threshold available
Chromium	1/1	56.0	17.0	81	0.21	Eliminated-Does not exceed threshold
Lead	1/1	34.3	12.2	47	0.26	Eliminated-Does not exceed threshold
Manganese	1/1	9.2	1.5	460	0.00	Eliminated-Does not exceed threshold
Vanadium	1/1	42.7	12.7	NA		Retained-No suitable threshold available
Zinc	1/1	26.9	9.1	150	0.06	Eliminated-Does not exceed threshold
Organics[3]						
Diethylphthalate	1/1	44.0	64.0	630	0.10	Eliminated-Does not exceed threshold

ND = None detected
NA = No suitable benchmark was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

30.5.5.3 Summary and Conclusions

The Mine Brook watershed is located on the northwestern section of the base. Epic Site Q is located on the southern border of the watershed, but no other RI sites are located in the watershed. Several roadways and other developed areas are present in the watershed, mainly extensive bunker complexes. Both upland and wetland habitats are also present in the watershed, and are mainly forested. Mine Brook and several of its tributaries are located in the northern portion of the watershed.

HQs for surface water contaminants were indicative of low potential risk, and the two inorganic final COPCs, aluminum and barium, were lower than background. The HQ value for arsenic, the only contaminant that exceeded an ET value, was indicative of low potential risk. Aluminum, vanadium, and beryllium were all conservatively retained as final COPCs since no suitable ETs were available, but were all lower than background. The sediment sample taken in the Mine Brook watershed was not analyzed for SVOCs. However, SVOCs have not been identified as potential contaminants anywhere in the watershed, and most of these compounds have strong affinities for organic carbon in soil and sediment, and hence, are fairly immobile in the environment. Additional samples could be taken where Mine Brook and its tributaries leave the base and analyzed for SVOCs, but do not appear to be completely warranted. Contaminant contributions and related potential risks from other contaminants appear to be low in Mine Brook watershed.

30.5.6 Ware Creek Watershed Assessment

30.5.6.1 Preliminary Problem Formulation and Ecological Effects Characterization

Preliminary Problem Formulation

Habitat Types and Ecological Receptors

The Ware Creek watershed is located in the northern and central sections of the Waterfront area (Figure 30-2). This watershed contains several different habitat types, including wetland and upland areas. The central section of the Waterfront complex, south of Route 36, is characterized by extensive forested uplands and scattered forested wetlands. Habitat types in the watershed are presented in Figure 30-2. A tributary of Ware Creek is located within the upper section of the central waterfront area, and most drainage flows towards this creek. Several roadways, including the railroad and roadway that link the Mainside and Waterfront areas of NWS Earle, are located within the central section of the watershed. Other developed areas, including some bunker complexes, are also present in the watershed. The northern section of the watershed, north of Route 36, contains an extensive *Phragmites* salt marsh. Ware Creek and several small waterways are located within the saltmarsh, which connects with Sandy Hook Bay. The Waterfront industrial complex is located in the northern section of the watershed. This area is

heavily developed, and contains RI Sites 6, 12, 15, and 17. Site 15 is located in a wooded wetland area that is not tidally influenced, but is connected to the marsh and Ware Creek via a small drainageway. Sites 6, 12, and 17 are all situated next to the salt marsh. Some small forested areas and wooded wetland are located next to these three sites. RI sites 7 and 9 are also located on the border of the Ware Creek and Wagner Creek watersheds, but are essentially part of the Wagner Creek drainage; therefore, they are primarily discussed in the Wagner Creek watershed assessment.

The forested upland and wetland areas in the central portion of the Waterfront area and Ware Creek watershed contain excellent habitat. Since surface water is not extensive in the forested wetlands, the habitat in these areas primarily attracts terrestrial receptors, such as white-tailed deer, gray fox, and small mammals, as well as species of birds found in the Waterfront area that are attracted to forested areas. The upper reaches of the Ware Creek tributary in this area is small with ephemeral water flow, but may still provide habitat for some small fish and amphibians. The tidal salt marsh and other wetland areas in the northern portion of the watershed provide excellent habitat for aquatic, semi-aquatic, and terrestrial receptors. The marsh may be utilized by piscivorous birds and mammals, as well as small fish and other semi-aquatic receptors.

Contaminant Sources, Release Mechanisms, and Migration Pathways

RI sites 6, 12, 15, and 17 are located in this watershed. The major contaminant release pathways from these sites are overland runoff and infiltration of contaminants. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and soils, particularly to surface water and sediments in Ware Creek tributaries, forested wetlands, and the saltmarsh. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a contaminant may be carried with the flow of groundwater to downgradient locations. Groundwater from the contaminated areas may eventually discharge to surface water in the marsh and wetlands; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. For the most part, aquatic migration pathways are the focus of this assessment.

Exposure Routes

Terrestrial receptors may come into contact with contaminants present in surface water by using it for drinking, although this pathway is generally insignificant. Aquatic and terrestrial organisms inhabiting waterways, saltmarsh, and other wetlands may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this watershed. In particular, contaminants detected in watershed surface water and sediments were considered preliminary COPCs.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminants in surface water and sediments. Samples were taken in areas with little or no tidal influence; therefore, ETs used for this watershed are based on freshwater systems. Surface water and sediment ET values are presented in Tables 2-26 and 2-27, respectively.

30.5.6.2 Preliminary Exposure Assessment and Risk Characterization

Preliminary Exposure Assessment

Contaminant concentrations in surface water used for this initial screening were obtained from data generated during 1995 RI activities. Data were obtained from surface water and sediment samples collected during the summer and fall of 1995. One sample (WSSW/SD21) was taken in a Ware Creek tributary where it passes beneath Normandy Road and one sample (WSSW/SD22) was taken in a drainage ditch southeast (upgradient) of Site 15 to investigate contaminant inputs from the central section of the waterfront into the watershed (Figure 30-2). The maximum detected contaminant concentrations in surface water and sediment were used as conservative representative exposure point concentrations. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

Risk Characterization

In Ware Creek watershed surface water, the inorganics aluminum, barium, cadmium, cobalt, lead, manganese, selenium, and zinc exceeded ETs and were retained as final COPCs (Table 30-16). In sediments, arsenic, cyanide, and silver exceeded both most and less conservative ET values (Table 30-17). Cadmium, mercury, and nickel exceeded most conservative ET values and were retained as final COPCs, but did not exceed less conservative values. For organics in sediments, 4,4'-DDE exceeded the most conservative ET value and was retained as a final COPC, but did not exceed the less conservative ET. In addition, aluminum, beryllium, selenium, thallium, and vanadium were conservatively retained as final COPCs in sediments since no suitable ET values were available.

The toxicological properties of all final COPCs in surface water and sediment are summarized in Appendix M.

30.5.6.3 Summary and Conclusions

The Ware Creek watershed is located in the northern and central section of the Waterfront area. RI sites 6, 12, 15, and 17 are located in the northern section of the watershed. Heavily developed areas and several roadways are also located in the northern section. Upland and wetland habitats are present, including an extensive saltmarsh that connects with Sandy Hook Bay. The central section of the waterfront area is heavily forested. The upland and wetland areas in the watershed provide excellent habitat for a wide variety of ecological receptors.

In surface water, most HQ values were indicative of low potential risk, with the exception of aluminum, barium, and manganese, which were indicative of moderate potential risk. However, a total of eight inorganics exceeded surface water ET values, suggesting the possibility of a cumulative toxic effect on aquatic ecological receptors. In sediments, several inorganics had HQ values indicative of moderate potential risk. Furthermore, some contaminants that were retained as COPCs because no suitable ET values were available were present in concentrations above background. In general, potential risks to aquatic receptors from contaminants in surface water are low to moderate, while risks from contaminants in sediments are of moderate concern. However, almost all of the maximum values for contaminants detected were from the surface water and sediment sample collected southeast of Site 15 (WSSW/SD22). Concentrations for almost all contaminants were much lower in the sample taken south of Route 36 in the Ware Creek tributary (WSSW/SD21). Sample WSSW/SD22 is upgradient of all RI site-related contaminant sources in the Waterfront industrial complex. Site 15 is nearby, but is downgradient for both surface and groundwater flow, and inorganics detected at Site 15 were relatively low. Therefore, the source of the elevated concentrations of metals is unknown, but metals concentrations are low downgradient of the watershed sampling site, suggesting limited migration from that sampling area.

TABLE 30-16
SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - WARE CREEK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentation (μg/L)	Maximum Concentration (μg/L)	Ecotox Threshold (μg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	2/2	409	2300	87	26.4	Retained-HQ > 1
Arsenic	1/2	ND	50.2	190	0.26	Eliminated-Does not exceed threshold
Barium	2/2	34	69.2	3.9	17.7	Retained-HQ > 1
Beryllium	1/2	0.33	4.6	5.1	0.90	Eliminated-Does not exceed threshold
Cadmium	1/2	0.18	2.8	1.0	2.8	Retained-HQ > 1
Cobalt	2/2	1.9	22.2	3	7.4	Retained-HQ > 1
Copper	1/2	9.8	7.5	11	0.68	Eliminated-Does not exceed threshold
Lead	1/2	4.4	5.1	2.5	2.04	Retained-HQ > 1
Manganese	2/2	55.5	1690	80	21.1	Retained-HQ > 1
Mercury	2/2	0.028	0.12	1.3	0.09	Eliminated-Does not exceed threshold
Nickel	2/2	7.1	31.9	160	0.20	Eliminated-Does not exceed threshold
Selenium	2/2	3.5	9.1	5.0	1.82	Retained-HQ > 1
Vanadium	1/2	0.9	13.7	19	0.72	Eliminated-Does not exceed threshold
Zinc	1/2	29.4	192	100	1.92	Retained-HQ > 1
Organics						
Phenol	1/2	ND	1.0	256.0	0.00	Eliminated-Does not exceed threshold
4,4'-DDD	1/2	ND	0.0006	0.013	0.05	Eliminated-Does not exceed threshold

ND = Not Detected

TABLE 30-17
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - WARE CREEK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	2/2	3940	8470	NA		Retained-No suitable threshold available
Arsenic	2/2	6.2	192	8.20/70	23.4/2.74	Retained-HQ > 1
Barium	2/2	10.6	26.5	40	0.66	Eliminated-Does not exceed threshold
Beryllium	2/2	0.57	6.0	NA		Retained-No suitable threshold available
Cadmium	1/2	ND	7.1	1.2/9.6	5.92/0.74	Retained-HQ > 1
Chromium	1/2	56.0	18.3	81	0.23	Eliminated-Does not exceed threshold
Cobalt	2/2	2.1	29.7	50	0.59	Eliminated-Does not exceed threshold
Copper	2/2	13.0	9.2	34	0.27	Eliminated-Does not exceed threshold
Cyanide	1/2	ND	1.7	0.1/0.25	17.0/6.8	Retained-HQ > 1
Lead	2/2	34.3	13.2	47	0.28	Eliminated-Does not exceed threshold
Manganese	2/2	9.2	231	460	0.50	Eliminated-Does not exceed threshold
Mercury	1/2	0.068	0.19	0.15/0.71	1.27/0.27	Retained-HQ > 1
Nickel	2/2	6.0	28.7	21/51.6	1.37/0.56	Retained-HQ > 1
Selenium	2/2	ND	32.7	NA		Retained-No suitable threshold available
Silver	1/2	ND	4.1	1.0/3.7	4.1/1.11	Retained-HQ > 1
Thallium	1/2	ND	23.4	NA		Retained-No suitable threshold available
Vanadium	2/2	42.7	54.4	NA		Retained-No suitable threshold available
Zinc	2/2	26.9	41.8	150	0.28	Eliminated-Does not exceed threshold
Organics[3]						
2-Butanone	1/2	ND	270	NA		Retained-No suitable threshold available
4,4'-DDE	1/2	1.7	26.0	2.2/27	11.8/0.96	Retained-HQ > 1
Alpha-Chlordane	1/2	ND	2.4	7	0.34	Eliminated-Does not exceed threshold
Tetrachloroethene	1/2	50	18.0	NA		Retained-No suitable threshold available

ND = None detected
NA = No suitable benchmark was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

Only marginal habitat is present where the sample was taken, partially mitigating potential aquatic risks. The increased levels of contaminants in the ditch where that sample was taken appear to be anomalous, and may be naturally-occurring or originate from off-base sources. More importantly, individual site assessments for the RI sites in the Waterfront industrial complex (Sites 6, 12, 15, and 17) indicated that some or all of those sites appear to be contributing contaminants to the watershed. In particular, these sites may be contributing contaminants to the saltmarsh. Additional surface water, sediment, and surface soil samples have been recommended at those sites based on individual site assessments. Those samples should be integrated with additional watershed surface water and sediment samples that focus on the Waterfront complex sites and their relation to Ware Creek and the marsh. Samples should be collected further out in the marsh and between the nearby RI sites to investigate the potentially impacted areas in the marsh.

30.5.7 Wagner Creek Watershed Assessment

30.5.7.1 Preliminary Problem Formulation and Ecological Effects Characterization

Habitat Types and Ecological Receptors

The Wagner Creek watershed is located in the eastern section of the Waterfront area, primarily south of Route 36 (Figure 30-2). This watershed contains several different habitat types, including wetland and upland areas, but is primarily composed of forested upland areas. Habitat types in the watershed are presented in Figure 30-2. Several roadways, mostly dirt and gravel access roads, and various other small developed areas exist in the watershed. Wagner Creek and several of its small tributaries are present within the watershed, and most drainage is towards these waterways. Wagner Creek eventually empties into a small tidal saltmarsh approximately one and one-half miles east of the Waterfront industrial complex. RI sites 7 and 9 are located within the watershed, close to the Ware Creek/Wagner Creek watershed division. A Wagner Creek tributary is located approximately 300 feet south of Site 9 and 1,000 feet northeast of Site 7. The tributary is small and usually dry; water is present only after periods of heavy rainfall.

Most sampling relevant to Site 9 was part of the Wagner Creek watershed sampling conducted in the intermittent stream south of the site. Therefore, Site 9 is assessed in detail in this watershed section, rather than the individual site section. The former 3-acre landfill is located in an isolated area in the eastern portion of the central Waterfront area. The site is bordered on the west by a dirt road, and is mostly covered with mature pines. Some bare areas with sparse vegetation are present on the landfill where cover material is thin. Wooded areas surround most of the site, and are dominated by tulip poplar and red maple. A forested wetland is located northwest of Site 9, and is dominated by red maple. A tributary to Wagner Creek is located 300 feet south of the site; however, the site slopes gently to the north

and runoff is to the northeast, although the relatively flat nature of the site promotes rapid infiltration rather than off-site runoff.

Contaminant Sources, Release Mechanisms, and Migration Pathways

The major contaminant release pathways from Sites 7 and 9 are overland runoff and infiltration of contaminants. Overland runoff from precipitation may carry constituents to nearby surface waters, sediments, and soils, particularly to surface water and sediments in Wagner Creek tributaries. Infiltrating precipitation may cause the contamination of subsurface soil and groundwater. Upon infiltrating the soil column and reaching the water table, a contaminant may be carried with the flow of groundwater to downgradient locations. Groundwater from the sites may eventually discharge to surface water in Wagner Creek and associated tributaries; contaminants may be subsequently deposited in sediment or they may accumulate in the tissues of aquatic organisms. For the most part, aquatic contaminant migration pathways are the focus of this assessment.

Exposure Routes

Terrestrial receptors may come into contact with contaminants present in surface water by using it for drinking, although this pathway is generally insignificant. Aquatic and terrestrial organisms inhabiting Wagner Creek waterways, such as the saltmarsh and other wetlands, may be exposed to contaminants via direct contact with surface water and sediments, incidental ingestion of surface water and sediments, and consumption of contaminated food items. Aquatic organisms may also be exposed to constituents from contaminated groundwater that flows into surface water.

Selection of Preliminary Contaminants of Potential Concern (COPCs)

Preliminary COPCs were those contaminants identified in 1995 RI activities for this watershed. In particular, contaminants detected in watershed surface water and sediments were considered preliminary COPCs. Constituents in soil samples taken from 1993 SI test pits were evaluated qualitatively.

Assessment and Measurement Endpoints

A detailed description of facility-wide assessment and measurement endpoints is provided in Section 2.6.

Conceptual Site Model

Site-specific conceptual models were beyond the scope of this initial screening. A facility-wide conceptual model is provided in Section 2.6.

Ecological Effects Assessment

Ecotox threshold (ET) values were used for screening potential ecological risks from contaminants in surface water and sediments. Surface water and sediment ET values are presented in Tables 2-26 and 2-27, respectively.

30.5.7.2 Preliminary Exposure Assessment and Risk Characterization

Preliminary Exposure Assessment

Contaminant concentrations in surface water and sediment used for this initial screening were obtained from data generated during 1995 RI activities. Data were obtained from surface water and sediment samples collected during the summer and fall of 1995. Four surface water and sediment samples were taken in the Wagner Creek tributary near Site 9 (WSSW/SD17-18) and one surface water sample (WSSW30) was taken in a small, intermittent stream northwest of Site 7 (Figure 30-2) to investigate potential contaminant inputs from Site 7 and 9 into the watershed. The maximum detected contaminant concentrations in surface water and sediment were used as conservative representative exposure point concentrations. In addition, soil samples collected from test pit samples during SI activities are discussed qualitatively below. Background concentrations presented for comparative purposes were obtained from facility-wide background samples. Section 2.4.1.1 contains a detailed description of data validation, treatment, and selection used in the ERA.

Risk Characterization

In Wagner Creek watershed surface water, twelve inorganics exceeded ET values and were retained as final COPCs (Table 30-18). In sediments, barium exceeded the only ET value available and was retained as a final COPC (Table 30-19). Arsenic and lead exceeded most conservative ET values and were retained as final COPCs, but did not exceed less conservative ET values. Aluminum, beryllium, selenium, thallium, and vanadium were conservatively retained as final COPCs since no suitable ET values were available. No organics in sediments exceeded ET values, but phenol was conservatively retained as a final COPC since no suitable ET was available.

The toxicological properties of all final COPCs in surface water and sediment are summarized in Appendix M.

30.5.7.3 Summary and Conclusions

The Wagner Creek watershed is located in the eastern section of the waterfront area. RI sites 7 and 9 are located in this watershed. Both upland and wetland habitats are present in this watershed, and

TABLE 30-18
SURFACE WATER CONTAMINANTS OF POTENTIAL CONCERN - WAGNER CREEK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentation (μg/L)	Maximum Concentration (μg/L)	Ecotox Threshold (μg/L)	Hazard Quotient	Reason for Retention or Elimination as Final COPC
Inorganics						
Aluminum	5/5	409	16,600	87	190.8	Retained-HQ > 1
Antimony	1/5	ND	4.4	160	0.03	Eliminated-Does not exceed threshold
Arsenic	4/5	ND	25.4	190	0.13	Eliminated-Does not exceed threshold
Barium	5/5	34	133	3.9	34.0	Retained-HQ > 1
Beryllium	4/5	0.33	0.84	5.1	0.16	Eliminated-Does not exceed threshold
Cadmium	1/5	0.18	0.34	1.0	0.34	Eliminated-Does not exceed threshold
Chromium	4/5	2.6	37.5	10	3.75	Retained-HQ > 1
Cobalt	5/5	1.9	17.8	3	5.9	Retained-HQ > 1
Copper	4/5	9.8	31.7	11	2.88	Retained-HQ > 1
Lead	4/5	4.4	50.4	2.5	20.2	Retained-HQ > 1
Manganese	5/5	55.5	1050	80	13.1	Retained-HQ > 1
Mercury	5/5	0.028	0.14	1.3	0.11	Eliminated-Does not exceed threshold
Nickel	5/5	7.1	29.7	160	0.19	Eliminated-Does not exceed threshold
Selenium	4/5	3.5	5.3	5.0	1.06	Retained-HQ > 1
Silver	1/5	0.86	0.74	0.01	74.0	Retained-HQ > 1
Thallium	2/5	5.5	4.3	4	1.08	Retained-HQ > 1
Vanadium	4/5	0.9	45.2	19	2.38	Retained-HQ > 1
Zinc	5/5	29.4	127	100	1.27	Retained-HQ > 1

ND = Not Detected

TABLE 30-19
SEDIMENT CONTAMINANTS OF POTENTIAL CONCERN - WAGNER CREEK WATERSHED
NWS EARLE, COLTS NECK, NEW JERSEY

Contaminant of Potential Concern (COPC)	Frequency of Detection	Background Concentration (mg/kg)	Maximum Concentration (mg/kg)	Ecotox Threshold (mg/kg)[1]	Hazard Quotient	Reason for Retention or Elimination as Final COPC[2]
Inorganics						
Aluminum	4/4	3940	10,500	NA		Retained-No suitable threshold available
Arsenic	4/4	6.2	32.9	8.20/70	4.01/0.47	Retained-HQ > 1
Barium	4/4	10.6	92.2	40	2.31	Retained-HQ > 1
Beryllium	3/4	0.57	1.3	NA		Retained-No suitable threshold available
Chromium	4/4	56.0	47.5	81	0.59	Eliminated-Does not exceed threshold
Cobalt	3/4	2.1	7.2	50	0.14	Eliminated-Does not exceed threshold
Copper	4/4	13.0	21.5	34	0.63	Eliminated-Does not exceed threshold
Lead	4/4	34.3	55.9	47/218	1.19/0.26	Retained-HQ > 1
Manganese	4/4	9.2	172	460	0.37	Eliminated-Does not exceed threshold
Mercury	2/4	0.068	0.14	0.15	0.93	Eliminated-Does not exceed threshold
Nickel	3/4	6.0	12.0	21	0.57	Eliminated-Does not exceed threshold
Selenium	3/4	ND	5.6	NA		Retained-No suitable threshold available
Thallium	1/4	ND	3.4	NA		Retained-No suitable threshold available
Vanadium	4/4	42.7	57.7	NA		Retained-No suitable threshold available
Zinc	4/4	26.9	73.1	150	0.49	Eliminated-Does not exceed threshold
Organics[3]						
Butylbenzylphthalate	1/4	ND	97.0	11,000	0.01	Eliminated-Does not exceed threshold
Diethylphthalate	3/4	44.0	110	630	0.17	Eliminated-Does not exceed threshold
Di-n-butylphthalate	2/4	ND	1300	11,000	0.12	Eliminated-Does not exceed threshold
Fluoranthene	1/4	1800.0	130	2900	0.04	Eliminated-Does not exceed threshold
Hexachloroethane	1/4	ND	55.0	1000	0.06	Eliminated-Does not exceed threshold
Phenol	1/4	ND	120	NA		Retained-No suitable threshold available
Pyrene	1/4	1900.0	110	660	0.17	Eliminated-Does not exceed threshold
Tetrachloroethene	2/4	50.0	46.0	530	0.087	Eliminated-Does not exceed threshold
Toluene	1/4	480.0	2.0	670	0.00	Eliminated-Does not exceed threshold

ND = None detected
NA = No suitable benchmark was available
1 When two values are presented, the left value is the most conservative available and the right value is a less conservative value, if available. In these instances, two HQ values are presented.
2 Contaminants were retained as final COPCs if the most conservative ET value available was exceeded.
3 All organic values are in μg/kg

habitats are primarily forested. A small Wagner Creek tributary with ephemeral water flow is located approximately 300 feet south of Site 9. Runoff from the site is primarily to the north, away from the stream, and is limited. Runoff from the site does not cross the access road to the west. Therefore, runoff from Site 9 to the forested wetland to the northwest is unlikely, and standing water is present in the forested wetland only after periods of heavy rainfall.

Six soil samples were taken from test pits during the SI. Low levels of some VOCs, pesticides, and TPH were detected, along with low levels of several metals. Cyanide was also detected in soil, but in only one sample. Several inorganics exceeded ET values in watershed surface water. Most of the HQ values were indicative of low potential risk, although aluminum, barium, lead, and silver HQs were indicative of moderate potential risks. HQs value for inorganics in sediment were indicative of low potential risk. However, aluminum, selenium, thallium, and vanadium were present above background and no suitable ET values were available for these inorganics.

Contaminants in Site 7 soils and sediments taken as part of Site 7 investigations were relatively low. Groundwater samples taken at Site 7 as part of 1993 RI/FS activities indicated slightly elevated contaminant levels, and 1995 RI groundwater samples contained slightly elevated levels of contaminants, most notably aluminum. The watershed sample taken northwest of Site 7 contained only low levels of a few contaminants, indicating negligible impacts to that area. Site 7 groundwater generally flows north toward Site 9 and the other watershed samples, but a fairly long distance separates the two areas: approximately 2,000 feet. Given the long distance between the sites and the levels of metals found in groundwater at the Site 7, it is unlikely that groundwater is impacting surface water in the Wagner Creek tributary near Site 9. Also, several of the metals detected in stream surface water and sediments were not elevated in Site 7 groundwater.

Runoff is limited at Site 9 and flows away from the stream. The direction of groundwater flow at Site 9 is unclear. Groundwater to surface water contaminant discharge may be possible, but concentrations of metals in Site 9 soil samples were not high enough to correlate with the elevated levels of some metals in nearby surface water and sediments. Potential risks from metals in Site 9 (watershed) surface water were mainly from elevated levels of aluminum, barium, lead, and silver. Concentrations of aluminum in test pit soil samples were only slightly elevated, concentrations of barium were fairly low, concentrations of lead were relatively low, and concentrations of silver were low. In addition, potential risks from barium and lead in sediments were low, and silver was not detected. The highest concentrations of most metals in watershed samples were in samples WSSW/SD17 and WSSW/SD20, which were collected several hundred feet southeast of Site 9. For these reasons, the source of elevated metals in the stream, mainly in stream surface water, is not clear. However, aquatic habitat is limited and of marginal quality in the stream, partially mitigating potential risks to aquatic and semi-aquatic receptors. It is possible that the elevated concentrations of metals in surface water are naturally-occurring or that relatively small

contaminant contributions from Site 9 have an additive effect with increased naturally-occurring concentrations of metals.

It appears that the only possible RI site-related contaminant source to the stream is Site 9 groundwater, although no evidence suggests that this may be occurring. Groundwater samples could be taken to ascertain the direction of groundwater flow at Site 9, but do not appear to be warranted based solely on ecological risk concerns. Increased concentrations of most metals in the stream may be localized or naturally-occurring. Additional surface water and sediment samples could be taken further downstream to investigate potential downstream contaminant migration, but intermittent water flow in the stream may inhibit significant migration. Also, the usefulness of these samples, especially for determining potential corrective action, is unclear since a defined source is not evident.

31.0 BACKGROUND

31.1 BACKGROUND SAMPLING

In order to determine the background level of chemicals present in and around NWS Earle, B&R Environmental collected samples from media at locations on the station that were selected or on the expectation that past or present operations have not impacted site media. The field team collected samples of surface soil, subsurface soil, sediment, surface water, and groundwater from areas throughout the station. The samples were collected in areas hydraulically upgradient and, where possible, upwind of station areas where industrial operations or other potential sources of contaminant accumulation in site media may have occurred. The results of the background sampling were used for comparison with analytical results obtained from the sampling activities at the RI sites. A total of four background samples were collected for each of the five media. The BG-4 suite of background media sampled was split between the Mainside (surface water and sediment) and Waterfront (groundwater and subsurface soils) areas because surface water and sediment were not available at the Waterfront BG-4 location.

Three background sampling locations were located on the Mainside (BG-1, BG-2, and BG-4) and two background sampling locations were located at the Waterfront area (BG-3 and BG-4). Figure 30-1 of Section 30 shows Mainside background and watershed sample locations. Figure 30-2 of Section 30 shows Waterfront background and watershed sample locations.

B&R Environmental conducted a survey of all newly installed background sample locations to establish horizontal locations and vertical elevations. Surveying notes are provided in Appendix F.

31.1.1 Background Sample Location 1

Background Sample Location 1 (BG-1) is situated in the northeastern portion of the Mainside southeast of Macedonia. This location is upgradient of the station and several thousand feet from an industrial area of the station. A full suite of background samples (surface soil, subsurface soil, sediment, surface water, and groundwater) was collected. Figure 30-1 of Section 30 shows sampling locations.

Surface Soil Sampling

One surface soil sample (BG SB01 00) was collected from Background Soil Boring 1 in June 1995. The surface soil sample was collected and submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TPH, TAL metals, mercury, cyanide, nitrite/nitrate, chloride, TOC, COD, moisture, sulfates, pH, phosphate, ammonia, and grain size analyses and to GP Environmental Services for

explosives analysis. A sample log sheet is presented in Appendix D. The sample was collected 0 to 6 inches bgs using a stainless-steel trowel and placed directly into the appropriate bottleware. The surface vegetation was removed before sampling.

Soil Borings and Subsurface Soil Sampling

One soil boring (BG SB 01), which was converted into a monitoring well (BGMW-01), was drilled in June 1995. The field team drilled the boring to a total depth of 27 feet bgs, and saturated conditions were encountered approximately 19.5 feet below grade during drilling. Subsurface soil samples were collected continuously to the water table using a 3-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. HNu readings were 0 ppm throughout the boring, and no stains or odors were noted. A soil boring log sheet was prepared for the boring to evaluate subsurface lithologies (see Appendix C).

The team collected one subsurface soil sample (BG SB01 05) from 5 to 7 feet bgs and submitted it to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TPH, TAL metals, moisture, sulfate, pH, mercury, cyanide, nitrite/nitrate, chloride, TOC, COD, phosphate, ammonia, and grain size analyses and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix D.

Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

B&R Environmental installed one shallow permanent monitoring well (BGMW-01).

The well was constructed with 2-inch-diameter, flush jointed and threaded, Schedule 40 PVC well casing and 2-inch-diameter, Schedule 40, 0.10-foot slotted well screen fitted with a PVC bottom cap. A 10-foot screen was installed in the well. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 2 feet above the top of the screen. A 3-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height of approximately 1 foot bgs. The well was completed with a 2-foot-high stickup surrounded by a 4-inch by 4-foot concrete pad keyed 1 foot into the well annulus at the ground surface. Table 31-1 shows monitoring well characteristics. The monitoring well construction sheet is in Appendix C.

Table 31-1
Background Monitoring Well Characteristics Summary
NWS Earle, Colts Neck, New Jersey

Monitoring Well Number	Total Depth[1] (feet)	Ground Surface Evaluation[2]			Diameter (inches)	Screened Interval Depth[1] (feet)	Filter Pack Interval Depth[1] (feet)	Date Installed
		Top of Concrete Pad[2] (feet)	Top of PVC Riser[2]	Top of Standpipe[2]				
BGMW-01	27	94.16	96.31	96.79	2	17 - 27	15 - 27	6/23/95
BGMW-02	77	231.19	233.70	233.32	2	67 - 77	65 - 77	6/22/95
BGMW-03	69	201.75	203.80	204.20	2	59 - 69	57 - 69	6/26/95
BGMW-04	20	26.82	28.96	29.51	2	10 - 20	8 - 20	6/28/95

Note: All wells are constructed of Schedule 40 polyvinyl chloride (PVC) wellcasing.

(1) In feet below grade. Reading obtained during monitoring well installation. See Table 30-2 for more accurate measurements.
(2) In feet above mean sea level.

The well was developed 1 week after installation. The water level, pH, conductivity, turbidity, dissolved oxygen, and temperature were monitored during development. Approximately 120 gallons of water were removed.

Static-Water-Level Measurements

B&R Environmental collected two rounds of static-water-level measurements. The first round of water-level measurements was collected on August 7, 1995, the second on October 17, 1995. Static-water levels were measured from the top of PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation was 74.38 feet above MSL during the first round of measurements and 73.61 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 31-2.

Groundwater Sampling

Two groundwater samples, including one field duplicate, were obtained from the newly installed monitoring well (BGMW-01) in August 1995. Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Prior to sampling, B&R Environmental purged the well using the micro-purge protocol to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure that little or no drawdown in water levels occurred throughout the purge and sample process.

Two groundwater samples, including one field duplicate (BG GW 01 and DUP-21), were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, cyanide, TPH, nitrite/nitrate, BOD, chloride, sulfate, ammonia, COD, TOC, and phosphate analyses and to GP Environmental Services for explosives analysis.

Sample log sheets are provided in Appendix D.

Surface Water Sampling

B&R Environmental collected one surface water sample (BG SW 01). The team collected the sample by dipping the sample bottle directly into the water. Field measurements collected during sampling included pH, specific conductivity, temperature, turbidity, dissolved oxygen, and salinity. The surface water sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, ammonia, TOC, phosphate, COD, cyanide, TPH, nitrite/nitrate, turbidity, BOD, chloride, hardness, and explosives analysis. Sample log sheets are presented in Appendix D.

TABLE 31-2
BACKGROUND STATIC-WATER-LEVEL MEASUREMENT SUMMARY
NWS EARLE, COLTS NECK, NEW JERSEY

Monitoring Well Number	August 7, 1995			October 17, 1995		
	Depth to Water Table[1] (feet)	Top of PVC Riser[2]	Elevation of Water Table[2]	Depth to Water Table[1] (feet)	Top of PVC Riser[2]	Elevation of Water Table[2]
BGMW-01	21.93	96.31	74.38	22.70	96.31	73.61
BGMW-02	70.30	233.70	163.40	71.20	233.70	162.50
BGMW-03	63.38	203.80	140.42	64.89	203.80	138.91
BGMW-04	15.45	28.96	13.51	17.13	28.96	11.83

(1) In feet below top of riser
(2) In feet above mean sea level

Sediment Sampling

The team collected one sediment sample (BG SED 01). The sediment sample was collected using a stainless-steel trowel from 0 to 6 inches below the sediment/water interface and consisted of brown, fine-grained sand with some organics. The sediment material was placed directly into the required bottleware via the stainless-steel trowel. The sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, ammonia, chloride, nitrite/nitrate, phosphate, TOC, cyanide, moisture, pH, TPH, grain size, and explosives analysis.

31.1.2 Background Sample Location 2

Background Sample Location 2 is situated on the north side of Hominy Hills, approximately 1 mile southwest of the intersection of Guadalcanal Road and Asbury Avenue. A full suite of background samples (surface soil, subsurface soil, sediment, surface water, and groundwater) was collected. Figure 30-1 of Section 30 shows sampling locations.

Surface Soil Sampling

Two surface soil samples, including one field duplicate (BG SB 02 00 and DUP-04), were collected from Background Soil Boring 2. The samples were collected 0 to 6 inches bgs using a stainless-steel trowel and placed directly into the appropriate bottleware. The surface vegetation was removed before sampling. The surface soil samples were submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TPH, TAL metals, mercury, moisture, sulfate, pH, cyanide, nitrite/nitrate, chloride, TOC, COD, phosphate, ammonia, grain size, and explosives analysis. Sample log sheets are presented in Appendix D.

Soil Boring Installation and Subsurface Soil Sampling

One soil boring (BG SB 02), which was converted into a monitoring well (BGMW-02), was drilled to a total depth of 79 feet bgs. Saturated conditions were encountered approximately 70 feet below grade during drilling. Subsurface soil samples were collected continuously to the water table using a 3-inch O.D. by 24-inch-long split barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. HNu readings were 0 ppm throughout the boring, and no stains or odors were noted. A soil boring log sheet was prepared for the boring to evaluate subsurface lithogies (see Appendix C).

The team collected one subsurface soil sample (BG SB02 05) from 5 to 7 feet bgs and submitted it to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TPH, TAL metals, moisture, sulfate, pH, mercury, cyanide, nitrite/nitrate, chloride, TOC, COD, phosphate, ammonia, and grain size

analyses and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix D.

Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

One shallow permanent monitoring well (BGMW-02) was installed. The boring was drilled to approximately 9 feet below the water table and completed as a cased well, screened across the water table.

The well was constructed with 2-inch-diameter, flush jointed and threaded, Schedule 40 PVC well casing and 2-inch-diameter, Schedule 40, 0.10-foot slotted PVC well screen fitted with a PVC bottom cap. A 10-foot screen was installed in the well. The annular space between the well screen and the borehole was packed with Morie No.1 sand to a height of approximately 2 feet above the top of the screen. A 3-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height of approximately 1 foot bgs. The well was completed with a 2-foot-high stickup surrounded by a 4- by 4-foot concrete pad, keyed 1 foot into the well annulus at ground surface. Table 31-1 presents monitoring well characteristics. The monitoring well construction sheet is in Appendix C.

The well was developed 1 week after installation. The water level, pH, conductivity, turbidity, dissolved oxygen, and temperature were monitored during development. Approximately 105 gallons of water were removed.

Static-Water-Level Measurements

B&R Environmental collected two rounds of static-water-level measurements. The first round of water-level measurements was collected on August 7, 1995, the second on October 17, 1995. Static-water levels were measured from the top of the PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation was 163.40 feet above MSL during the first round of measurements and 162.5 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 31-2.

Groundwater Sampling

B&R Environmental collected one groundwater sample from the newly installed monitoring well (BGMW-02) in August 1995. Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Prior to sampling, B&R Environmental purged the well using the micro-purge protocol to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure little or no drawdown in water levels occurred throughout the purge and sample process.

The groundwater sample (BG MW 02) was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, cyanide, TPH, nitrite/nitrate, BOD, chloride, sulfate, ammonia, COD, TOC, and phosphate analyses and to GP Environmental Services for explosives analysis.

Sample log sheets are provided in Appendix C.

Surface Water Sampling

One surface water sample (BG SW 02) was collected. The team collected the sample by dipping the sample bottle directly into the water. Field measurements collected during sampling included pH, specific conductivity, temperature, turbidity, dissolved oxygen, and salinity. The surface water sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, ammonia, phosphate, TOC, COD, cyanide, TPH, nitrite/nitrate, turbidity, BOD, chloride, hardness, and explosives analysis. Sample log sheets are presented in Appendix C.

Sediment Sampling

One sediment sample (BG SED 02) was collected using a stainless-steel trowel from 0 to 6 inches below the sediment/water interface. The sample consisted of brown sand and peat with some gravels. The sediment material was placed directly into the required bottleware via the stainless-steel trowel. B&R Environmental submitted the sample to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, ammonia, chloride, nitrite/nitrate, phosphate, TOC, cyanide, moisture, pH, TPH, grain size, and explosives analysis. Sample log sheets are presented in Appendix C.

31.1.3 Background Sample Location 3

Background Sample Location 3 is situated at the Waterfront area of the station, approximately 1,000 feet northwest of High Point Chapel. This location is upgradient and generally upwind of all industrial operations at the Waterfront portion of the station. Surface soil, subsurface soil, and groundwater samples were collected. Surface water and sediment samples were not collected. Figure 30-2 of Section 30 shows sampling locations.

Surface Soil Sampling

One surface soil sample (BG SB03 00) was collected from Background Soil Boring 3 (Figure 30-2). The sample was collected 0 to 6 inches bgs using a stainless-steel trowel and placed directly into the appropriate bottleware. The surface vegetation was removed before sampling. The surface soil sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TPH, TAL metals, cyanide, nitrite/nitrate, chloride, TOC, COD, BOD, moisture, sulfate, pH, phosphate, and ammonia analyses and to GP Environmental Services for explosives analysis. The surface soil sample consisted of brown silty sand. Sample sheets are presented in Appendix C.

Soil Boring and Subsurface Soil Sampling

One soil boring (BG SB 03), which was converted into a monitoring well (BGMW-03), was drilled to a total depth of 70 feet bgs and saturated conditions were encountered approximately 61 feet below grade during drilling. Subsurface soil samples were collected continuously to the water table using a 3-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. HNu readings were 0 ppm throughout the boring with no stains or odors observed. A soil boring log sheet was prepared for the boring to evaluate subsurface lithologies (see Appendix C).

One subsurface soil sample (BG SB03 05) was collected from 5 to 7 feet bgs and submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TPH, TAL metals, moisture, sulfate, pH, cyanide, nitrite/nitrate, chloride,TOC, COD, phosphate, ammonia, and BOD analyses and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix D.

Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installations

B&R Environmental installed one shallow permanent monitoring well (BGMW-03). The boring was drilled to approximately 9 feet below the water table and completed as a cased well, screened across the water table.

The well was constructed with 2-inch-diameter, flush jointed and threaded, Schedule 40 PVC well casing and 2-inch-diameter, Schedule 40, 0.10-foot slotted well screen fitted with a PVC bottom cap. A 10-foot screen was installed in the well. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 2 feet above the top of the screen. A 3-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height of approximately 1 foot bgs. The well was completed with a 2-foot-high stickup surrounded by a 4- by 4-foot concrete pad keyed into the well annulus at ground level. Table 31-1 presents monitoring well characteristics. The monitoring well construction sheet is in Appendix C.

The well was developed 2 weeks after installation. No instrument readings were recorded during development because of equipment failure.

Static-Water-Level Measurements

B&R Environmental collected two rounds of static-water-level measurements. The first round of water-level measurements was collected on August 7, 1995, the second on October 17, 1995. Static-water levels were measured from the top of the PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation was 140.42 feet above MSL during the first round of measurements and 138.91 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 31-2.

Groundwater Sampling

One groundwater sample was obtained from the newly installed monitoring well (BGMW-03) in August 1995. Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity.

Prior to sampling, B&R Environmental purged the well using the micro-purge protocol to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure that little or no drawdown in water levels occurred throughout the purge and sample process.

The groundwater sample (BG GW O3) was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, cyanide, TPH, nitrate/nitrite, BOD, chloride, sulfate, ammonia, COD, TOC, and phosphate analyses and to GP Environmental Services for explosives analysis. Sample log sheets are provided in Appendix D.

31.1.4 Background Sample Location 4

Background Sample Location 4 is situated approximately 250 feet east of Site 15. B&R Environmental installed a monitoring well and collected soil samples at this location to provide data on background conditions near the shoreline. No surface water or sediment samples were collected at this location. The surface water and sediment samples for Background Location 4 were collected from the Mainside, on the south side of Hominy Hills, west of the intersection of Route 34 and Midway Road due to a lack of available surface water/sediment sample locations at the Waterfront area. Figure 30-2 shows sample locations.

Surface Soil Sampling

The field team collected one surface soil sample (BG SB04 00) from Background Soil Boring 4. The sample was collected 0 to 6 inches bgs using a stainless-steel trowel and placed directly into the appropriate bottleware. The surface vegetation was removed before sampling. The surface soil sample consisted of brown silty sand. The surface soil sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TPH, TAL metals, cyanide, nitrite/nitrate, chloride, TOC, COD, moisture, pH, phosphate, ammonia, sulfate, and BOD analyses and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix D.

Soil Boring Installation and Subsurface Soil Sampling

One soil boring (BG SB 04), which was converted into a monitoring well (BGMW-04), was drilled to a total depth of 20 feet bgs, and saturated conditions were encountered approximately 12 feet below grade. Subsurface soil samples were collected continuously to the water table using a 3-inch O.D. by 24-inch-long split-barrel sampler. The samples were screened with an HNu and visually inspected for evidence of contamination (such as staining and odors) and for lithologic description. HNu readings were 0 ppm

throughout the boring, and no stains or odors were noted. A soil boring log sheet was prepared for the boring to evaluate subsurface lithogies (see Appendix C).

One subsurface soil sample (BG SB04 05) was collected from 5 to 7 feet bgs and submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCB, TPH, TAL metals, cyanide, nitrite/nitrate, moisture, pH, chloride, TOC, COD, phosphate, ammonia, sulfate, and BOD analyses and to GP Environmental Services for explosives analysis. Sample log sheets are presented in Appendix D.

Permanent Monitoring Well Installation, Static-Water-Level Measurements, and Groundwater Sampling

Monitoring Well Installation

B&R Environmental installed one shallow permanent monitoring well (BGMW-04). The boring was drilled to approximately 8 feet below the water table and completed as a cased well, screened across the water table. Figure 30-2 shows the BGMW-04 location. The well was constructed with a 2-inch-diameter, flush jointed and threaded, Schedule 40, PVC well casing and 2-inch-diameter, Schedule 40, 0.10-foot slotted well screen fitted with a PVC bottom cap. A 10-foot screen was installed in the well. The annular space between the well screen and the borehole was packed with Morie No. 1 sand to a height of approximately 2 feet above the top of the screen. A 2-foot annular seal, consisting of bentonite pellets, was placed on top of the filter pack. The remainder of the well annulus was backfilled with a cement grout to a height of approximately 1 foot below the ground surface. The well was completed with a 2-foot-high stickup surrounded by a 4- by 4-foot concrete pad keyed 1 foot into the well annulus at ground level. Table 31-1 presents monitoring well characteristics. The monitoring well construction sheet is in Appendix C.

The well was developed 2 weeks after installation. The water level, pH, conductivity, turbidity, dissolved oxygen, and temperature were monitored during development. Approximately 30 gallons of water were removed.

Static-Water-Level Measurements

Two rounds of static-water-level measurements were collected. The first round of water-level measurements was collected on August 7, 1995, the second on October 17, 1995. Static-water levels were measured from the top of PVC riser using an electronic water-level indicator (M-scope) or an interface probe and recorded to the nearest 0.01 foot. The water-table elevation was 13.51 feet above MSL during the first round of measurements and 11.83 feet above MSL during the second round of measurements. Water-level measurements are summarized in Table 31-2.

Groundwater Sampling

One groundwater sample was obtained from the newly installed monitoring well (BGMW-04) in August 1995. Field measurements collected during purging were pump rate (L/min), water level, pH, conductivity, temperature, turbidity, dissolved oxygen, and salinity. Prior to sampling, B&R Environmental purged the well using the micro-purge protocol to reduce turbidity until groundwater parameters stabilized within acceptable limits. Care was taken to ensure little or no drawdown in water levels occurred throughout the purge and sample process.

One groundwater sample (BG GW 04) was collected and submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, cyanide, TPH, nitrite/nitrate, BOD, chloride, sulfate, ammonia, COD, TOC, and phosphate analyses and to GP Environmental Services for explosives analysis. Sample log sheets are provided in Appendix D.

Surface Water Sampling

One surface water sample (BG SW 04) was obtained by dipping the sample bottle directly into the water. Field measurements collected during sampling included pH, specific conductivity, temperature, turbidity, dissolved oxygen, and salinity. The surface water sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/PCBs, TAL metals, ammonia, TOC, phosphate, COD, cyanide, TPH, nitrite/nitrate, turbidity, BOD, chloride, hardness, and explosives analysis. Sample log sheets are presented in Appendix C. Extra volume was collected for this sample for the MS/MSD analysis.

Sediment Sampling

One sediment sample (BG SED 04) was collected using a stainless-steel trowel from 0 to 6 inches below the sediment/water interface and consisted of brown silty sand with some gravel. The sediment material was placed directly into the required bottleware via the stainless-steel trowel. The sample was submitted to Lancaster Laboratories for TCL VOC, TCL SVOC, TCL pesticides/ PCBs, TAL metals, ammonia, chloride, moisture, nitrite/nitrate, pH, phosphate, TOC, cyanide, TPH, grain size, and explosives analysis. Sample log sheets are presented in Appendix C. Extra volume was collected for this sample for the MS/MSD analysis.

31.2 BACKGROUND WELL GEOLOGY

The four new background monitoring wells were completed in distinct geological formations across the facility. The surficial soils outcrop found at the monitoring well location was not necessarily the same geologic unit into which the well screen was installed.

Regional mapping places BGMW-01 within the outcrop of the Kirkwood Formation. The Kirkwood Formation ranges between 60 and 100 feet in thickness and the boring is 27 feet deep. The lithology of the sediments encountered in this background boring generally agrees with the published description of the Kirkwood Formation. The well was screened from 17 to 27 feet below grade and is assumed to be screened in the Kirkwood Formation.

Regional mapping places BGMW-02 within the outcrop area of the Cohansey Sand; Quaternary surficial deposits may be present at this location. Quaternary surficial deposits in this area generally are 10 feet or less in thickness, and the Cohansey Sand ranges between 0 and 35 feet in thickness. The lithology of the sediments encountered in the soil boring generally agrees with the published description of the Cohansey Sand. However, because the boring reached a depth of 80 feet, it is likely that the boring also encountered the Kirkwood Formation. The Kirkwood Formation ranges between 60 and 100 feet in thickness. The well was screened to 67 to 77 feet below grade and is therefore assumed to be screened in the Kirkwood Formation.

Regional mapping places BGMW-03 within the outcrop area of the Red Bank Sand and Tinton Sand, combined, range between 35 and 135 feet in thickness, and the soil boring is 70 feet deep. The lithology of the sediments encountered in the boring generally agrees with the published description of the Red Bank Sand and Navesink Formation. Assuming a portion of the Red Bank Sand was removed by erosion, it is possible that the boring penetrated the underlying Navesink Formation. The well was screened from 59 to 69 feet and is assumed to be screened in the Red Bank Sand and Navesink Formation.

Regional mapping places BGMW-04 within the outcrop area of the Englishtown Formation. The Englishtown Formation ranges between 35 and 150 feet in thickness and the soil boring is 21 feet deep. The lithology of the sediments encountered in the boring generally agrees with the published description of the Englishtown Formation. The well was screened from 10 top 20 feet below grade and is assumed to be screened in the Englishtown Formation.

31.3 BACKGROUND GROUNDWATER STATISTICAL ANALYSIS

In order to compare site-related metals concentrations found during RI sampling to facility-wide naturally occurring (background) groundwater concentrations, it was necessary to choose additional facility monitoring wells deemed to have been installed in "background" locations upgradient of RI sites. The Navy proposed a list of existing monitoring wells to be used. After EPA and NJDEP comment and revision, a list of additional monitoring wells to be used for background statistical comparisons was agreed to. Table 31-3 shows the chosen background and upgradient wells grouped by interpreted aquifer.

Formations were grouped accordingly to similarity and intimate association of certain geologic units found across NWS Earle.

TABLE 31-3
BACKGROUND WELLS AND UPGRADIENT WELLS GROUPED BY INTERPRETED AQUIFER
NWS EARLE, COLTS NECK, NEW JERSEY

Interpreted Aquifer[1]	Well No.	Site
Cohansey Sand	MW4-04	4
Cohansey Sand and Kirkwood Formation	BGMW-02	Background 2
Kirkwood Formation	BGMW-01	Background 1
	MW26-03	26
Kirkwood Formation	MW3-06	3
Kirkwood and Vincentown Formations	MW5-02	5
	MW5-03	5
	MW19-01	19
Vincentown Formation	MW1-03	1
	MW5-08	5
	MW11-03	11
Red Bank Sand and Navesink Formation	BGMW-3	Background 3
Red Bank Sand	MW7-03	7
Englishtown Formation	BGMW-04	Background 4
Fill and Englishtown Formation	MW6-01	6
	MW17-01	17

Table 31-4 presents a summary of the statistical evaluation of background metals data for monitoring wells completed in the Cohansey Sand, Kirkwood, and Vincentown Formations. Table 31-5 presents a summary of the statistical evaluation of background metals data for monitoring wells completed in the Red Bank Sand and Navesink formations. Table 31-6 presents a summary of the statistical evaluation of background metals data for monitoring wells completed in fill and the Englishtown Formation at the Waterfront. The 95 percent UTLs presented in these tables were compared to the individual maximum site-related results for corresponding wells grouped in the same interpreted aquifer.

31.4 BACKGROUND SURFACE SOIL STATISTICAL ANALYSIS

In order to compare site-related metals concentrations, found during RI sampling to facility wide naturally occurring (background) surface soil concentrations, a statistical evaluation was performed as described in Section 2.4.6.1. Table 31-7 presents a summary of the statistical evaluation of background surface soil results, showing the UTLs that were compared to individual maximum site-related results.

31.5 BACKGROUND SUBSURFACE SOIL STATISTICAL ANALYSIS

In order to compare site-related metals concentrations found during RI sampling to facility wide naturally occurring (background) subsurface soil concentrations, a statistical evaluation was performed as described in Section 2.4.6.1. Table 31-8 presents a summary of the statistical evaluation of background subsurface soil results showing the UTLs that were compared to individual maximum site-related results.

Table 31-4
Statistical Evaluation of Background Groundwater Metals Data
Cohansey Sand, Kirkwood, and Vincentown Formations
CTO 231, NWS Earle, Colts Neck, New Jersey

Substance	Background Distribution	No. of Detects	No. of Results	Mean or Geometric Mean ug/L	Standard Deviation or Log Standard Deviation	Student's t-Distribution Coefficient	95 % Upper Tolerance Limit - ug/L
Aluminum	Lognormal	11	11	1560	1.14	1.812	13500
Arsenic	Lognormal	1	11	1.85	0.379	1.812	3.79
Barium	Normal	11	11	115	190	1.812	474
Beryllium	Normal	4	11	0.246	0.457	1.812	1.11
Cadmium	Normal	5	11	0.604	0.596	1.812	1.73
Calcium	Normal	11	11	4150	4900	1.812	13400
Chromium, Total	Normal	9	11	14.7	16.8	1.812	46.4
Cobalt	Normal	6	11	2.03	3.01	1.812	7.73
Copper	Normal	9	11	3.27	4.28	1.812	11.4
Iron	Normal	11	11	2100	2420	1.812	6670
Lead	Lognormal	3	11	1.03	0.557	1.812	2.97
Magnesium	Normal	11	11	4220	7800	1.812	19000
Manganese	Lognormal	11	11	17	0.888	1.812	91.4
Mercury	Normal	11	11	0.0585	0.0485	1.812	0.15
Nickel	Normal	10	11	5.99	7.83	1.812	20.8
Potassium	Lognormal	11	11	1080	0.797	1.812	4900
Selenium	Lognormal	1	11	2.38	0.265	1.812	3.94
Sodium	Normal	11	11	4220	2640	1.812	9220
Thallium	Lognormal	3	11	2.33	0.443	1.812	5.38
Vanadium	Normal	10	11	8.24	12.6	1.812	32.1
Zinc	Normal	6	9	89.3	135	1.86	354

Notes:
(1) Background statistics are based on the estimated distribution type (normal or lognormal).
(2) The tolerance limit defines the concentration range that, on the average, is estimated to contain 95 % of all data points from the background population.
(3) If a site-related sample exceeds the tolerance limit, statistical evidence suggests the sample comes from a population with a different distribution and higher concentrations than the background data.

Table 31-5
Statistical Evaluation of Background Groundwater Metals Data
Red Bank Sand and Navesink Formations
CTO 231, NWS Earle, Colts Neck, New Jersey

Substance	No. of Detects	No. of Results	Geometric Mean ug/L	Log Standard Deviation	Student's t-Distribution Coefficient	95 % Upper Tolerance Limit - ug/L
Aluminum	2	2	308	0.343	6.314	4370
Barium	2	2	46	0.123	6.314	119
Beryllium	1	2	0.148	1.4	6.314	1.32 *
Calcium	2	2	2930	0.984	6.314	17587 *
Chromium, Total	1	2	2.68	2.42	6.314	52.83 *
Cobalt	2	2	15.4	0.856	6.314	80.81 *
Iron	2	2	459	0.61	6.314	1790 *
Magnesium	2	2	1950	0.116	6.314	4780
Manganese	2	2	217	0.175	6.314	843
Mercury	1	2	0.0097	2.23	6.314	0.17 *
Nickel	2	2	6.2	0.849	6.314	32.29 *
Potassium	2	2	1230	0.766	6.314	5819 *
Sodium	2	2	6050	0.353	6.314	92710
Vanadium	1	2	0.653	1.08	6.314	4.31 *
Zinc	2	2	6.63	0.4	6.314	146

Notes:
(1) Background statistics are calculated using the EPA default lognormal distribution (too few samples to statistically verify type of distribution).
(2) The tolerance limit defines the concentration range that, on the average, is estimated to contain 95 % of all data points from the background population.
(3) If a site-related sample exceeds the tolerance limit, statistical evidence suggests the sample comes from a population with a different distribution and higher concentrations than the background data.
(*) The EPA Region II test (2X background arithmetic mean) is shown because the tolerance limit is impractical (large uncertainties are caused by too few samples and a high lognormal standard deviation).

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Table 31-6
Statistical Evaluation of Background Groundwater Metals Data
Fill and Englishtown Formation
CTO 231, NWS Earle, Colts Neck, New Jersey

Substance	Background Distribution Type Used	No. of Detects	No. of Results	Mean or Geometric Mean ug/L	Standard Deviation or Log Standard Deviation	Student's t-Distribution Coefficient	95 % Upper Tolerance Limit - ug/L
Aluminum	Lognormal	3	3	1660	0.23	2.92	3610
Arsenic	Lognormal	1	3	2.4	0.652	2.92	21.6
Barium	Lognormal	3	3	49	0.472	2.92	241
Beryllium	Lognormal	2	3	0.385	2.25	2.92	5.84 *
Cadmium	Normal	3	3	2.65	3.77	2.92	15.4
Calcium	Normal	3	3	19000	7040	2.92	42760
Chromium, Total	Lognormal	1	3	0.637	0.473	2.92	3.14
Cobalt	Lognormal	3	3	8.44	1.03	2.92	30.98 *
Iron	Lognormal	3	3	7880	2.21	2.92	123637 *
Magnesium	Lognormal	3	3	12900	0.363	2.92	43930
Manganese	Lognormal	3	3	1590	0.73	2.92	18580
Mercury	Lognormal	1	3	0.0056	1.78	2.92	0.06 *
Nickel	Lognormal	3	3	11.9	1.23	2.92	54.73 *
Potassium	Lognormal	3	3	3380	0.103	2.92	4790
Sodium	Lognormal	3	3	49500	0.991	2.92	134326 *
Vanadium	Lognormal	1	3	0.468	0.741	2.92	5.68
Zinc	Lognormal	2	2	24.2	0.348	6.314	355

Notes:
(1) Background statistics are calculated assuming the EPA default lognormal distribution, except where this assumption is statistically improbable in cases where a normal distribution assumption is not improbable (based on the W-test using a P level of 0.05).
(2) The tolerance limit defines the concentration range that, on the average, is estimated to contain 95 % of all data points from the background population.
(3) If a site-related sample exceeds the tolerance limit, statistical evidence suggests the sample comes from a population with a different distribution and higher concentrations than the background data.
(*) The EPA Region II test (2X background arithmetic mean) is presented for this metal because the tolerance limit is impractical (large uncertainties are caused by too few sampling points along with a moderate to high lognormal standard deviation).

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Table 31-7

Statistical Evaluation of Background Surface Soil Metals Data
CTO 231, NWS Earle, Colts Neck, New Jersey

Metal	Background Distribution Type Used	No. of Detects	No. of Results	Mean or Geometric Mean mg/kg	Standard Deviation or Log Standard Deviation	Student's t-Distribution Coefficient	95 % Upper Tolerance Limit - mg/kg
Aluminum	Normal	4	4	3080	1680	2.353	7510
Antimony	- - -	0	4	- - -	- - -	- - -	- - -
Arsenic	Normal	4	4	6.71	6.17	2.353	23
Barium	Normal	4	4	11.3	13.6	2.353	47.1
Beryllium	Lognormal	1	4	0.112	1.48	2.353	5.55 •
Cadmium	Normal	1	4	0.333	0.159	2.353	0.751
Calcium	Lognormal	4	4	144	1.47	2.353	6810 *
Chromium	Normal	4	4	34.5	27.7	2.353	107
Cobalt	Normal	2	4	1.58	2.29	2.353	7.61
Copper	Normal	4	4	5.03	3.83	2.353	15.1
Iron	Normal	4	4	26200	26500	2.353	95800
Lead	Lognormal	4	4	11.4	1.35	2.353	397 *
Magnesium	Normal	4	4	289	233	2.353	901
Manganese	Normal	4	4	64.2	101	2.353	329
Mercury	Lognormal	4	4	0.0724	0.798	2.353	0.591
Nickel	Normal	2	4	2.59	3.12	2.353	10.8
Potassium	Lognormal	4	4	358	0.922	2.353	4050
Selenium	Normal	2	4	0.516	0.308	2.353	1.33
Silver	Normal	2	4	0.345	0.237	2.353	0.967
Sodium	Normal	4	4	39.2	32	2.353	123
Thallium	Normal	2	4	0.82	0.74	2.353	2.77
Vanadium	Lognormal	4	4	29.4	0.731	2.353	201
Zinc	Lognormal	3	4	4.69	1.74	2.353	461 *

Notes:

(1) Background statistics are calculated assuming the EPA default lognormal distribution, except where this assumption is statistically improbable in cases where a normal distribution assumption is not improbable (based on the W-test using a P level of 0.05).

(2) The tolerance limit defines the concentration range that, on the average, is estimated to contain 95 % of all data points from the background population.

(3) If a site-related sample exceeds the tolerance limit, statistical evidence suggests the sample comes from a population with a different distribution and higher concentrations than the background data.

(*) The EPA Region II test (2X background arithmetic mean) is presented for this metal because the tolerance limit is impractical (large uncertainties are caused by too few sampling points along with a moderate to high lognormal standard deviation).

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Table 31-8

Statistical Evaluation of Background Subsurface Soil Metals Data

CTO 231, NWS Earle, Colts Neck, New Jersey

Metal	Background Distribution Type Used	No. of Detects	No. of Results	Mean or Geometric Mean mg/kg	Standard Deviation or Log Standard Deviation	Student's t-Distribution Coefficient	95 % Upper Tolerance Limit - mg/kg
Aluminum	Normal	8	8	2690	1580	1.895	5870
Arsenic	Normal	8	8	6.64	5.21	1.895	17.1
Barium	Normal	8	8	8.96	10.2	1.895	29.5
Beryllium	Lognormal	2	8	0.0738	1.4	1.895	1.22
Cadmium	Normal	1	8	0.288	0.115	1.895	0.52
Calcium	Normal	8	8	289	286	1.895	864
Chromium	Normal	8	8	27.4	22.9	1.895	73.4
Cobalt	Normal	4	8	1.38	1.66	1.895	4.73
Copper	Normal	8	8	4.33	3.42	1.895	11.2
Iron	Normal	8	8	20400	19400	1.895	59500
Lead	Normal	8	8	12.2	13.6	1.895	39.5
Magnesium	Lognormal	8	8	172	1.11	1.895	1600
Manganese	Normal	8	8	46.3	71.1	1.895	189
Mercury	Normal	8	8	0.0648	0.0523	1.895	0.17
Nickel	Normal	4	8	2.38	2.45	1.895	7.3
Potassium	Lognormal	7	8	276	1.15	1.895	2780
Selenium	Normal	2	8	0.397	0.239	1.895	0.877
Silver	Normal	2	8	0.256	0.182	1.895	0.622
Sodium	Normal	8	8	39.7	31.7	1.895	103
Thallium	Normal	4	8	0.688	0.529	1.895	1.75
Vanadium	Lognormal	8	8	27.7	0.622	1.895	96.7
Zinc	Normal	6	8	15.7	17.2	1.895	50.2

Notes:

(1) Background statistics are calculated assuming the EPA default lognormal distribution, except where this assumption is statistically improbable in cases where a normal distribution assumption is not improbable (based on the W-test using a P level of 0.05).

(2) The tolerance limit defines the concentration range that, on the average, is estimated to contain 95 % of all data points from the background population.

(3) If a site-related sample exceeds the tolerance limit, statistical evidence suggests the sample comes from a population with a different distribution and higher concentrations than the background data.