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INSTALLATION RESTORATION PROGRAM
PHASE II - CONFIRMATION/QUANTIFICATION
STAGE 2

VOLUME 1 OF 4

for
Seymour Johnson Air Force Base, NC

by
Research Triangle Institute
Center for Environmental Measurements
P. O. Box 12194
Research Triangle Park, NC 27709

November 1988

FINAL REPORT

Prepared For

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United States Air Force
Occupational & Environmental Health Laboratory (USAF O EHL)
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19. ABSTRACT (Continue on reverse if necessary and identify by block number) A Phase II, Stage 2 survey has been conducted at the Seymour Johnson Air Force Base under the Department of Defense's Installation Restoration Program (IRP). Six sites were identified by the Air Force for further study and include: Fire Training Area No. 3 (Site 1); Landfill No. 4 (Site 2); Landfill No. 1 (Site 3); Landfill No. 3 (Site 4); DPDO Waste Storage Area (Site 5); and Coal Pile Storage Area (Site 6). The evaluation primarily included the drilling of soil test borings, the installation, development, and sampling of new monitoring wells, resampling of selected Stage 1 monitoring wells, and the analysis of soil and water samples. A thin surficial aquifer was encountered at shallow depths beneath the sites that border the southeastern side of Stoney Creek. The surficial aquifer is contaminated at Sites 1, 2, 4, and 5 as a result of Base activities. Groundwater flow in the surficial aquifer is primarily horizontal and discharges into Stoney Creek along the northwestern limit of the Base. The major environmental concern revealed by this evaluation is the potential discharge of contaminated water from the surficial aquifer into Stoney Creek.				
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PREFACE

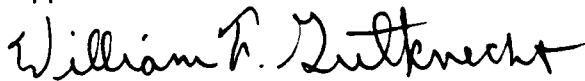
The primary objectives of this project were to collect and analyze groundwater, surface-water, soil, and sediment samples at six potential contamination sites on Seymour Johnson Air Force Base (AFB) near Goldsboro, North Carolina. The hydrogeology of the sites was characterized and recommendations were made for follow-up study. This study was conducted by the Research Triangle Institute (RTI) and constituted Phase II, Stage 2 of the U.S. Air Force Installation Restoration Program (IRP). The primary technical program manager for this stage of the IRP was Capt. Brian McCarty, Technical Services Division, USAF Occupational Environmental Health Laboratory (OEHL), Brooks AFB. Capt. Steve Warren served as the Base point of contact, Seymour Johnson AFB. Later in the project, Lt. Jerald E. Styles assumed the role of technical program manager, Technical Services Division, OEHL. Near the end of the project, Mr. Sam A. Taffinder assumed the role of technical program manager, Technical Services Division, OEHL.

This project was performed by RTI's Center for Environmental Measurements which had responsibility for the field work, inorganic chemical analyses, and reporting activities required for this stage of the IRP Survey. Mr. W. Joseph Alexander served as project leader and Dr. William F. Gutknecht served as project supervisor. Mr. Steven L. Winters served as project hydrogeologist and Mr. Scott A. Guthrie served as field hydrogeologist. Field operations were also supported by Mr. Craig O. Whitaker. RTI's inorganic analytical services were primarily performed by Mr. Peter M. Grohse, Ms. Bea M. Wilson, Mr. David L. Hardison, and Ms. Ann R. Turner. Ms. Bonnie S. Barbee is acknowledged for secretarial support throughout the project. Ms. Sharon Rowland and Ms. Tammie L. Howard are acknowledged for secretarial support on the report preparation. The organic analyses were performed by Industrial and Environmental Analysts, Inc. in the Research Triangle Park, NC. The drilling services were performed by Bore and Core, Inc. of Raleigh, NC, and the surveying was performed by MAPS, Inc. of Wade, NC.

The reconnaissance field work began in September 1986 with most drilling and soil sampling activities performed in October and November 1986. Monitoring well development was conducted in November and December 1986. Additional

environmental sampling, including groundwaters, surface waters and sediments, was conducted in January and February 1987. An informal technical information report was submitted to the U.S. Air Force in February 1987 resulting in additional sampling in April 1987. Advance draft reports were issued in June and July 1987. The first draft report was issued to the U.S. Air Force on August 17, 1987.

Approved:

A handwritten signature in cursive script, reading "William F. Gutknecht". The signature is written in dark ink and is positioned above the printed name.

William F. Gutknecht, Ph.D.
Contract Program Manager

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EXECUTIVE SUMMARY

E.1 SITES STUDIED

A Phase II, Stage 2 Survey has been conducted at the Seymour Johnson Air Force Base under the Department of Defense's Installation Restoration Program (IRP). Six sites were identified by the Air Force for further study in the IRP Phase II, Stage 2 (Figure E-1). These six sites include:

- Fire Training Area No. 3 (Site 1)
- Landfill No. 4 (Site 2)
- Landfill No. 1 (Site 3)
- Landfill No. 3 (Site 4)
- DPDO Waste Storage Area (Site 5)
- Coal Pile Storage Area (Site 6)

E.2 WORK PERFORMED

The evaluation primarily included the drilling of soil test borings, the installation, development, and sampling of new monitoring wells, resampling of selected Stage 1 monitoring wells, and the analysis of soil and water samples (Table E-1). Also used in the evaluation were available hydrogeologic data, Seymour Johnson AFB documents, prior IRP reports, field measurements of water quality, multiple water-level measurements, and site observations.

On this project, RTI staff members were responsible for the development of a technical operations plan for all field and laboratory procedures, field reconnaissance, layout and oversight of soil borings and monitoring well installations, lithologic descriptions of soil samples obtained from the drilling activities, monitoring well development, collection and analysis of soil and water samples, evaluation of data, and reporting. Fifteen soil borings were completed as monitoring wells and seven soil borings were drilled for lithologic and/or laboratory analyses of soils.

Water and soil samples were analyzed for a number of organic and inorganic parameters, depending on contaminants most likely to be associated with the activities of the individual sites. Laboratory chemical analyses that were performed at selected sites included:

Petroleum Hydrocarbons	Common Anions
Volatile Organic Compounds	Non-Halogenated Volatile Organics
Priority Pollutant Metals	Total Cyanide
Extractable Priority Pollutants	Alkalinity
Lead	Total Metals Screen

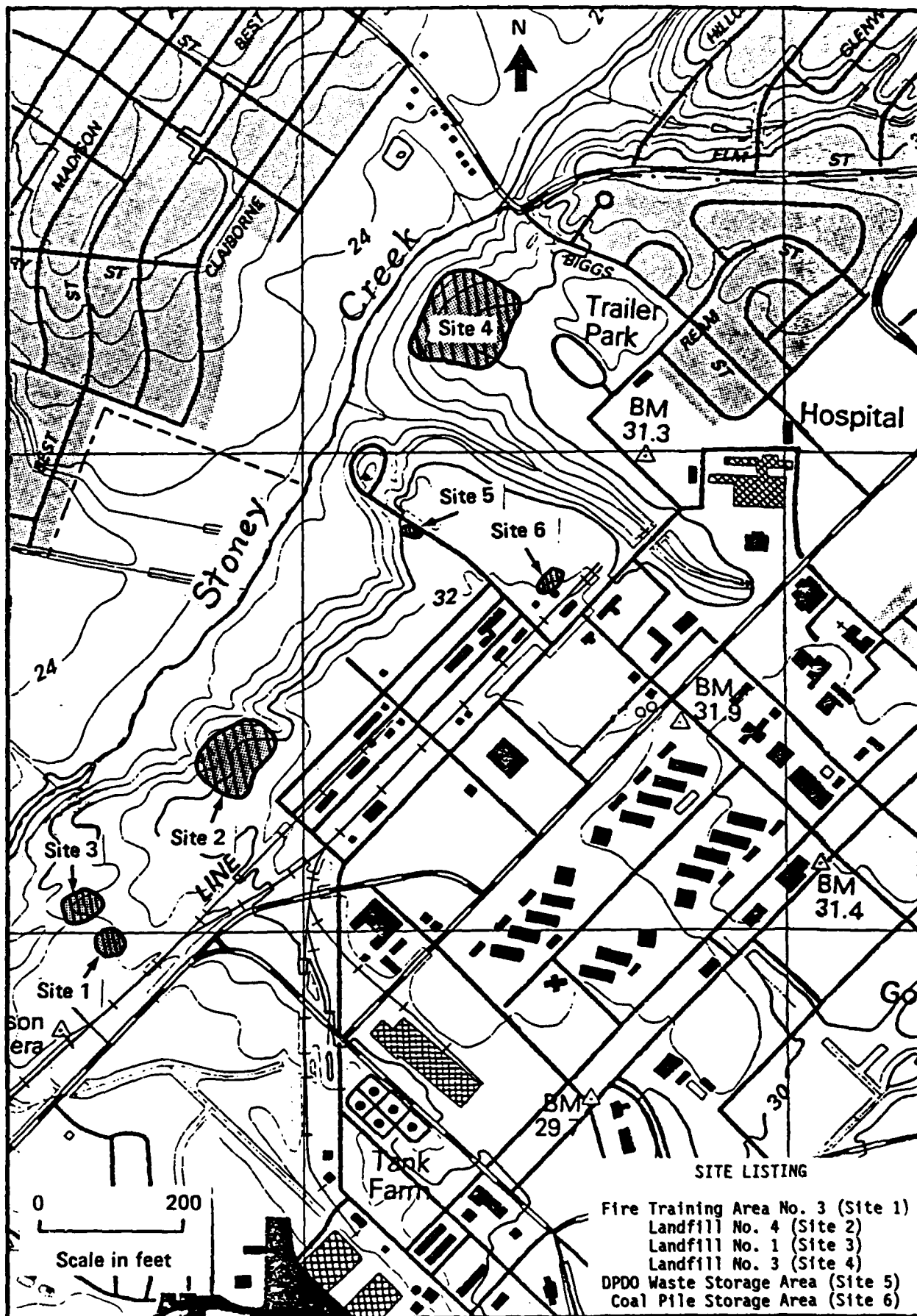


FIGURE E-1. LOCATION OF SIX SITES EVALUATED FOR IRP PHASE 11, STAGE 2

SEYMOUR JOHNSON AFB, NC

TABLE E-1. INDEX TO BASE SITES STUDIED

Site Number	Site Name	Stage 1 Sampling Locations	Stage 2 New Sampling Locations
1	Fire Training Area No. 3	MW-11	MW-40, MW-41, MW-42
2	Landfill No. 4	MW-13, MW-14, SW-1	MW-43, MW-44, MW-45, MW-46 MW-47, MW-48, MW-49, SB-49 SW-10, SW-11, SD-12, SD-13
3	Landfill No. 1	MW-12	None
4	Landfill No. 3	None	MW-50, MW-51, MW-52, MW-53
5	DPDO Waste Storage Area	SB-7, SB-8, SB-9, SB-10	MW-54, SB-55, SB-56, SB-57 SW-12, SW-13, SD-14, SD-15
6	Coal Pile Storage Area	None	SB-58, SB-59, SB-60

MW = Monitoring well.
 SB = Soil boring.
 SW = Seepage sample.
 SD = Sediment sample.

The hydrogeology and chemistry of the individual sites summarized in this report are provided on the basis of field observations, analytical data, published and unpublished hydrogeologic data, and the evaluation of the available subsurface data.

E.3 HYDROGEOLOGY

A thin surficial aquifer was encountered at shallow depths beneath the sites that border the southeastern side of Stoney Creek. The surficial aquifer is susceptible to contamination by Base activities because of its shallow occurrence and properties. Groundwater flow in the surficial aquifer is primarily horizontal and discharges into Stoney Creek along the northwestern limit of the Base.

A distinctive clayey stratum forms the base of the surficial aquifer in the areas studied and represents the upper section of the Black Creek formation. This dense clayey stratum is at least seventy feet thick in the flood plain area of Stoney Creek. The downward movement of water and contaminants through this clayey stratum is limited because of its thickness, stratification, and composition. Beneath the clayey stratum, the deeper permeable sections of the Black Creek formation and underlying Cape Fear formation form a principal aquifer system. No evidence of this aquifer system was identified within the investigative depths and areas of the Stage 2 Survey.

E.4 CATEGORY 1 SITES

The analytical results provide a basis for evaluating the sites studied. A detailed discussion of the analytical findings and relationship to water quality standards is provided in Section 4. Category 1 sites consist of sites where no further action (including remedial action) is required. Data from these sites are considered sufficient to rule out significant public health or environmental hazards. A summary of the recommendations for each site is provided in Table E-2. A more detailed discussion of alternative measures and recommendations is provided in Sections 5 and 6 respectively.

TABLE E-2. SUMMARY OF RECOMMENDATIONS FOR BASE SITES

SITE NUMBER/NAME	RECOMMENDATIONS	RATIONALE
1 (Fire Training Area No. 3)	Collect samples from existing wells and reanalyze groundwater for aromatic volatile organic compounds to verify data. If warranted, consider installation of shallow water-level piezometers and additional downgradient monitoring wells.	Chlorobenzene detected in one well downgradient of site.
2 (Landfill No. 4)	Collect samples from existing wells and reanalyze for organics, base/neutral extractables, halogenated volatile organics, and selected inorganic parameters to verify data. Also consider collecting water samples from springs and Stoney Creek. If warranted, consider installation of shallow water-level piezometers and additional downgradient monitoring wells. Consider use of geophysical surveying.	Organics detected in four wells downgradient of site. Some metals detected in downgradient wells exceed relevant standards or criterion.
3 (Landfill No. 1)	No Further Action (Category 1)	No groundwater contamination indicated by data.
4 (Landfill No. 3)	Collect samples from existing wells and reanalyze for organics, base/neutral extractables, halogenated volatile organics, and selected inorganic parameters, to verify data. Also consider collecting water samples from springs and Stoney Creek. If warranted, consider installation of shallow water-level piezometers and additional downgradient monitoring wells. Consider use of geophysical surveying.	Organics detected in two wells downgradient of site.
5 (DPDO Waste Storage Area)	Collect samples from existing well and surface water and analyze water samples for aromatic volatile organics, petroleum hydrocarbons, and selected inorganic parameters to verify data. Collect additional surficial soil samples and analyze for gross soil contamination. If warranted, consider installation of shallow water level piezometers, additional downgradient monitoring wells, and an upgradient monitoring well.	Organics detected in one groundwater, surface water, and sediment sample downgradient of site. Some metals detected in groundwater and surface water sample exceed relevant standards or criterion.
6 (Coal Pile)	No Further Action (Category 1)	No soils contamination indicated by data.

E.4.1 Site 3 - Landfill No. 1

No groundwater contamination was indicated at Site 3 (Landfill No. 1) and no further action is recommended at this site on the basis of available data (Table E-2). Data from this site are considered sufficient to rule out significant public health or environmental hazards. Site 3 is, therefore, considered appropriate for placement in Category 1.

E.4.2 Site 6 - Coal Pile

Similarly, no soils contamination is apparent at Site 6 (Coal Pile) which would also be appropriate for placement in Category 1. No further action is recommended at this site on the basis of available data (Table E-2).

E.5 CATEGORY 2 SITES

The most significant sites are those where groundwater contamination by organic or inorganic compounds has been confirmed in the surficial aquifer as a result of Base activities. Additional Phase II efforts are required to determine the full magnitude and extent of groundwater contamination at these Category 2 sites. They include:

- Site 1 (Fire Training Area No. 3)
- Site 2 (Landfill No. 4)
- Site 4 (Landfill No. 3)
- Site 5 (DPDO Waste Storage Area)

E.5.1 Site 1 - Fire Training Area No. 3

Chlorobenzene was detected in only one well downgradient of the Fire Training Area No. 3 (Table E-3). The extent of chlorobenzene in the groundwater appears to be limited to the surficial aquifer in a relatively small area in the vicinity of well MW-41. Samples should be collected from existing wells and reanalyzed for selected parameters to verify the data. If warranted, shallow water-level piezometers and additional shallow monitoring wells should be considered (Table E-2).

E.5.2 Site 2 - Landfill No. 4

Some wells downgradient of Landfill No. 4 contained detectable concentrations of benzene; 1,1-dichloroethane; trans-1,2-dichloroethene; or trichloroethene (Table E-4). The extent of organics in the groundwater at Landfill No. 4 appears to be limited to the surficial aquifer downgradient of the

TABLE E-3. RESULTS OF POSITIVE ORGANIC ANALYSES (WATER); SITE 1 (FIRE TRAINING AREA NO. 3)

Results of Groundwater Analyses; Concentrations in ug/L

Sampling Point:		MW-41	
Date Sampled:		25 FEB 87	
Sticker No., ID:		579, A1	
	<u>Detection Limit (ug/L)</u>		<u>Recommended Maximum Contaminant Levels (RMCLs)</u>
AROMATIC VOLATILE ORGANICS (Method 602)			
Chlorobenzene	1.0	8.0	60 ug/L ¹⁾
HALOGENATED VOLATILE ORGANICS (Method 601)			
Chlorobenzene	1.0	23.0	60 ug/L ¹⁾

¹⁾Proposed RMCLs for Monochlorobenzene Reported in the Federal Register, Vol. 50,
No. 219, Wednesday, November 13, 1985, p. 46981.

Note: Each value of chlorobenzene was obtained using a different method.

Note: The results reported as positive on this table are those for which
second-column confirmation by gas chromatography has been performed
on samples.

TABLE E-4. RESULTS OF POSITIVE ORGANIC ANALYSES (WATER); SITE 2 (LANDFILL NO. 4)

Results of Groundwater Analyses; Concentrations in ug/L

Sampling Point: Date Sampled: Sticker No., ID:		MW-13 26 FEB 87 589, AI	MW-44 26 FEB 87 581, AI	MW-45 26 FEB 87 583, AI	MW-46 26 FEB 87 585, AI	MW-49 26 FEB 87 587, AI
Detection Limit (ug/L)						
AROMATIC VOLATILE ORGANICS (Method 602)						
Benzene	1.0	7.0	BDL	BDL	5.0	BDL
HALOGENATED VOLATILE ORGANICS (Method 601)						
1,1-Dichloroethane	1.0	BDL	BDL	6.0	BDL	BDL
Trans-1,2-Dichloroethane	1.0	41.0	3.6	1.0	13.0	1.7
Trichloroethane	1.0	3.8	BDL	BDL	3.6	BDL

Recommended Maximum
Contaminant Levels (RMCLs)

5 ug/L¹⁾

--2)
70 ug/L³⁾
5 ug/L¹⁾

BDL = Below Detection Limit

1) Final RMCLs for Benzene, and Trichloroethylene Reported in the Federal Register, Vol. 52, No. 130, Wednesday, July 8, 1987, p. 25691.

2) No RMCLs Have Been Proposed at this Time for 1,1-Dichloroethane.

3) Proposed RMCLs for Trans-1,2-Dichloroethylene Reported in the Federal Register, Vol. 50, No. 219, Wednesday, November 13, 1985, p. 46981.

Note: The results reported as positive on this table are those for which second-column confirmation by gas chromatography has been performed on samples.

site in the flood plain of Stoney Creek. Concentrations of lead, nickel, and silver were also detected in groundwater downgradient of the landfill at levels that exceed relevant standards or criterion (Table E-5). Samples should be collected from existing wells and surface water and reanalyzed for selected parameters to verify the data. If warranted, shallow water-level piezometers and additional shallow monitoring wells should be considered (Table E-2).

E.5.2 Site 4 - Landfill No. 3

Some wells downgradient of Landfill No. 3 contained detectable concentrations of benzene; chlorobenzene; 1,4-dichlorobenzene; or toluene (Table E-6). The extent of organics in the groundwater appears to be limited to the surficial aquifer and is primarily in an area surrounding downgradient wells MW-51 and MW-52 in the flood plain adjacent to Stoney Creek. Samples should be collected from existing wells and surface water and reanalyzed for selected parameters to verify the data. If warranted, shallow water-level piezometers and additional shallow monitoring wells should be considered (Table E-2).

E.5.3 Site 5 - DPDO Storage Area

Only one well downgradient from Site 5 contained detectable concentrations of trans-1,2-dichloroethene and trichloroethene (Table E-7). Trichloroethene was also detected in one surface water sample downslope of the DPDO Waste Storage Area (Table E-7). Shallow subsurface soils downslope of Site 5 contained detectable concentrations of petroleum hydrocarbons (Table E-8). A sediment sample downslope of Site 5 also contained detectable concentrations of petroleum hydrocarbons. The groundwater downgradient of the DPDO Waste Storage Area also had concentrations of lead and silver that exceeded relevant standards (Table E-9). The total extent of contamination from Site 5 is probably limited to the near surface soils and surficial aquifer in the adjacent flood plain area of Stoney Creek. Samples should be collected from the existing well and surface water and reanalyzed for selected parameters to verify the data. Additional surficial soils should be collected and analyzed for gross soil contamination. If warranted, shallow water level piezometers and additional monitoring wells should be considered (Table E-2).

TABLE E-5. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 2 (LANDFILL NO. 4); p. 1 of 3

GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

			Sampling Point: Date Sampled:	MW-13 21 JAN 87	MW-14 20 JAN 87	MW-43 14 JAN 87
			Relevant Standard or Criterion			
<u>SELECTED INDICATOR PARAMETERS</u>						
	(Units)					
pH				5.65	4.70	4.70
Specific Conductance	(umhos/cm)			210	60	52
<u>SELECTED ANIONS</u>						
	(Detection Limits)					
Chloride	(0.01 mg/L)	250 mg/L ¹⁾		14.7	3.7	3.6
Bromide	(0.05 mg/L)			0.55	BDL	BDL
<u>SELECTED PRIORITY POLLUTANTS</u>						
	(Detection Limits)					
Lead	(0.053 mg/L)	0.05 mg/L ²⁾		0.070	BDL	BDL
Nickel	(0.010 mg/L)	0.0134 mg/L ³⁾		0.020	BDL	BDL
Silver	(0.007 mg/L)	0.05 mg/L ²⁾		0.025	BDL	BDL

BDL = Below Detection Limit

1) = Secondary Drinking Water Standards

2) = Maximum Contaminant Levels Reported in 40CFR141.11,
Inorganic Chemicals, Revised July 1, 1985, p. 523.

3) = EPA, "No Adverse Effect Level", 1980.

TABLE E-5. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 2 (LANDFILL NO. 4); p. 2 of 3

GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

			Sampling Point: Date Sampled:	MW-44 16 JAN 87	MW-45 16 JAN 87	MW-46 16 JAN 87
			<u>Relevant Standard or Criterion</u>			
<u>SELECTED INDICATOR PARAMETERS</u>						
	(Units)					
pH				4.25	5.10	6.3
Specific Conductance	(umhos/cm)			60	80	490
<u>SELECTED ANIONS</u>						
	(Detection Limits)					
Chloride	(0.01 mg/L)	250 mg/L ¹⁾		11.5	17.3	38.5
Bromide	(0.05 mg/L)			0.61	0.46	0.89
<u>SELECTED PRIORITY POLLUTANTS</u>						
	(Detection Limits)					
Lead	(0.053 mg/L)	0.05 mg/L ²⁾		BDL	BDL	BDL
Nickel	(0.010 mg/L)	0.0134 mg/L ³⁾		BDL	BDL	BDL
Silver	(0.007 mg/L)	0.05 mg/L ²⁾		BDL	0.134	BDL

BDL = Below Detection Limit

1) = Secondary Drinking Water Standards

2) = Maximum Contaminant Levels Reported in 40CFR141.11,
Inorganic Chemicals, Revised July 1, 1985, p. 523.

3) = EPA, "No Adverse Effect Level", 1980.

TABLE E-5. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 2 (LANDFILL NO. 4); p. 3 of 3

GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

			Sampling Point: Date Sampled:	MW-47 20 JAN 87	MW-48 20 JAN 87	MW-49 20 JAN 87
			Relevant Standard or Criterion			
<u>SELECTED INDICATOR PARAMETERS</u>						
	(Units)					
pH				5.0	5.05	5.40
Specific Conductance	(umhos/cm)			315	330	430
<u>SELECTED ANIONS</u>						
	(Detection Limits)					
Chloride	(0.01 mg/L)	250 mg/L ¹⁾		19.7	3.6	15.8
Bromide	(0.05 mg/L)			0.19	BDL	0.14
<u>SELECTED PRIORITY POLLUTANTS</u>						
	(Detection Limits)					
Lead	(0.053 mg/L)	0.05 mg/L ²⁾		BDL	0.109	0.068
Nickel	(0.010 mg/L)	0.0134 mg/L ³⁾		BDL	BDL	0.028
Silver	(0.007 mg/L)	0.05 mg/L ²⁾		BDL	0.062	BDL

BDL = Below Detection Limit

1) = Secondary Drinking Water Standards

2) = Maximum Contaminant Levels Reported In 40CFR141.11,
Inorganic Chemicals, Revised July 1, 1985, p. 523.

3) = EPA, "No Adverse Effect Level", 1980.

TABLE E-8. RESULTS OF POSITIVE ORGANIC ANALYSES (SOIL); SITE 5 (DPDO WASTE STORAGE AREA)

Results of Soil and Sediment Analyses; Concentrations in mg/Kg

Sampling Point:	SB-56	SB-57	SD-15
Date Sampled:	12 NOV 87	13 NOV 86	23 JAN 87
Sticker No., ID:	20, B	35, B	385, A
Depth Interval (ft):	0-2	0-2	---
Detection Limit (mg/Kg)			
PETROLEUM HYDROCARBONS (Method E418.1)	310	560	38

NOTE: No Environmental or Regulatory Criteria are Known for Petroleum Hydrocarbons in Soil

TABLE E-9. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 5 (DPDO WASTE STORAGE AREA)

SURFACE AND GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

SELECTED PRIORITY POLLUTANTS			SW-12 28 JAN 87	SW-13 28 JAN 87	MW-54 23 JAN 87
	(Detection Limits)	(Relevant ¹⁾ Standards)			
Cadmium	(0.006 mg/L)	(0.010 mg/L)	0.008	0.012	0.008
Lead	(0.053 mg/L)	(0.05 mg/L)	BDL	BDL	0.100
Silver	(0.007 mg/L)	(0.05 mg/L)	BDL	BDL	0.116

BDL = Below Detection Limit

1) = Maximum Contaminant Levels Reported in 40CFR141.11,
Inorganic Chemicals, Revised July 1, 1985, p. 523.

TABLE E-6. RESULTS OF POSITIVE ORGANIC ANALYSES (WATER); SITE 4 (LANDFILL NO. 3)

Results of Groundwater Analyses; Concentrations in ug/L

Sampling Point:		MW-51	MW-51	MW-52	Recommended Maximum Contaminant Levels (RMCLs)
Date Sampled:		5 MAR 87	15 APR 87	5 MAR 87	
Sticker No., ID:		69, AI	713, EI	73, AI	
<u>Detection Limit (ug/L)</u>					
AROMATIC VOLATILE ORGANICS (Method 602)					
Benzene	1.0	2.0	-	BDL	5 ug/L ¹⁾
Chlorobenzene	1.0	15.0	-	8.0	60 ug/L ²⁾
1,4-Dichlorobenzene	1.0	7.0	-	13.0	750 ug/L ¹⁾
Toluene	1.0	4.0	-	BDL	2000 ug/L ²⁾
BASE/NEUTRAL EXTRACTABLES (Method 625)					
1,4-Dichlorobenzene	10.0	-	26.0	-	750 ug/L ¹⁾
HALOGENATED VOLATILE ORGANICS (Method 601)					
Chlorobenzene	1.0	15.0	-	8.0	60 ug/L ²⁾
1,4-Dichlorobenzene	1.0	7.0	-	13.0	750 ug/L ¹⁾

BDL = Below Detection Limit

- = Compounds Not Analyzed on Date Indicated

¹⁾ Final RMCLs for Benzene and p-Dichlorobenzene Reported in the Federal Register, Vol. 52, No. 130, Wednesday, July 8, 1987, p. 25691.

²⁾ Proposed RMCLs for Monochlorobenzene and Toluene Reported in the Federal Register, Vol. 50, No. 219, Wednesday, November 13, 1985, p. 46981.

Note: The results reported as positive on this table are those for which second-column confirmation by gas chromatography has been performed on samples.

TABLE E-7. RESULTS OF POSITIVE ORGANIC ANALYSES (WATER); SITE 5 (DPDO WASTE STORAGE AREA)

Results of Groundwater and Surface Water Analyses; Concentrations in ug/L

Sampling Point:		MW-54	SW-13	Recommended Maximum Contaminant Levels (RMCLs)
Date Sampled:		2 MAR 87	2 MAR 87	
Sticker No., ID:		77, A2	547, A2	
Detection Limit (ug/L)				
HALOGENATED VOLATILE ORGANICS (Method 601)				
Trans-1,2-Dichloroethene	1.0	12.0	BDL	70 ug/L ¹⁾
Trichloroethene	1.0	79.0	3.0	5 ug/L ²⁾

BDL = Below Detection Limit

1) Proposed RMCLs for Trans-1,2-Dichloroethylene Reported in the Federal Register, Vol. 50, No. 219, Wednesday, November 13, 1985, p. 46891.

2) Final RMCLs for Trichloroethylene Reported in the Federal Register, Vol. 52, No. 130, Wednesday, July 8, 1987, p. 25691.

Note: The results reported as positive on this table are those for which second-column confirmation by gas chromatography has been performed on samples.

E.6 SIGNIFICANCE OF FINDINGS

The groundwater contamination encountered at the Category 2 sites appears to be confined to the surficial aquifer near Stoney Creek and does not appear to represent a direct adverse impact on groundwater users. A few groundwater users have been identified within a one mile radius of the Stage 2 sites. The closest known well to any of the sites is the Base hospital supply well, which is only used for emergency purposes. As with all other Base wells, the hospital supply well is probably cased through the surficial aquifer (on the order of 50 feet) and draws water from the principal aquifer system. The principal aquifer system appears to be protected from direct contamination because of its hydrogeologic setting. The major environmental concern revealed by this evaluation is the potential discharge of small concentrations of contaminated water from the surficial aquifer into Stoney Creek and ultimately the Neuse River.

SECTION 1

INTRODUCTION

1.1 INSTALLATION RESTORATION PROGRAM

The United States Air Force, due to its primary mission, has long been engaged in a wide variety of operations dealing with toxic and hazardous materials. Federal, State, and local governments have developed strict regulations to require that disposers identify the locations and contents of disposal sites and take action to eliminate the hazards in an environmentally responsible manner. The primary Federal legislation governing disposal of hazardous waste is the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Under Section 6003 of the Act, Federal agencies are directed to assist the Environmental Protection Agency (EPA) and, under Section 3012, State agencies are required to inventory past disposal sites and make the information available to the requesting agencies. To ensure compliance with these hazardous waste regulations, the Department of Defense (DOD) developed the Installation Restoration Program (IRP). The current DOD IRP policy is contained in Defense Environmental Quality Program Policy Memorandum (DEQPPM) 81-5, dated 11 December 1981 and implemented by an Air Force message dated 21 January 1982. DEQPPM 81-5 reissued and amplified all previous directives and memoranda on the Installation Restoration Program. DOD policy is to identify and evaluate past hazardous material disposal and spill sites and to control the migration of hazardous materials from those sites. The IRP will be the basis for response actions on Air Force installations under the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as clarified by Executive Order 12316.

The IRP was organized into four phases, consisting of:

- Phase I - Initial Assessment/Records Search
- Phase II - Confirmation and Quantification
- Phase III - Technology Base Development
- Phase IV - Operations/Remedial Actions

Phase I of the IRP was intended to identify the potential for environmental contamination from past hazardous waste disposal practices. Phase I consists of a review of installation files on past missions, current operations, waste generation, past disposal practices, and interviews with key current and former installation employees. The Phase I study results in one of the following:

- Termination of the IRP on the installation if no potential hazard is found.
- A Phase II to perform additional evaluation and sampling to confirm suspected contamination.
- A Phase IV remedial action to ameliorate contamination that presents an imminent threat to public health.

Phase II of the IRP was intended to define and quantify the presence of absence of contamination that may have an adverse effect on public health or the environment. Phase II consists of comprehensive environmental and ecological surveys, which include sampling and analysis to verify the presence of contamination and the magnitude and rate of contamination movement. A Phase II Survey may require more than one study to adequately assess contaminant concentration and rate of movement. The completion of Phase II efforts results in one of the following at each investigated site:

- Termination of the IRP at a base if contamination is not confirmed or is determined to be insignificant.
- Long-term monitoring when contamination does not warrant remedial action at the time.
- A recommendation for Phase IV remedial actions when appropriate technology already exists, or a request for a Phase III effort to develop appropriate remedial technology.

Phase III of the IRP was intended to implement research and development on new toxic and hazardous waste cleanup methods. A Phase III requirement can be identified and instituted at any time during the IRP.

Phase IV of the IRP was intended to assess, select, and implement appropriate control measures that will comply with DOD and Air Force policy regarding former hazardous waste disposal sites. Phase IV generally

encompasses individual sites or closely spaced groups of sites rather than all sites on an installation. The key element of Phase IV is the development of a Remedial Action Plan (RAP). The RAP is a detailed study listing available control technologies, an assessment of their effectiveness and cost/benefits, and selection of a preferred alternative which will become the basis for future action.

The Phase I activities at Seymour Johnson Air Force Base (AFB) were completed by Engineering-Science, Inc. The specific goal of Phase I was to identify the potential for environmental contamination from past waste disposal practices at the Base and to assess the potential for contaminant migration. Recommendations for Phase II were included in the Phase I report issued in July 1982.

The Research Triangle Institute (RTI) performed the Phase II, Stage 1 Survey at Seymour Johnson AFB under Contract Number F33615-83- D-4010 between September 1983 and July 1984. The final report of the Phase II, Stage 1 evaluation was prepared by RTI in July, 1985.

1.2 PURPOSE AND SCOPE OF THE PHASE II, STAGE 2 SURVEY

Research Triangle Institute was directed by the Occupational and Environmental Health Laboratory (OEHL), Brooks Air Force Base, Texas, to conduct a presurvey for Phase II, Stage 2 at Seymour Johnson Air Force Base in Goldsboro on March 26, 1986. The presurvey meeting was attended by representatives of the U.S. Air Force (OEHL, HQ TAC, and Seymour Johnson); the State of North Carolina (Raleigh and Washington Regional Offices); and RTI. In June, 1986 RTI presented plans for the Phase II, Stage 2 Survey that were accepted by the Air Force on July 17, 1986 under Contract number F33615-83-4010, Order 16. The Statement of Work for Order 16 (Appendix A) outlined the specific activities to be accomplished in the Stage 2 Survey. The goals of the Installation Restoration Program (IRP) Phase II, Stage 2 Survey at Seymour Johnson Air Force Base (AFB) have been to:

- Confirm the presence or absence of contamination resulting from past waste disposal practices at the Base;
- Determine (if possible) the extent and magnitude of contamination and the potential for migration of those contaminants in the various environmental media;

- Identify public health and environmental hazards associated with the contaminated media;
- Recommend any additional actions or future environmental monitoring necessary to fully assess the potential for contaminant migration at or from the Base.

1.3 LOCATION OF SEYMOUR JOHNSON AIR FORCE BASE

Seymour Johnson AFB is in Wayne County, North Carolina, just southeast of the City of Goldsboro (Figure 1-1). The Base comprises 3,216 acres of contiguous property. In addition, the Air Force owns or has easements on four additional sites totaling 13 acres located in the immediate vicinity of Seymour Johnson AFB. These sites are primarily used for navigation and communication purposes, and have not been included in this Phase II, Stage 2 Survey.

1.4 HISTORY OF SEYMOUR JOHNSON AIR FORCE BASE

Seymour Johnson AFB was activated in June 1942, when the War Department approved the establishment of a technical school southeast of Goldsboro. The primary mission was to serve as a Headquarters Technical School, Army Air Force. In 1943, additional missions followed, including the Provisional Overseas Replacement Training Center, preparing officers and enlisted men for overseas duty; and the 326th Fighter Group, providing training for replacement pilots for the P-47 Thunderbolt. In 1944, basic training of P-47 pilots became the primary mission at Seymour Johnson AFB.

At the end of World War II in Europe, Seymour Johnson AFB was designated a Central Assembly Station for processing and training troops being reassigned throughout the continental United States and the Pacific. This function was discontinued in September 1945, and the Base became an Army Air Force Separation Center.

In May 1946, Seymour Johnson AFB was deactivated, and in 1949 the property was deeded to the City of Goldsboro. Between 1950 and 1953, Piedmont Airlines conducted regular flights into Seymour Johnson Field. Other facilities at the Base were leased to private interests for warehousing, temporary residence for a road circus, light manufacturing, family housing, and special presentations.

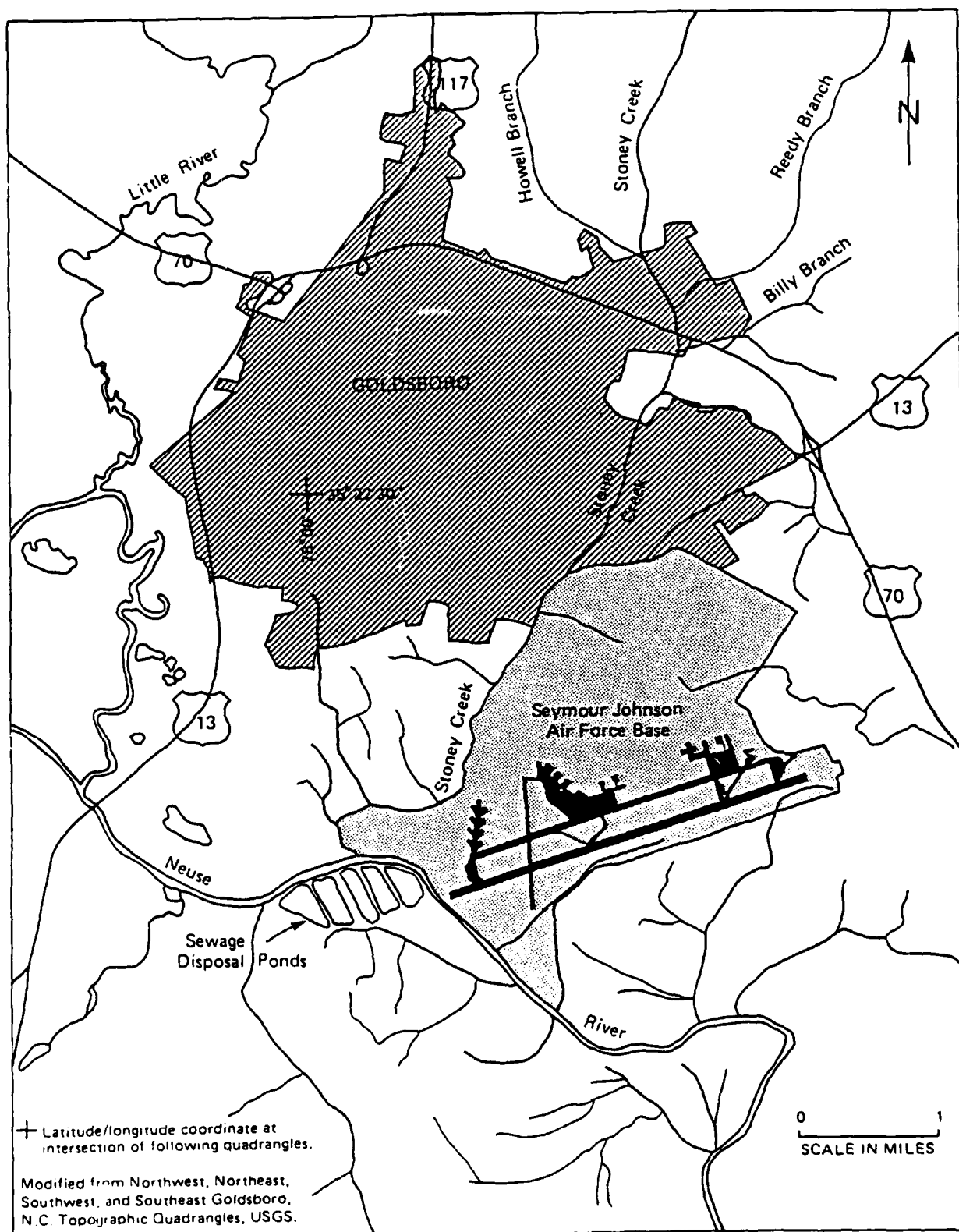


FIGURE 1-1. LOCATION OF SEYMOUR JOHNSON AIR FORCE BASE, NORTH CAROLINA

At the end of 1952, the City of Goldsboro transferred the Base to the Federal Government, and, shortly thereafter, the U.S. Army Corps of Engineers began construction activities for reopening the Base. In 1956, Seymour Johnson AFB was reactivated as a Tactical Air Command Base, and during the same year, the 83rd Fighter-Day Wing was assigned to the Base. The 83rd Fighter-Day Wing was deactivated in 1957, and the 4th Fighter Group was assigned to the Base as the primary, or host, unit. The 4th Fighter Group was later designated the 4th Fighter Wing. A Strategic Air Command Unit designated the 4241st Strategic Wing was activated at Seymour Johnson in 1958. Activation of the 911th Refueling Squadron took place in early 1959. The 4241st was redesignated the 68th Bomb Wing in 1963, but since then the 68th Bomb Wing was deactivated. More recently, Seymour Johnson AFB has had a strategic Air Command Wing equipped with B-5L Bombers and KC-135 Tankers. The primary mission at Seymour Johnson AFB is the Tactical Air Command's mission to train, deploy, and fight using the F-4E Weapons Systems anywhere in the world.

1.5 DESCRIPTION AND HISTORY OF SITES STUDIED

Ten sites were identified in the Phase I report as potentially containing hazardous materials resulting from past activities. Five of the sites identified in Phase I were selected by the Air Force and Research Triangle Institute (RTI) for the Phase II, Stage 1 Survey. Two additional sites (the DPDO Waste Storage Site and a suspected JP-4 contamination site) were added for the Phase II, Stage 1 Survey. Representatives from the U.S. Air Force, State of North Carolina, and RTI also visited and/or discussed three other sites from the Phase I survey and concluded that no further investigation was warranted. These sites included Landfill No. 2, the B-52 Crash Site, and the Munitions Residue Burial Site. Five sites studied during the Phase II, Stage 1 Survey (Sites 1 through 5) have been moved to Phase IV (Operations and Remedial Actions) of the IRP Program. The area identified as Site 6 during the Stage 1 Survey has been divided into 3 separate sites for this Stage 2 Survey. These sites included the Fire Training Area 3, Landfill No. 1, and Landfill No. 4. The second stage of the Phase II Survey included two sites identified in the Phase I report, but not selected as part of the Phase II, Stage 1 Survey. These sites include Landfill No. 3 and the Coal Pile Storage Area.

The following descriptions of the six sites that were studied for the Phase II, Stage 2 Survey are based upon the findings of the Phase I report (Engineering-Science, 1982) and the Phase II, Stage 1 report (RTI, 1985). The approximate location of all six sites are shown in Figure E-1.

1.5.1 Site 1 - Fire Training Area No. 3

The fire department has operated fire protection training areas on Base where fires have been ignited and then extinguished. Fire Training Area No. 3 has been in operation since 1956 and is still used as the major permanent fire training area on Base. The facility is located adjacent to a fenced truck yard off an extension to Collier Avenue (Figure 1-2).

The fire training area is comprised of an earthen diked pit formed on a compacted base. An underdrain system was installed to drain the pit to an underground oil/water separator prior to discharging the water into the sanitary sewer system. A fuel system was later installed to evenly distribute the fuel within the pit from an adjacent fuel storage tank. Until 1974, the area was used on a monthly basis. After 1974, the frequency of training was reduced to quarterly exercises. Between 1956 and the mid-1970's, contaminated fuels and some combustible waste chemicals were burned in the pit. Beginning in 1976, fire training exercises were conducted using only uncontaminated JP-4. Approximately 500 gallons of fuel were used during a typical training exercise. The area was saturated with water prior to the application of fuel. Protein foams, Aqueous Film Forming Foam (AFFF), Halon 1211, and dry chemicals were utilized as extinguishing agents from 1956 to the present. Residual fuels were burned prior to draining the pit.

One 30-foot deep monitoring well (MW-11) was installed southwest of the site during the Phase II, Stage 1 Survey. The purpose of this well was to determine the groundwater quality downgradient of the diked pit (Figure 1-2). No indications of groundwater contamination were noted based on the results of nitrate, oil and grease, total organic carbon, total organic halogen, or phenol analyses performed on samples during the Phase II, Stage 1 Survey (Table 1-1). However, it was assumed that the water quality in well MW-11 may not have been a true reflection of water quality in the very shallow surficial sands because of its screen depth relative to the water table.

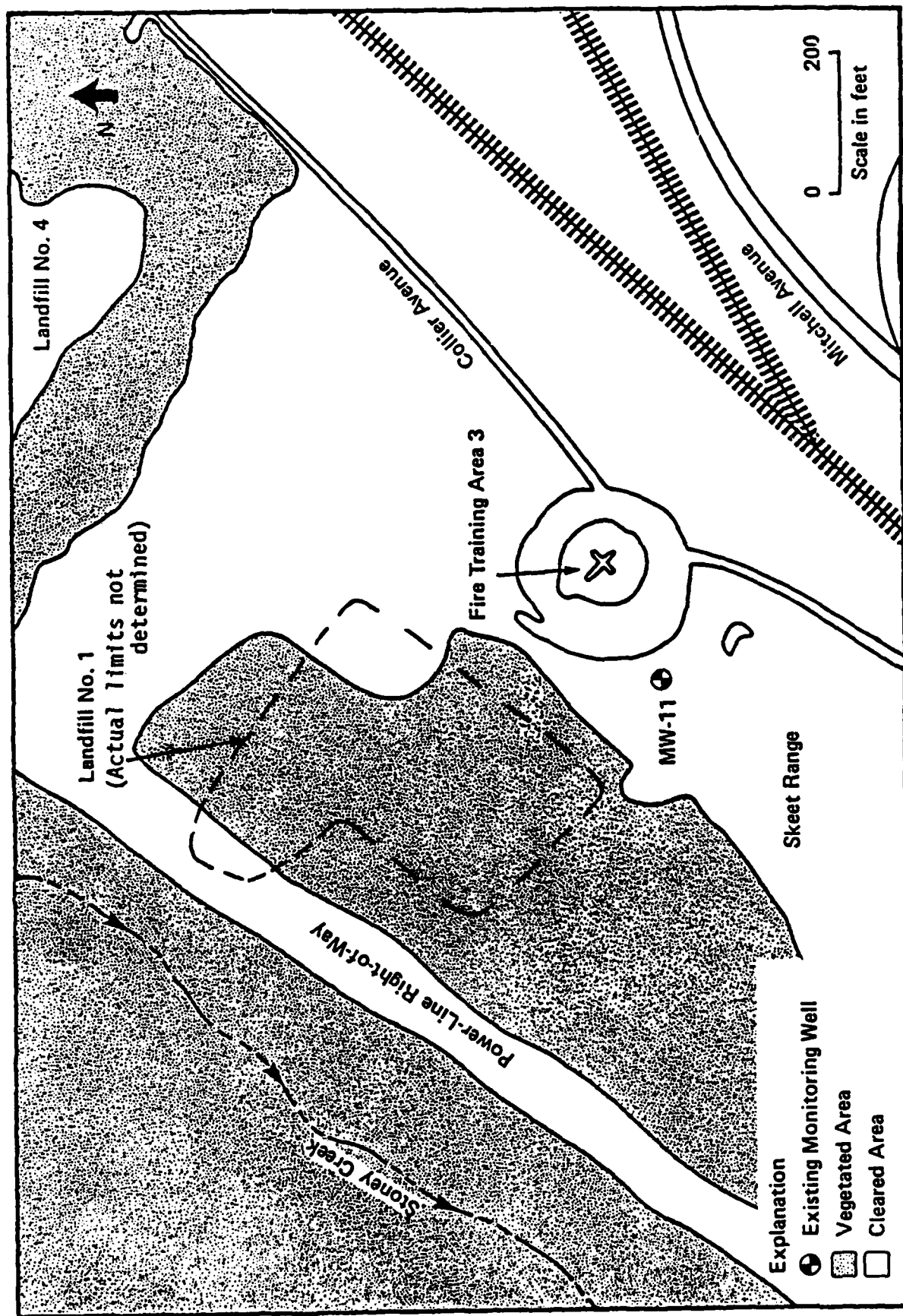


FIGURE 1-2. LOCATION OF SITE 1 (FIRE TRAINING AREA NO. 3)

SEYMOUR JOHNSON AFB, NC

TABLE 1-1. SUMMARY OF STAGE 1 GROUNDWATER ANALYSES;
SITE 1 (FIRE TRAINING AREA)

Sampling Point: Date Sampled:		MW-11 4 APR 84
<u>Indicator Parameters</u>	<u>(Units)</u>	
pH		5.5
Specific Conductance	(umhos/cm)	50
<u>Organic Parameters</u>		
Oil and Grease	(mg/l)	1.85
Total Organic Carbon	(mg/l)	0.60

Note: Analyses for nitrate, total organic halogen
and phenol were below detection limits.

1.5.2 Site 2 - Landfill No. 4

Landfill No. 4 is located between Collier Avenue and Stoney Creek (Figure 1-3). The total area of the landfill is approximately 8 acres. The present surface of the landfill is fairly flat with a slope to the northwest. The northwestern limit of the landfill is marked by an abrupt scarp where the landfill extends onto the flat-lying plain near Stoney Creek. The landfill operation began in 1970. Landfill No. 4 was utilized through 1978 for the disposal of general refuse generated on the Base with the exception of refuse from the housing area and some miscellaneous industrial chemicals. The landfill was operated in a trench and fill fashion; no burning occurred, and the wastes were covered daily. Trenches were described in the Phase I report as extending from 6 to 7 feet in depth.

In 1978, the Base established a contract for collection and off-base disposal of all refuse generated at Seymour Johnson AFB. The only waste disposed of in the landfill from 1978 to the present consists of rubble from ground maintenance. Trench and fill procedures have been discontinued, and the landfill has been filled along a slope.

Seepage has been observed along the northern toe of the landfill. This leachate was sampled (SW-1), and two monitoring wells (MW-13, MW-14) were installed at the landfill during the Phase II, Stage 1 Survey (Figure 1-3). The seepage sample had detectable concentrations of benzene (30 $\mu\text{g/L}$), ethylbenzene (30 $\mu\text{g/L}$), trans-1,2-dichloroethylene (19 $\mu\text{g/L}$), and toluene (50 $\mu\text{g/L}$) (Table 1-2). Concentrations of lead (0.002 mg/L) and nickel (0.037 mg/L) were also noted in the seepage sample. Groundwater extracted from well MW-13 at the landfill had a total organic carbon concentration of 40.9 mg/L, a total organic halogen concentration of 100.9 g/L, and a phenol concentration of 184 $\mu\text{g/L}$ (Table 1-3). Groundwater extracted from well MW-14 exhibits water quality that appears to be unaffected by the landfill (Table 1-3). The groundwater sample from well MW-14 had a specific conductance of only 50 $\mu\text{mhos/cm}$ and a total organic carbon concentration of 1.0 mg/L. The other organic parameters analyzed were below detection limits (Table 1-3). A more detailed discussion of the Stage 1 and Stage 2 monitoring results is provided in Section 4.

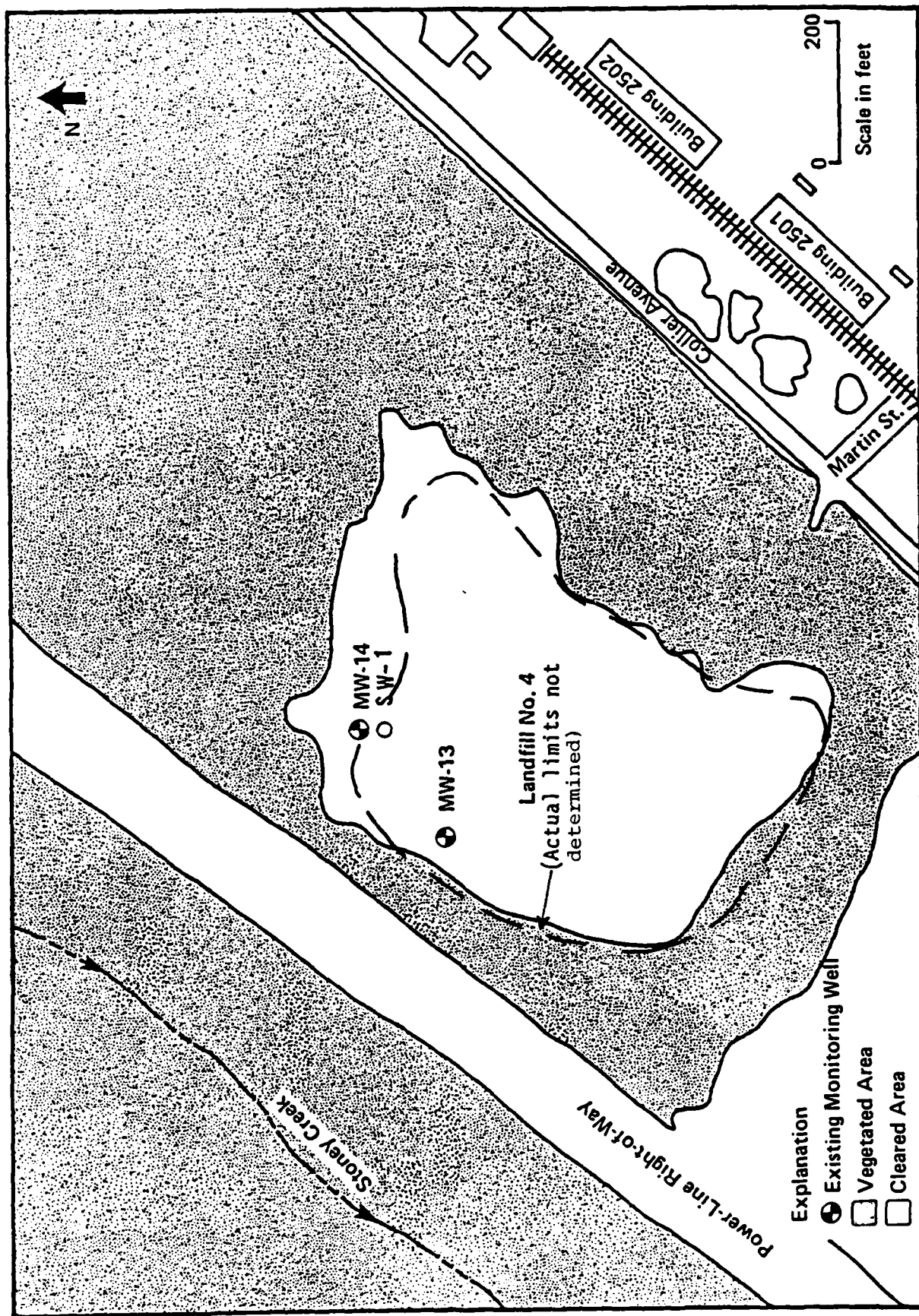


FIGURE 1-3. LOCATION OF SITE 2 (LANDFILL NO. 4)

SEYMOUR JOHNSON AFB, NC

**TABLE 1-2. SUMMARY OF STAGE 1 SURFACE WATER ANALYSES;
SITE 2 (LANDFILL NO. 4)**

Sampling Point: Date Sampled:		SW-1 4 APR 84
<u>Indicator Parameters</u>	<u>(Units)</u>	
pH		6.45
Specific Conductance	(umhos/cm)	1700
<u>Volatile Organic Compounds</u>	<u>(ug/l)</u>	
Benzene		30
Ethylbenzene		30
Trans-1,2-Dichloroethylene		19
Toluene		50
<u>Inorganic Parameters</u>	<u>(mg/L)</u>	
Lead (Filtered)		0.00211
Lead (Not Filtered)		0.00501
Cadmium (Filtered)		0.00052
Cadmium (Not Filtered)		0.00075
Chromium (Not Filtered)		0.00231
Nickel (Filtered)		0.0370
Nickel (Not Filtered)		0.0269

Note: Dissolved analysis for chromium was below detection limits. Also below detection limits were other volatile organic compounds delineated by method 624 (31 priority pollutants) not listed above.

TABLE 1-3. SUMMARY OF STAGE 1 GROUNDWATER ANALYSES;
SITE 2 (LANDFILL NO. 4)

Sampling Point: Date Sampled:		MW-13 4 MAR 84	MW-14 4 APR 84
<u>Indicator Parameters</u>	<u>(Units)</u>		
pH		6.20	4.95
Specific Conductance	(umhos/cm)	1090	50
<u>Organic Parameters</u>			
Total Organic Carbon	(mg/l)	40.9	1.0
Total Organic Halogen	(ug/l)	100.9	BDL
Phenol	(ug/l)	184	BDL

1.5.3 Site 3 - Landfill No. 1

Landfill No. 1 is located approximately northwest of Fire Training Area No. 3 and southeast of Stoney Creek (Figure 1-4). The total area of the site is reportedly about 2.5 acres, although the actual layout of the landfill is not known. The ground surface rises further to the northwest of the power lines, and then drops steeply to Stoney Creek.

The site was operated from 1941 through 1946, during the initial activation of the Base. During this same period, the Base operated a refuse incinerator, and the landfill only received a portion of the waste and refuse generated at the Base. Ash from the incinerator was likely disposed of in this landfill along with a small quantity of miscellaneous industrial wastes. Refuse suitable for animal feed was sold to local farmers, and scrap metals were salvaged from the landfill. Since 1946, the landfill has been closed, and the majority of the area has an established vegetative cover. In recent years an excavation training program was conducted in the landfill area. These excavations have uncovered remnants of landfill debris.

One monitoring well (MW-12) was installed between the assumed northern limits of the landfill and Stoney Creek (assumed to be downgradient) as part of the Phase II, Stage 1 Survey (Figure 1-4). Except for measurement of total organic carbon from well MW-12 (3.8 mg/L), there were no other indications of groundwater quality degradation during the Phase II, Stage 1 Survey (Table 1-4).

1.5.4 Site 4 - Landfill No. 3

Landfill No. 3 is located along the northern periphery of the Base (Figure 1-5), northwest of the intersection of Biggs Street and Ream Street. The site was operated between 1961 and 1970 and encompasses an area of approximately 15 acres, although the exact limits of the landfill are not known. Soils in the landfill area are reported in the Phase I report as being a sand clay mix. The area of the landfill that is adjacent to Stoney Creek is in a flat-lying flood plain. Landfill operations have included both trench and slope fill practices with trenches ranging from 30 to 35 feet long and a maximum depth of 10 feet. Landfilling began in the southwestern portion of

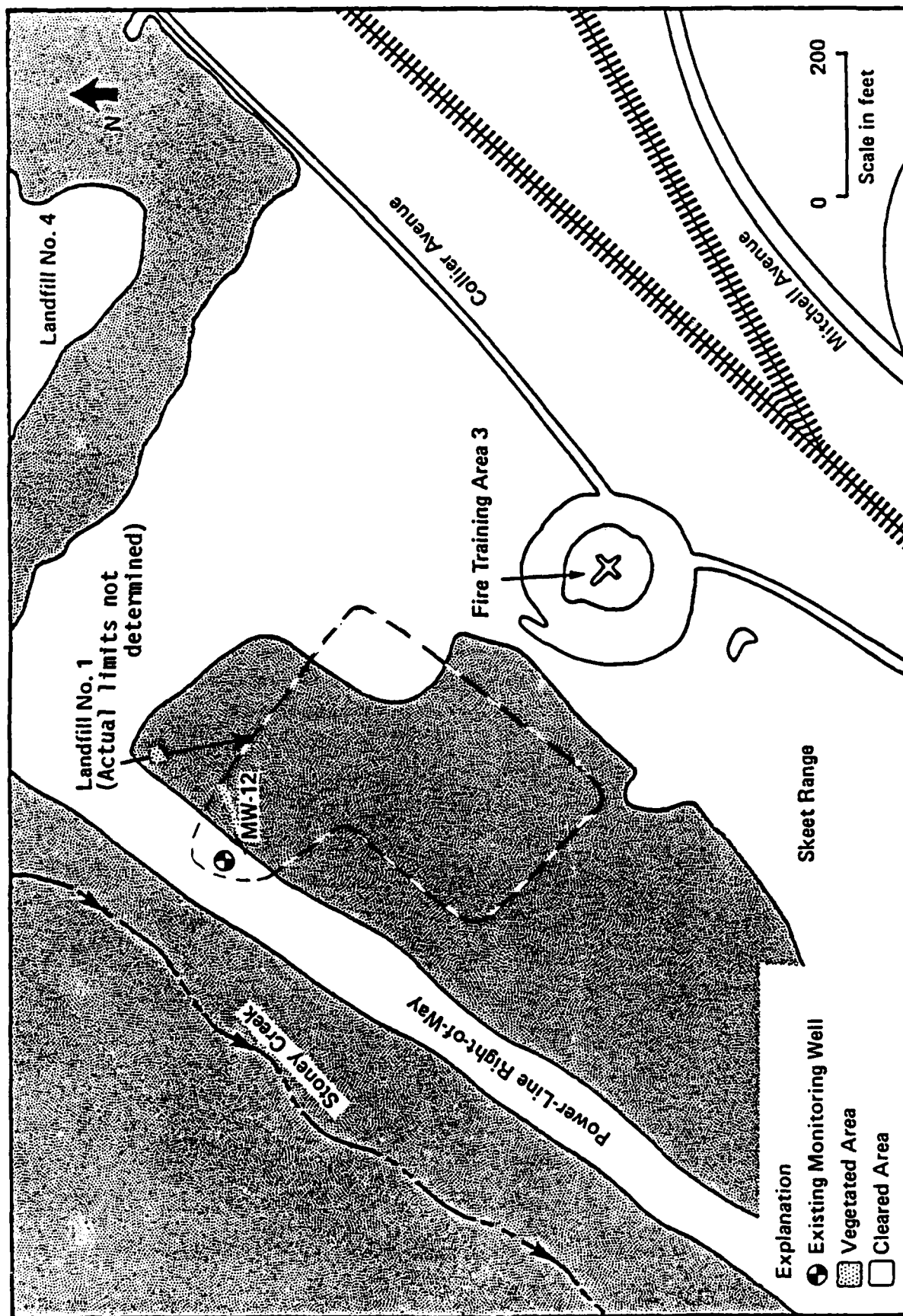


FIGURE 1-4. LOCATION OF SITE 3 (LANDFILL NO. 1)
SEYMOUR JOHNSON AFB, NC

TABLE 1-4. SUMMARY OF STAGE 1 GROUNDWATER ANALYSES;
SITE 3 (LANDFILL NO. 1)

Sampling Point: Date Sampled:		MW-12 4 MAR 84
<u>Indicator Parameters</u>	<u>(Units)</u>	
pH		5.5
Specific Conductance	(umhos/cm)	100
<u>Organic Parameters</u>		
Total Organic Carbon	(mg/l)	3.8

Note: Measurements of total organic halogen and phenol were below detection limits.

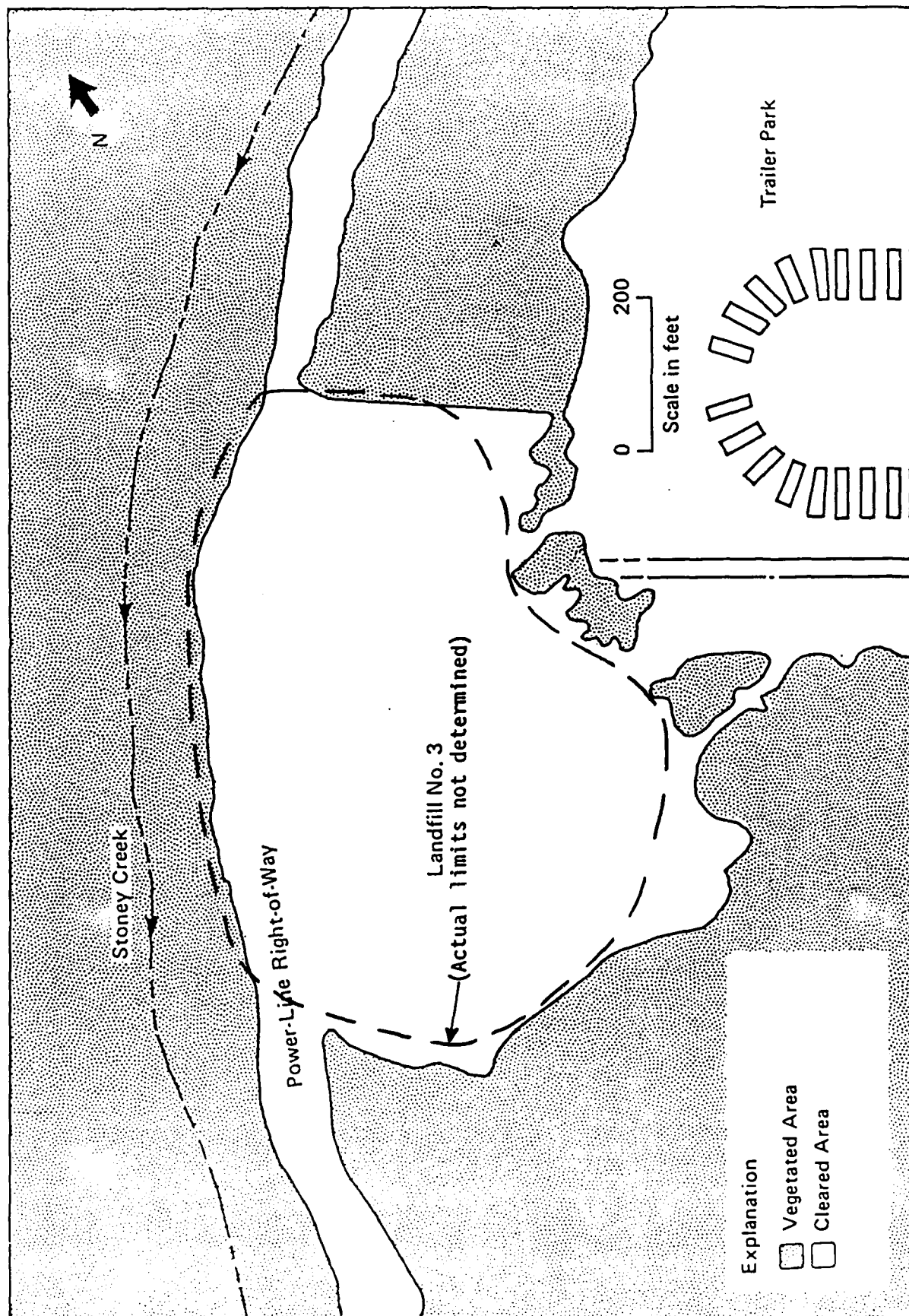


FIGURE 1-5. LOCATION OF SITE 4 (LANDFILL NO. 3)
SEYMOUR JOHNSON AFB, NC

the site and extended towards the northeast. The depth of the trenches decreased to 3 to 4 feet as the landfiling operations approached Stoney Creek. The early operational procedures included daily burning and covering, however, during the final stages of landfiling, the burning practice was discontinued. The waste materials disposed in the landfill include general refuse, glass, coal bottom ash and paint residues. Small quantities of spent solvents and other miscellaneous industrial wastes may have been disposed in this landfill. No contaminated fuels or oils were disposed of in the landfill. The area was closed and covered with two feet of sandy-loam soil in 1970. Landfill No. 3 was not investigated during the Phase II, Stage 1 Survey.

1.5.5 Site 5 - DPDO Waste Storage Area

Site 5 is located on the northern section of the Base, just south of Fickel Street (Figure 1-6). The area is enclosed by a fence but is not paved. No known spills have occurred from the hazardous waste tank. There are also no obvious indications of spills on the ground surface. An underground storage tank exists at the site and is used to store commingled POL waste products. Pesticides and waste solvents have also been stored at the site.

The ground surface in the immediate vicinity of the site is relatively flat. There were some indications, noted during the Phase II, Stage 1 Survey, that some of the area had received soil fill. To the west, the site area slopes steeply for a few hundred feet and then reaches the wide, flat-lying plain occupied by Stoney Creek.

Four soil test borings were drilled around the site to depths of 30 feet during the Phase II, Stage 1 Survey but no monitoring wells were installed. Analyses of soil samples for lead, chromium, and oil and grease indicated some contamination of the soils possibly resulting from the DPDO Storage Area (Table 1-5). A more detailed discussion of the Stage 1 and Stage 2 monitoring results is provided in Section 4.

1.5.6 Site 6 - Coal Pile Storage Area

A large outdoor area was used from 1956 to 1972 for coal storage. The area is approximately 600 feet long by 200 feet wide and located adjacent to

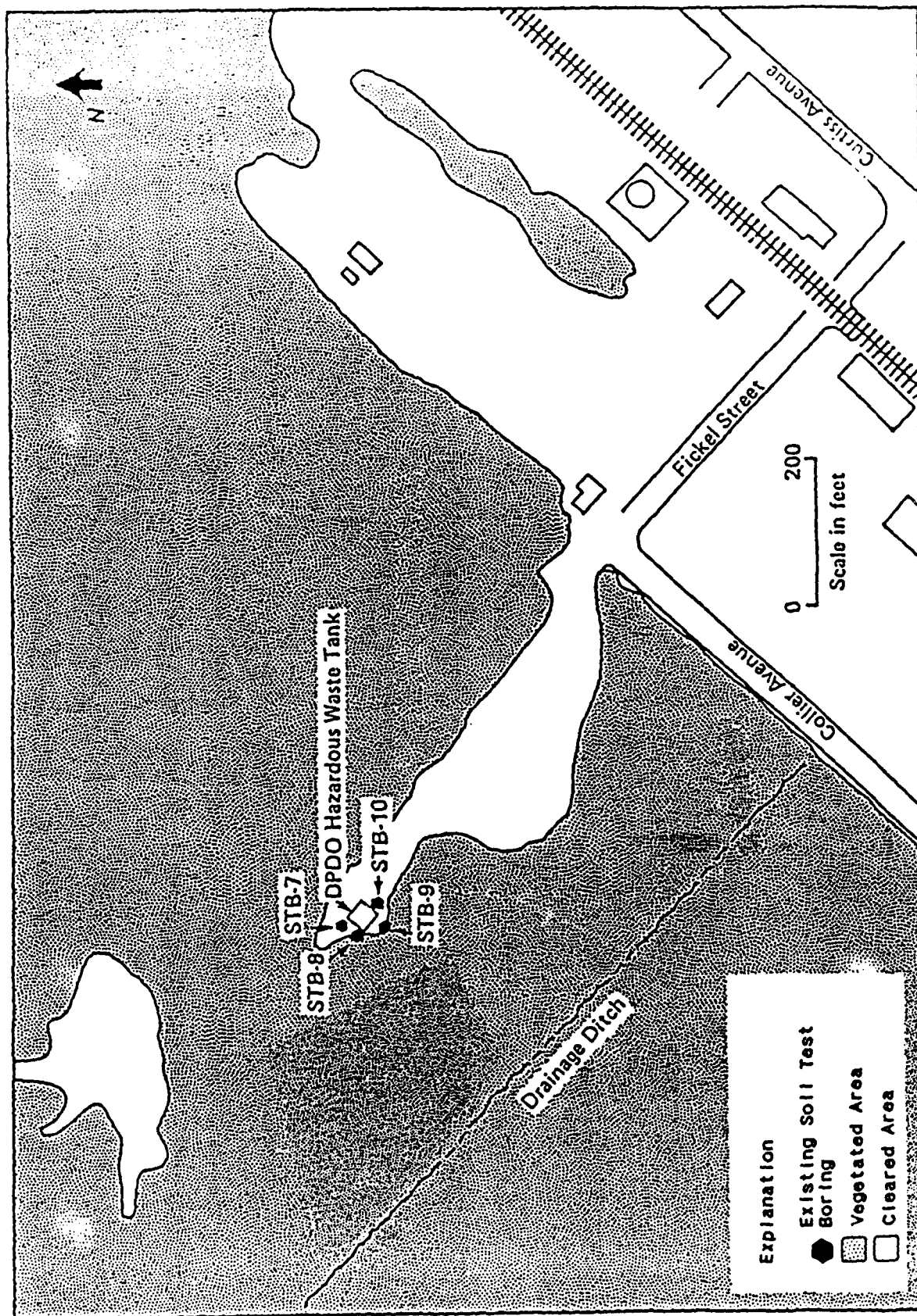


FIGURE 1-6. LOCATION OF SITE 5 (DPDO WASTE STORAGE AREA)
SEYMOUR JOHNSON AFB, NC

TABLE 1-5. RESULTS OF STAGE 1 CHEMICAL ANALYSIS (SOILS);
SITE 5 (DPDO)

Soil test boring number	Sample depth (ft)	Date drilled (1984)	Oil and grease (mg/Kg)	Lead (mg/Kg)	Chromium (mg/Kg)	Pestl- cides (mg/Kg)
STB-7	3	1-17	63.9	2.3	3.0	BDL
	9		BDL	3.0	7.5	BDL
	15		BDL	2.5	9.7	BDL
	21		BDL	3.3	7.3	BDL
	27		BDL	BDL	4.6	BDL
STB-8	3	1-17	243.3	676.0	71.0	BDL
	9		BDL	BDL	2.5	BDL
	15		BDL	6.8	3.1	BDL
	21		BDL	0.8	8.2	BDL
	27		BDL	3.5	7.4	BDL
STB-9	3	1-17	9,074.0	0.6	6.8	BDL
	9		BDL	2.6	2.9	BDL
	15		BDL	2.4	10.2	BDL
	21		BDL	1.1	7.8	BDL
	27		BDL	9.5	3.0	BDL
STB-10	3	1-17	BDL	0.9	3.1	BDL
	9		BDL	0.9	4.2	BDL
	15		BDL	1.6	6.4	BDL
	21		BDL	1.8	6.7	BDL
	27		BDL	2.3	5.9	BDL

BDL = Below detection limits

the heat plant between Curtis Avenue and Fickle Street (Figure 1-7). Coal residue is still noticeable in the area. No liners or surface barriers were provided for the coal pile during its active use. The coal pile has been depleted for ten years and only small amounts of coal residues are present on the surface. As indicated in the Phase I report, soil sampling completed in the coal pile area at the time of the Phase I investigation apparently indicated no metals concentrations above background levels. The soil sampling at the coal pile referred to in the Phase I report was not done as a part of the IRP Phase I. The coal pile was not investigated during the Phase II, Stage 1 Survey.

1.6 ANALYSES PERFORMED AT THE SITES

The laboratory analyses and field measurements required at the six sites are presented in Tables 1-6 through 1-11. The results of these analyses are described in detail in Section 4. The methods and detection limits listed in Tables 1-6 through 1-11 are those requested in the Statement of Work (Appendix A). In some cases, as noted in Tables 1-12 and 1-13, there were inadvertent substitutions of methods by laboratory personnel as a result of miscommunications, or requested detection limits were not actually achieved at the time and conditions of analysis.

The methods used in place of those prescribed have been carefully reviewed. In the first case, Cyanide Method E335.2 was used instead of Cyanide Method 412B,C. A side-by-side comparison of each of the components of the two procedures indicates only minor differences. Cyanide Method E335.2, which has been used by RTI for previous Air Force work, is fully expected to yield results statistically equivalent to those acquired by Cyanide Method 412B,C.

In the second case, EPA Methods E601, E602, and E625 were used rather than Methods SW8010, SW8020 and SW8270. EPA-601 and SW-846/SW8010 for halogenated volatile organics have been compared. Principle differences include the following:

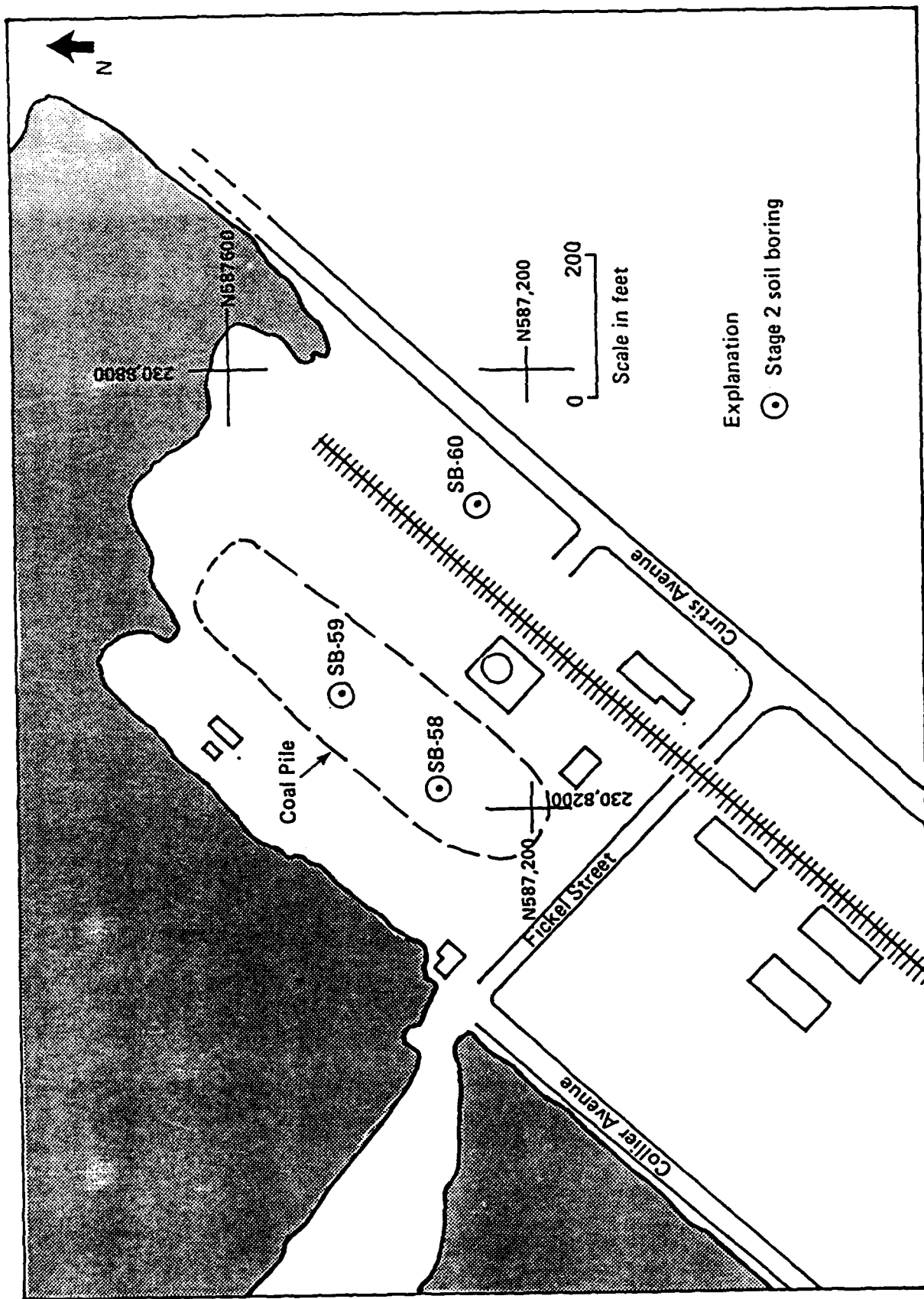


FIGURE 1-7. LOCATION OF SOIL BORINGS AT SITE 6 (COAL PILE STORAGE AREA)
SEYMOUR JOHNSON AFB, NC

- The detection limit for SW-846/SW8010 is 10 ug/L vs. 1.0 ug/L for EPA-601.
- The SW-846/SW8010 list of deliverable compounds is different from the EPA-601 list. The EPA-601 list contains indicator compounds which have been proven to be sufficiently representative in determining the presence of contamination in water and soil.
- Method SW-846/SW8010 requires a five-point calibration curve. The method used has a one-point calibration curve. Previous check samples (blinds and knowns) have proven the acceptability of the accuracy of the one-point, mid-range calibration.

EPA-602 and SW-846/SW8020 for aromatic volatile organics have also been compared and have essentially identical hardware requirements.

Principle differences include the following:

- The SW-846/SW8020 list of deliverable compounds is different from the EPA-602 list. However, the only compound not included on the EPA-602 deliverable list is xylene. Xylene can be and was quantitated from data gathered as part of the EPA-602 procedure.
- The detection limit for SW-846/SW8020 is 10 ug/L vs. 1.0 ug/L for EPA-602.
- Method SW-846-SW8020 requires a five-point calibration curve, whereas a one-point, mid-range calibration was performed. The accuracy of the one-point, mid-range calibration has been proven as in the case of EPA-601.

Finally, EPA-625 and SW-846/SW8270 for acid extractables have been compared. Again, hardware requirements are essentially identical.

Principle differences include the following:

- The SW-846/SW8270 list of deliverable compounds is different from the EPA-625 list. The EPA-625 list contains indicator compounds which have been proven to be sufficiently representative in determining the presence of contamination in water and soil.
- As with the other SW-846 methods, SW-846/SW8270 requires a five-point calibration curve, whereas a one-point, mid-range calibration was performed. The accuracy of the one-point, mid-range calibration has been proven, as in the cases of EPA Methods 601 and 602.

Another question which has arisen is the matter of using the E series water methods (EPA-601, EPA-602) for soil samples. SW-846 protocols were followed. That is, the soil samples were mixed with a volume of deionized water and the resultant slurry purged with needle sparge to remove and collect the volatile organic compounds. Spiked internal standards (and surrogates in the case of EPA-601) were used as quality control instruments to indicate the achievement of acceptable recovery and precision.

The methods used in lieu of those specified are standard EPA methods which have been proven by EPA to yield results sufficiently accurate and precise to determine the presence of contamination in water and soil. The acceptability of the data for its intended purpose which has been obtained using those EPA methods has been still further verified through performance of standard quality control procedures. Additionally, USAFOEHL/TSS has approved the substitution of the aforementioned chemistry methods through the implementation of modification 01 to the initial Statement of Work.

1.7 IDENTIFICATION OF FIELD TEAM

The preliminary field activities included site reconnaissance, layout of boring locations, and development of detailed field procedures and safety plans. These activities included the following RTI professional staff:

W. J. Alexander	- Project Leader
S. L. Winters	- Project Hydrogeologist
S. A. Guthrie	- Field Hydrogeologist
R. W. Pratt	- Project Safety Officer
S. K. Liddle	- Development of Field Procedures

The primary field activities included drilling of soil borings, collection and classification of soil samples, supervision of monitoring-well installation, development of new and previously installed monitoring wells, and collection and custody of groundwater, surface-water, and sediment samples. The field team for these primary field activities included:

S. L. Winters	- Project Hydrogeologist
S. A. Guthrie	- Field Hydrogeologist
C. O. Whitaker	- Environmental Scientist

The primary field activities were performed between September 1986 and February 1987. Additional environmental samples were collected in April 1987. Resumes of key RTI professional staff involved in the Stage 2 Survey are provided in Appendix B.

TABLE 1-6. ANALYSES REQUIRED FOR SITE 1 (FIRE TRAINING AREA NO. 3)

Analytical Parameter	Method	Detection Limit	Existing Well	New Wells			
				MW-11	MW-40	MW-41	MW-42
<u>Petroleum Hydrocarbons</u>							
- Water	E418.1	1 mg/L	x	x	x	x	x
<u>Aromatic Volatile Organics</u>							
- Water	SW5030/ SW8020	*	x	x	x	x	x
<u>Halogenated Volatile Organics</u>							
- Water	E601	*	x	x	x	x	x
<u>Lead</u>							
- Water	E239.2	0.002 mg/L	x	x	x	x	x
<u>Specific Conductance 1)</u>							
- Water	E120.1 1)	---	x	x	x	x	x
<u>pH 1)</u>							
- Water	E150.1 1)	---	x	x	x	x	x
<u>Temperature 1)</u>							
- Water	E170.1 1)	---	x	x	x	x	x

- x Analysis to be done
 * Detection limits as specified by the procedure
 --- Detection limits dependent on field conditions
 1) Field Tests

TABLE 1-7. ANALYSES REQUIRED FOR SITE 2 (LANDFILL 4); p. 1 of 3

Analytical Parameter	Method	Detection Limit	Existing Wells	New Shallow Wells	New Deep Well	Seepage	Sediment
<u>Petroleum Hydrocarbons</u>							
- Water	E418.1	1 mg/L	x	x	x	x	
- Soil	SW3550/ E418.1	1 mg/kg					x
<u>Aromatic Volatile Organics</u>							
- Water	SW5030/ SW8020	*	x	x	x	x	
- Soil	SW5030/ SW8020	*					x
<u>Halogenated Volatile Organics</u>							
- Water	E601	*	x	x	x	x	
- Soil	SW5030/ SW8010	*					x
<u>13 Priority Pollutant Metals (Water)</u>							
Arsenic	E206.2	0.001 mg/L	x	x	x	x	
Antimony	E200.7	0.032 mg/L	x	x	x	x	
Beryllium	"	0.0003 mg/L	x	x	x	x	
Cadmium	"	0.004 mg/L	x	x	x	x	
Chromium	"	0.007 mg/L	x	x	x	x	
Copper	"	0.006 mg/L	x	x	x	x	
Lead	"	0.042 mg/L	x	x	x	x	
Mercury	E245.1	0.0002 mg/L	x	x	x	x	
Nickel	E200.7	0.015 mg/L	x	x	x	x	
Selenium	E270.2	0.002 mg/L	x	x	x	x	
Silver	E200.7	0.007 mg/L	x	x	x	x	
Thallium	"	0.040 mg/L	x	x	x	x	
Zinc	"	0.002 mg/L	x	x	x	x	

TABLE 1-7. REQUIRED ANALYSES FOR SITE 2 (LANDFILL 4); p. 2 of 3

Analytical Parameter	Method	Detection Limit	Existing Wells	New Shallow Wells	New Deep Well	Seepage	Sediment
<u>13 Priority Pollutant Metals (Soil)</u>							
Arsenic	SW3050/ SW7060	0.1 mg/kg	MW-13 MW-14	MW-43 MW-44 MW-45 MW-46 MW-47 MW-48	MW-49	SM-10 SM-11	SD-10 SD-11
Antimony	SW3050/ SW6010	3.2 mg/kg					
Beryllium	"	0.03 mg/kg					
Cadmium	"	0.4 mg/kg					
Chromium	"	0.7 mg/kg					
Copper	"	0.6 mg/kg					
Lead	"	4.2 mg/kg					
Mercury	SW7471	0.1 mg/kg					
Nickel	SW3050/ SW6010	1.5 mg/kg					
Selenium	SW3050/ SW7740	0.2 mg/kg					
Silver	SW3050/ SW6010	0.7 mg/kg					
Thallium	"	4.0 mg/kg					
Zinc	"	0.2 mg/kg					
<u>Extractable Priority Pollutants</u>							
- Water	E625	#	x	x	x	x	
- Soil	SW3550/ SW8270	#					
<u>Common Anions</u>							
Bromide	A429	0.1 mg/L	x	x	x	x	x
Chloride	"	0.1 mg/L	x	x	x	x	x
Fluoride	"	0.05 mg/L	x	x	x	x	x
Nitrate	"	0.1 mg/L	x	x	x	x	x
Nitrite	"	0.1 mg/L	x	x	x	x	x
Phosphate	"	0.1 mg/L	x	x	x	x	x
Sulfate	"	0.1 mg/L	x	x	x	x	x

TABLE 1-7. REQUIRED ANALYSES FOR SITE 2 (LANDFILL 4); P. 3 of 3

Analytical Parameter	Method	Detection Limit	Existing Wells	New Shallow Wells	New Deep Well	Seepage	Sediment
<u>Specific Conductance</u>							
- Water	E120.1	---	MW-13 MW-14 x x	MW-43 MW-44 MW-45 MW-46 MW-47 MW-48 x x x x x x	MW-49 x	SM-10 SW-11 x x	SD-10 SD-11 x x
<u>pH</u>							
- Water	E150.1 1)	---	x	x x x x x x	x	x x	x
<u>Total Dissolved Solids</u>							
- Water	E160.1 1)	10 mg/L	x	x x x x x x	x	x x	x
<u>Temperature</u>							
- Water	E170.1 1)	---	x	x x x x x x	x	x x	x

x Analysis to be done
 * Detection limits as specified by the method
 --- Detection limits dependent on field conditions
 1) Field Tests

TABLE 1-8. REQUIRED ANALYSES FOR SITE 3 (LANDFILL No. 1)

Analytical Parameter	Method	Detection Limit	Existing Well
<u>Petroleum Hydrocarbons</u>			
			MW-12
- Water	E418.1	1 mg/L	x
<u>Aromatic Volatile Organics</u>			
- Water	SW5030/ SW8020	*	x
<u>Halogenated Volatile Organics</u>			
- Water	E601	*	x
<u>13 Priority Pollutant Metals (Water)</u>			
Arsenic	E206.2	0.001 mg/L	x
Antimony	E200.7	0.032 mg/L	x
Beryllium	"	0.0003 mg/L	x
Cadmium	"	0.004 mg/L	x
Chromium	"	0.007 mg/L	x
Copper	"	0.006 mg/L	x
Lead	"	0.042 mg/L	x
Mercury	E245.1	0.0002 mg/L	x
Nickel	E200.7	0.015 mg/L	x
Selenium	E270.2	0.002 mg/L	x
Silver	E200.7	0.007 mg/L	x
Thallium	"	0.040 mg/L	x
Zinc	"	0.002 mg/L	x
<u>Extractable Priority Pollutants</u>			
- Water	E625	*	x
<u>Common Anions</u>			
Bromide	A429	0.1 mg/L	x
Chloride	"	0.1 mg/L	x
Fluoride	"	0.05 mg/L	x
Nitrate	"	0.1 mg/L	x
Nitrite	"	0.1 mg/L	x
Phosphate	"	0.1 mg/L	x
Sulfate	"	0.1 mg/L	x
<u>Specific Conductance</u>			
- Water	E120.1	---	x
<u>pH</u>			
- Water	E150.1 ¹⁾	---	x
<u>Total Dissolved Solids</u>			
- Water	E160.1 ¹⁾	10mg/L	x
<u>Temperature</u>			
- Water	E170.1 ¹⁾	---	x

x Analysis to be done

* Detection limits as specified by the method

--- Detection limits dependent on field conditions

1) Field Tests

TABLE 1-9. REQUIRED ANALYSES FOR SITE 4 (LANDFILL No. 3)

Analytical Parameter	Method	Detection Limit	New Wells			
			MW-50	MW-51	MW-52	MW-53
<u>Petroleum Hydrocarbons</u>						
- Water	E418.1	1 mg/L	x	x	x	x
<u>Aromatic Volatile Organics</u>						
- Water	SW5030/ SW8020	*	x	x	x	x
<u>Halogenated Volatile Organics</u>						
- Water	E601	*	x	x	x	x
<u>13 Priority Pollutant Metals (Water)</u>						
Arsenic	E206.2	0.001 mg/L	x	x	x	x
Antimony	E200.7	0.032 mg/L	x	x	x	x
Beryllium	"	0.0003 mg/L	x	x	x	x
Cadmium	"	0.004 mg/L	x	x	x	x
Chromium	"	0.007 mg/L	x	x	x	x
Copper	"	0.006 mg/L	x	x	x	x
Lead	"	0.042 mg/L	x	x	x	x
Mercury	E245.1	0.0002 mg/L	x	x	x	x
Nickel	E200.7	0.015 mg/L	x	x	x	x
Selenium	E270.2	0.002 mg/L	x	x	x	x
Silver	E200.7	0.007 mg/L	x	x	x	x
Thallium	"	0.040 mg/L	x	x	x	x
Zinc	"	0.002 mg/L	x	x	x	x
<u>Extractable Priority Pollutants</u>						
- Water	E625	*	x	x	x	x
<u>Common Anions</u>						
Bromide	A429	0.1 mg/L	x	x	x	x
Chloride	"	0.1 mg/L	x	x	x	x
Fluoride	"	0.05 mg/L	x	x	x	x
Nitrate	"	0.1 mg/L	x	x	x	x
Nitrite	"	0.1 mg/L	x	x	x	x
Phosphate	"	0.1 mg/L	x	x	x	x
Sulfate	"	0.1 mg/L	x	x	x	x
<u>Specific Conductance</u>						
- Water	E120.1	---	x	x	x	x
<u>pH</u>						
- Water	E150.1 ¹⁾	---	x	x	x	x
<u>Total Dissolved Solids</u>						
- Water	E160.1 ¹⁾	10 mg/L	x	x	x	x
<u>Temperature</u>						
- Water	E170.1 ¹⁾	---	x	x	x	x

x Analysis to be done

* Detection limits as specified by the method

--- Detection limits dependent on field conditions

1) Field Tests

TABLE 1-10. REQUIRED ANALYSES FOR SITE 5 (DPDO WASTE SITE); p. 1 of 3

Analytical Parameter	Method	Detection Limit	New Well	1) Soil Borings				Surface Water		Sediment	
			MW-54	SB-55	SB-56	SB-57	SW-12	SW-13	SD-12	SD-13	
<u>Petroleum Hydrocarbons</u>											
- Water	E418.1	1 mg/L	x				x	x			
- Soil	SW3550/ E418.1	1 mg/kg		x	x	x			x	x	
<u>Aromatic Volatile Organics</u>											
- Water	SW5030/ SW8020	*	x				x	x			
- Soil	SW5030/ SW8020	*		x	x	x			x	x	
<u>Halogenated Volatile Organics</u>											
- Water	E601	*	x				x	x			
- Soil	SW5030/ SW8010	*		x	x	x			x	x	
<u>Non-Halogenated Volatile Organics</u>											
- Water or Soil	SW5030/ SW8015	*	x	x	x	x	x	x	x	x	
<u>13 Priority Pollutant Metals (Water)</u>											
Arsenic	E206.2	0.001 mg/L	x				x	x			
Antimony	E200.7	0.032 mg/L	x				x	x			
Beryllium	"	0.0003 mg/L	x				x	x			
Cadmium	"	0.004 mg/L	x				x	x			
Chromium	"	0.007 mg/L	x				x	x			
Copper	"	0.006 mg/L	x				x	x			
Lead	"	0.042 mg/L	x				x	x			
Mercury	E245.1	0.0002 mg/L	x				x	x			
Nickel	E200.7	0.015 mg/L	x				x	x			
Selenium	E270.2	0.002 mg/L	x				x	x			
Silver	E200.7	0.007 mg/L	x				x	x			
Thallium	"	0.040 mg/L	x				x	x			
Zinc	"	0.002 mg/L	x				x	x			

1) = As many as six samples per borehole maybe collected and analyzed for these parameters.

TABLE 1-10. REQUIRED ANALYSES FOR SITE 5 (DPDO WASTE SITE); p. 2 of 3

Analytical Parameter	Method	Detection Limit	New Well	1) Soil Borings				Surface Water		Sediment	
			MW-54	SB-55	SB-56	SB-57	SW-12	SW-13	SD-12	SD-13	
<u>13 Priority Pollutant Metals (Soil)</u>											
Arsenic	SW3050/ SW7060	0.1 mg/kg			x	x	x			x	x
Antimony	SW3050/ SW6010	3.2 mg/kg			x	x	x			x	x
Beryllium	"	0.03 mg/kg			x	x	x			x	x
Cadmium	"	0.4 mg/kg			x	x	x			x	x
Chromium	"	0.7 mg/kg			x	x	x			x	x
Copper	"	0.6 mg/kg			x	x	x			x	x
Lead	"	4.2 mg/kg			x	x	x			x	x
Mercury	SW7471	0.1 mg/kg			x	x	x			x	x
Nickel	SW3050/ SW6010	1.5 mg/kg			x	x	x			x	x
Selenium	SW3050/ SW7740	0.2 mg/kg			x	x	x			x	x
Silver	SW3050/ SW6010	0.7 mg/kg			x	x	x			x	x
Thallium	"	4.0 mg/kg			x	x	x			x	x
Zinc	"	0.2 mg/kg			x	x	x			x	x
<u>Extractable Priority Pollutants</u>											
- Water	E625	*	x					x	x		
- Soil	SW3550/ SW8270	*			x	x	x			x	x
<u>Common Anions</u>											
Bromide	A429	0.1 mg/L	x					x	x		
Chloride	"	0.1 mg/L	x					x	x		
Fluoride	"	0.05 mg/L	x					x	x		
Nitrate	"	0.1 mg/L	x					x	x		
Nitrite	"	0.1 mg/L	x					x	x		
Phosphate	"	0.1 mg/L	x					x	x		
Sulfate	"	0.1 mg/L	x					x	x		

1) = As many as six samples per borehole maybe collected and analyzed for these parameters.

TABLE 1-10. REQUIRED ANALYSES FOR SITE 5 (DPDO WASTE SITE); p. 3 of 3

Analytical Parameter	Method	Detection Limit	New Well	1) Soil Borings				Surface Water		Sediment	
			MW-54	SB-55	SB-56	SB-57	SW-12	SW-13	SD-12	SD-13	
<u>Specific Conductance</u>											
- Water	E120.1 1)	---	x				x	x			
<u>pH</u>											
- Water	E150.1 1)	---	x				x	x			
<u>Temperature</u>											
- Water	E170.1 1)	---	x				x	x			
<u>Total Dissolved Solids</u>											
- Water	E160.1	10 mg/L	x				x	x			
<u>Total Cyanide</u>											
- Water	A412D	0.020 mg/L	x				x	x			
- Soil	A412D	20 mg/kg		x	x	x			x	x	
<u>Alkalinity (Water)</u>											
Bicarbonate	A403	10 mg/L	x				x	x			
Carbonate	A403	10 mg/L	x				x	x			
Hydroxide	A403	10 mg/L	x				x	x			

x Analysis to be done

* Detection limit as specified by the method

--- Detection limit dependent on field conditions

1) Field Tests

TABLE 1-11. REQUIRED ANALYSES FOR SITE 6 (COAL PILE)

Analytical Parameter	Method	Detection Limit	Soil Borings (3 Samples/Boring)		
			SB-58	SB-59	SB-60
<u>Total Metals Screen (Soil)</u>					
Aluminum	SW3050/ SW6010	4.5 mg/kg	xxx	xxx	xxx
Antimony	"	3.2 mg/kg	xxx	xxx	xxx
Barium	"	0.2 mg/kg	xxx	xxx	xxx
Beryllium	"	0.03 mg/kg	xxx	xxx	xxx
Boron	"	0.5 mg/kg	xxx	xxx	xxx
Cadmium	"	0.4 mg/kg	xxx	xxx	xxx
Calcium	"	1.0 mg/kg	xxx	xxx	xxx
Chromium	"	0.7 mg/kg	xxx	xxx	xxx
Cobalt	"	0.7 mg/kg	xxx	xxx	xxx
Copper	"	0.6 mg/kg	xxx	xxx	xxx
Iron	"	0.7 mg/kg	xxx	xxx	xxx
Lead	"	4.2 mg/kg	xxx	xxx	xxx
Magnesium	"	3.0 mg/kg	xxx	xxx	xxx
Manganese	"	0.2 mg/kg	xxx	xxx	xxx
Molybdenum	"	0.8 mg/kg	xxx	xxx	xxx
Nickel	"	1.5 mg/kg	xxx	xxx	xxx
Potassium	"	*	xxx	xxx	xxx
Silica	"	5.8 mg/kg	xxx	xxx	xxx
Silver	"	0.7 mg/kg	xxx	xxx	xxx
Sodium	"	2.9 mg/kg	xxx	xxx	xxx
Thallium	"	4.0 mg/kg	xxx	xxx	xxx
Vanadium	"	0.8 mg/kg	xxx	xxx	xxx
Zinc	"	0.2 mg/kg	xxx	xxx	xxx

x Analysis to be done

* Determine at the time of analysis

TABLE 1-12. COMPARISON OF ANALYTICAL METHODS (ORGANIC)

ANALYTICAL PARAMETERS	SPECIFIED METHODS	METHODS USED (IEA)	SPECIFIED DETECTION LIMITS	DETECTION LIMITS ACHIEVED (IEA)
Aromatic Volatile Organics Soil/Water - Xylene ²⁾	SW5030/ SW8020	E602 SW8020	10 ug/L 0.010 mg/Kg	1.0 ug/L 0.001 mg/Kg 1.0 ug/L ¹⁾
Halogenated Volatile Organics	E601 SW8010	E601	10 ug/L 0.010 mg/Kg	1.0 ug/L 1.0 mg/Kg
Petroleum Hydrocarbons - Water - Soil	E418.1 SW3550/ E418.1	E418.1 SW3550/ E418.1	1 mg/L 1 mg/Kg	2.0 mg/L 25 mg/Kg
Non-Halogenated Volatile Organics - Soil/Water	SW5030/ SW8015	SW5030/ SW8015		<25 ug/L ¹⁾ <0.025 mg/Kg
Acid Extractables (Water) - 2,4-Dinitrophenol - 2-Methyl-4,6-Dinitrophenol	E625	SW3550/625A	10 ug/L ⁴⁾ 50 ug/L 50 ug/L	25 ug/L ³⁾ 250 ug/L 250 ug/L
Acid Extractables (Soil) - 2,4-Dinitrophenol - 2-Methyl-4,6-Dinitrophenol	SW3550/ SW8270	SW3550/625A	3.30 mg/Kg ⁴⁾ 3.30 mg/Kg ⁴⁾ 3.30 mg/Kg ⁴⁾	1.0 mg/Kg ¹⁾ 10.0 mg/Kg 10.0 mg/Kg
Base/Neutral Extractables (Water) - Acenaphthene - Benzo (ght) Perylene - Indeno (1,2,3-cd) Pyrene	E625	SW3550/ 625B/N	10 mg/L ⁴⁾ 50 mg/L ⁴⁾ 50 mg/L ⁴⁾ 50 mg/L ⁴⁾	10 ug/L ³⁾ 25 ug/L 25 ug/L 25 ug/L
Base/Neutral Extractables (Soil) - Acenaphthene - Benzo (ght) Perylene - Indeno (1,2,3-cd) Pyrene	SW3550/ SW8270	SW3550/ 625B/N	0.66 mg/g ⁴⁾ 0.66 mg/g ⁴⁾ 0.66 mg/g ⁴⁾ 0.66 mg/g ⁴⁾	0.400 mg/Kg ¹⁾ 1.000 mg/Kg 1.000 mg/Kg 1.000 mg/Kg
PCB's and Pesticides	SW3550/ SW8270W	SW3550/ 625B/N	(not specified)	10 mg/L 400 mg/Kg

1) Matrix Dependent (IEA)

2) Xylene was Quantitated as Ethlybenzene in method 602 for IEA reports 103, 107, 119, 123, 125, and 126

3) Elevated detection limits due to matrix interference

4) SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods; Laboratory Manual, Volume 18.

TABLE 1-13. COMPARISON OF ANALYTICAL METHODS (INORGANIC); p. 1 of 3

ANALYTICAL PARAMETERS	SPECIFIED METHODS	METHODS USED	SPECIFIED DETECTION LIMITS	DETECTION LIMITS ACHIEVED
<u>13 Priority Pollutant Metals (Soil)</u>				
Arsenic	SW3050/SW7060	SW3050/SW7060	0.1 mg/Kg	0.13
Antimony	SW3050/SW7041	SW3050/SW7041	3.2 mg/Kg	0.9 mg/Kg
Beryllium	SW3050/SW6010	SW3050/SW6010	0.03 mg/Kg	0.12 mg/Kg
Cadmium	SW3050/SW6010	SW3050/SW6010	0.4 mg/Kg	0.34 mg/Kg
Chromium	SW3050/SW6010	SW3050/SW6010	0.7 mg/Kg	0.8 mg/Kg
Copper	SW3050/SW6010	SW3050/SW6010	0.6 mg/Kg	0.9 mg/Kg
Lead	SW3050/SW6010	SW3050/SW6010	4.2 mg/Kg	3.5 mg/Kg
Mercury	SW7471	SW7471	0.1 mg/Kg	0.10 mg/Kg
Nickel	SW3050/SW6010	SW3050/SW6010	1.5 mg/Kg	1.0 mg/Kg
Selenium	SW3050/SW7740	SW3050/SW7740	0.2 mg/Kg	0.22 mg/Kg
Silver	SW3050/SW6010	SW3050/SW6010	0.7 mg/Kg	0.6 mg/Kg
Thallium	SW3050/SW7841	SW3050/SW7841	4.0 mg/Kg	0.20 mg/Kg
Zinc	SW3050/SW6010	SW3050/SW6010	0.2 mg/Kg	0.3 mg/Kg
Iron*	(not specified)	SW3050/SW6010	---	4.50 mg/Kg
Aluminum*	(not specified)	SW3050/SW6010	---	4.00 mg/Kg
<u>13 Priority Pollutant Metals (Water)</u>				
Arsenic	E206.2	E206.2	0.001 mg/L	0.002 mg/L
Antimony	E204.2	E204.2	0.032 mg/L	0.009 mg/L
Beryllium	E200.7	E200.7	0.0003 mg/L	0.0012 mg/L
Cadmium	E200.7	E200.7	0.004 mg/L	0.006 mg/L
Chromium	E200.7	E200.7	0.007 mg/L	0.008 mg/L
Copper	E200.7	E200.7	0.606 mg/L	0.014 mg/L
Lead	E200.7	E200.7	0.042 mg/L	0.005 mg/L
Mercury	E245.1	E245.1	0.0002 mg/L	0.0002 mg/L
Nickel	E200.7	E200.7	0.002 mg/L	0.004 mg/L
Selenium	E270.2	E270.2	0.002 mg/L	0.004 mg/L
Silver	E200.7	E200.7	0.007 mg/L	0.007 mg/L
Thallium	E200.7	E200.7	0.040 mg/L	0.002 mg/L
Zinc	E200.7	E200.7	0.002 mg/L	0.003 mg/L

* Not a priority pollutant metal

TABLE 1-13. COMPARISON OF ANALYTICAL METHODS; p. 2 of 3

ANALYTICAL PARAMETERS	SPECIFIED METHODS	METHODS USED	SPECIFIED DETECTION LIMITS	DETECTION LIMITS ACHIEVED
<u>Total Metals Screen Soil</u>				
Aluminum	SW3050/SW6010	SW3050/SW6010	4.5 mg/Kg	---
Antimony	SW3050/SW7041	SW3050/SW7041	3.2 mg/Kg	0.9 mg/Kg
Barium	SW3050/SW6010	SW3050/SW6010	0.2 mg/Kg	1.0 mg/Kg
Beryllium	SW3050/SW6010	SW3050/SW6010	0.03 mg/Kg	0.12 mg/Kg
Boron	SW3050/SW6010	SW3050/SW6010	0.5 mg/Kg	2.4 mg/Kg
Cadmium	SW3050/SW6010	SW3050/SW6010	0.4 mg/Kg	0.34 mg/Kg
Calcium	SW3050/SW6010	SW3050/SW6010	1.0 mg/Kg	2.4 mg/Kg
Chromium	SW3050/SW6010	SW3050/SW6010	0.7 mg/Kg	0.5 mg/Kg
Cobalt	SW3050/SW6010	SW3050/SW6010	0.7 mg/Kg	0.8 mg/Kg
Copper	SW3050/SW6010	SW3050/SW6010	0.6 mg/Kg	0.9 mg/Kg
Iron	SW3050/SW6010	SW3050/SW6010	0.7 mg/Kg	4.5 mg/Kg
Lead	SW3050/SW6010	SW3050/SW6010	4.2 mg/Kg	6.3 mg/Kg
Magnesium	SW3050/SW6010	SW3050/SW6010	3.0 mg/Kg	12.0 mg/Kg
Manganese	SW3050/SW6010	SW3050/SW6010	0.2 mg/Kg	1.5 mg/Kg
Molybdenum	SW3050/SW6010	SW3050/SW6010	0.8 mg/Kg	0.9 mg/Kg
Nickel	SW3050/SW6010	SW3050/SW6010	1.5 mg/Kg	3.0 mg/Kg
Potassium	SW3050/SW6010	SW3050/SW6010	4 mg/Kg	0.5 mg/Kg
Silica	SW3050/SW6010	SW3050/SW6010	5.8 mg/Kg	7.0 mg/Kg
Silver	SW3050/SW6010	SW3050/SW6010	0.7 mg/Kg	2.8 mg/Kg
Sodium	SW3050/SW6010	SW3050/SW6010	2.9 mg/Kg	12.0 mg/Kg
Thallium	SW3050/SW7841	SW3050/SW7841	4.0 mg/Kg	0.2 mg/Kg
Vanadium	SW3050/SW6010	SW3050/SW6010	0.8 mg/Kg	0.6 mg/Kg
Zinc	SW3050/SW6010	SW3050/SW6010	0.2 mg/Kg	0.6 mg/Kg

TABLE 1-13. COMPARISON OF ANALYTICAL METHODS; p. 3 of 3

ANALYTICAL PARAMETERS	SPECIFIED METHODS	METHODS USED	SPECIFIED DETECTION LIMITS	DETECTION LIMITS ACHIEVED
<u>Common Anions (Water)</u>	A429	A429	0.1 mg/L	0.01 mg/L
Fluoride			0.5 mg/L	0.01 mg/L
Chloride			0.01 mg/L	0.01 mg/L
Nitrate			0.03 mg/L	0.03 mg/L
Phosphate			0.60 mg/L	0.60 mg/L
Bromide			0.05 mg/L	0.05 mg/L
Nitrite			0.05 mg/L	0.05 mg/L
Sulfate			0.05 mg/L	0.05 mg/L
<u>Alkalinity (Water)</u>	A403	A403	10 mg/L	1.0 mg/L
<u>Lead (Water)</u>	E239.2	E239.2	0.002 mg/L	0.002 mg/L
<u>Total Cyanide</u> <u>(Water)</u> <u>(Soil)</u>	A412D A412D	E335.2 E335.2	0.020 mg/L 20 mg/Kg	0.020 mg/L 0.50 mg/L
<u>Total Dissolved Solids (Water)</u>	E160.1	E160.1	10 mg/L	± 5 mg/L

SECTION 2

ENVIRONMENTAL SETTING

2.1 PHYSIOGRAPHY

2.1.1 Location

Seymour Johnson AFB is located in the Atlantic Coastal Plain physiographic province. The North Carolina Coastal Plain has been subdivided into three physiographic regions and the Base is within the middle region (Figure 2-1). Scarps associated with former high stands of sea level delineate the regions. Major changes in soil conditions, stratigraphy, and geomorphology occur across these subdivisions.

The Piedmont-Coastal Plain boundary is marked by the fall line (Figure 2-1). The upper Coastal Plain extends east of the fall line to the Coats scarp (Figure 2-2). The lower Coastal Plain extends from the Surry scarp to the sea (Daniels, Gamble, and Wheeler, 1971).

The middle Coastal Plain is bounded on the west by the Coats scar and extends eastward to the Surry scarp (Figure 2-2). The elevation at the toe of the Coats scarp is 275 feet above mean sea level (msl). The elevation at the toe of the Surry scarp is 94 feet above msl. The middle Coastal Plain is an area of generally fluvial sediments, somewhat dissected, but with relatively broad flat areas between the streams. Three seaward sloping terrace plains (Brandywine, Coharie, and Sunderland) exist in the Neuse River Basin of the middle Coastal Plain (Figure 2-2). The Goldsboro area is on the post-Miocene Sunderland surface.

2.1.2 Climate

Precipitation in the Goldsboro area is greatest in July and least in December or January (Pusey, 1960). The mean annual precipitation measured at the Base according to data available from the Detachment 2, 3rd Weather Squadron, is about 50 inches. The net recharge to groundwater in Wayne County is estimated to be approximately 10 inches per year. The remaining 40 inches of precipitation is lost to surface runoff and evapotranspiration.

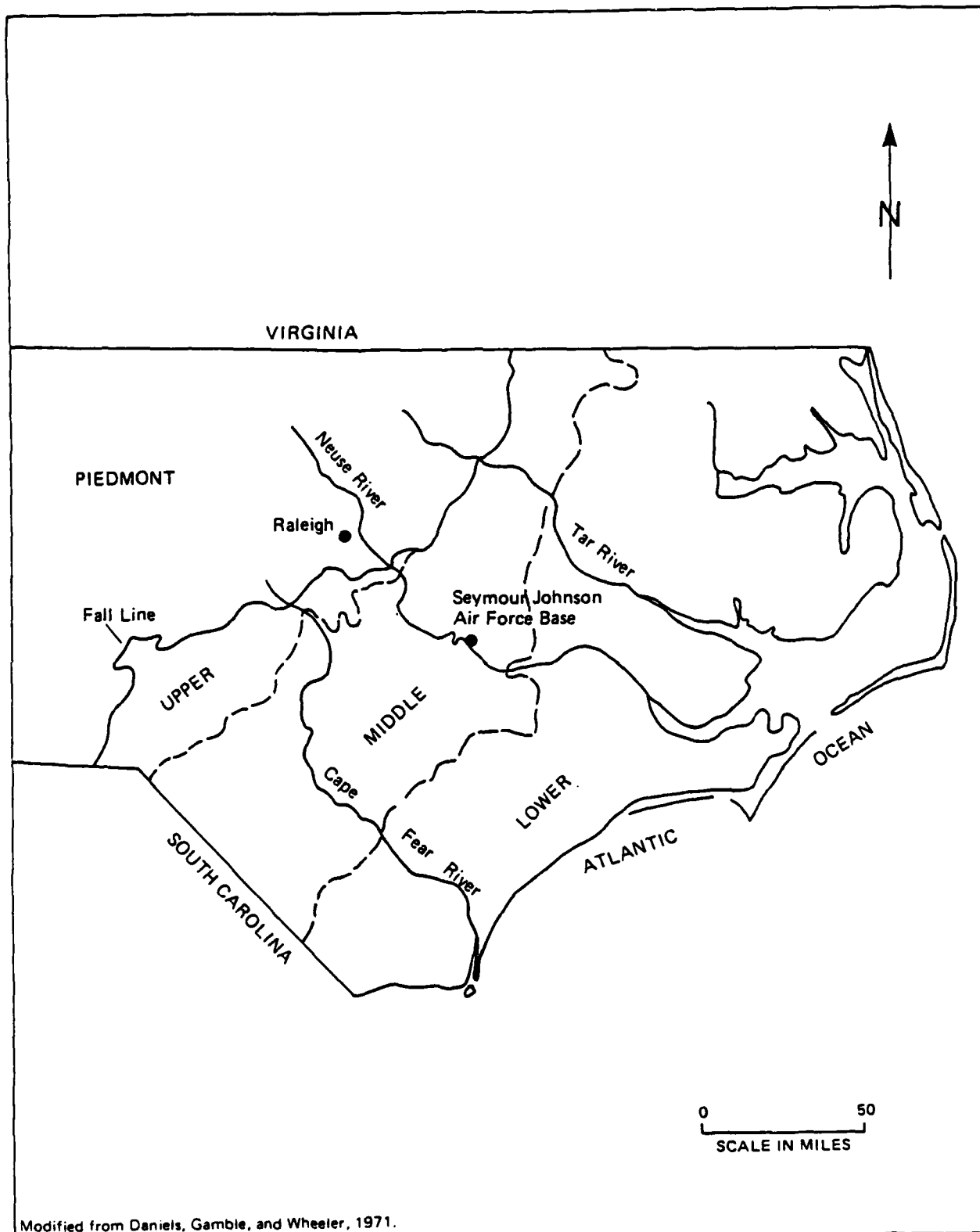


FIGURE 2-1. SUBDIVISIONS OF THE NORTH CAROLINA COASTAL PLAIN

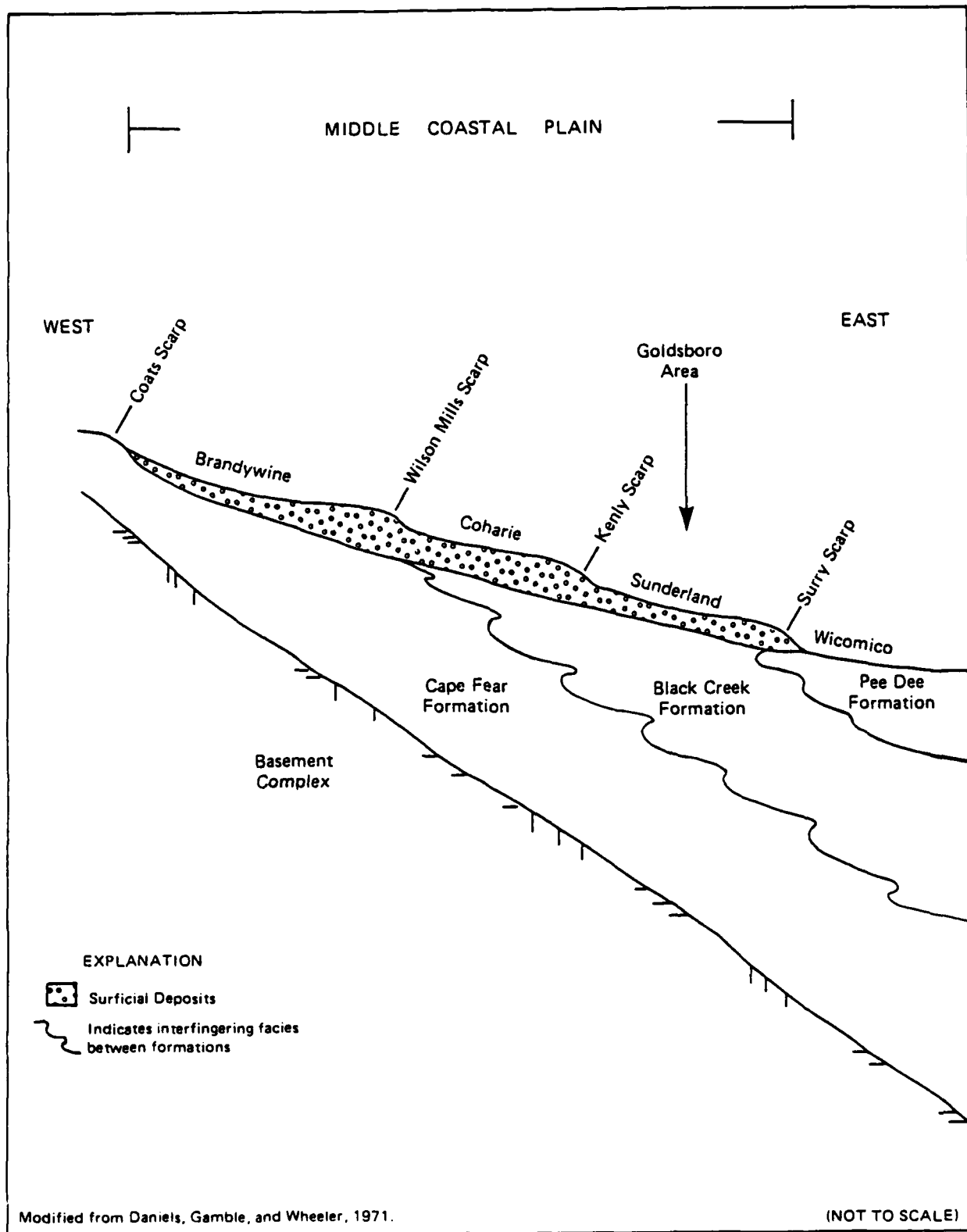


FIGURE 2-2. GENERALIZED CROSS SECTION THROUGH THE MIDDLE COASTAL PLAIN, NC

2.1.3 Topography and Drainage

Land surface elevations in the Goldsboro area average about 110 feet, msl. At the Base, the land surface slopes from about 112 feet above msl along the eastern side to 60 feet above msl along the Neuse River flood plain on the west. The Neuse River is the principal drainage feature at the Base. Drainage from the northern half of the Base enters Stoney Creek, a significant tributary to the Neuse in the Goldsboro area (Figure 1-1). The center line of Stoney Creek also serves as an installation boundary along the northwest side of the Base. The southern portion of the Base is drained by a manmade channel that also flows into the Neuse River. Drainage in much of the area surrounding the Base has been augmented by drainage ditches. The area is generally well drained with no normally occurring wetlands. The location of the 100 year flood plain is shown in Figure 2-3.

Sections of the Base are subject to flooding from Stoney Creek and the Neuse River during intense rainfall such as 100-year storm events. Stoney Creek drains an area of nearly 28 square miles at its confluence with the Neuse River. The Neuse River drains an area of some 2,420 square miles, measured from its point of origin to the west installation boundary.

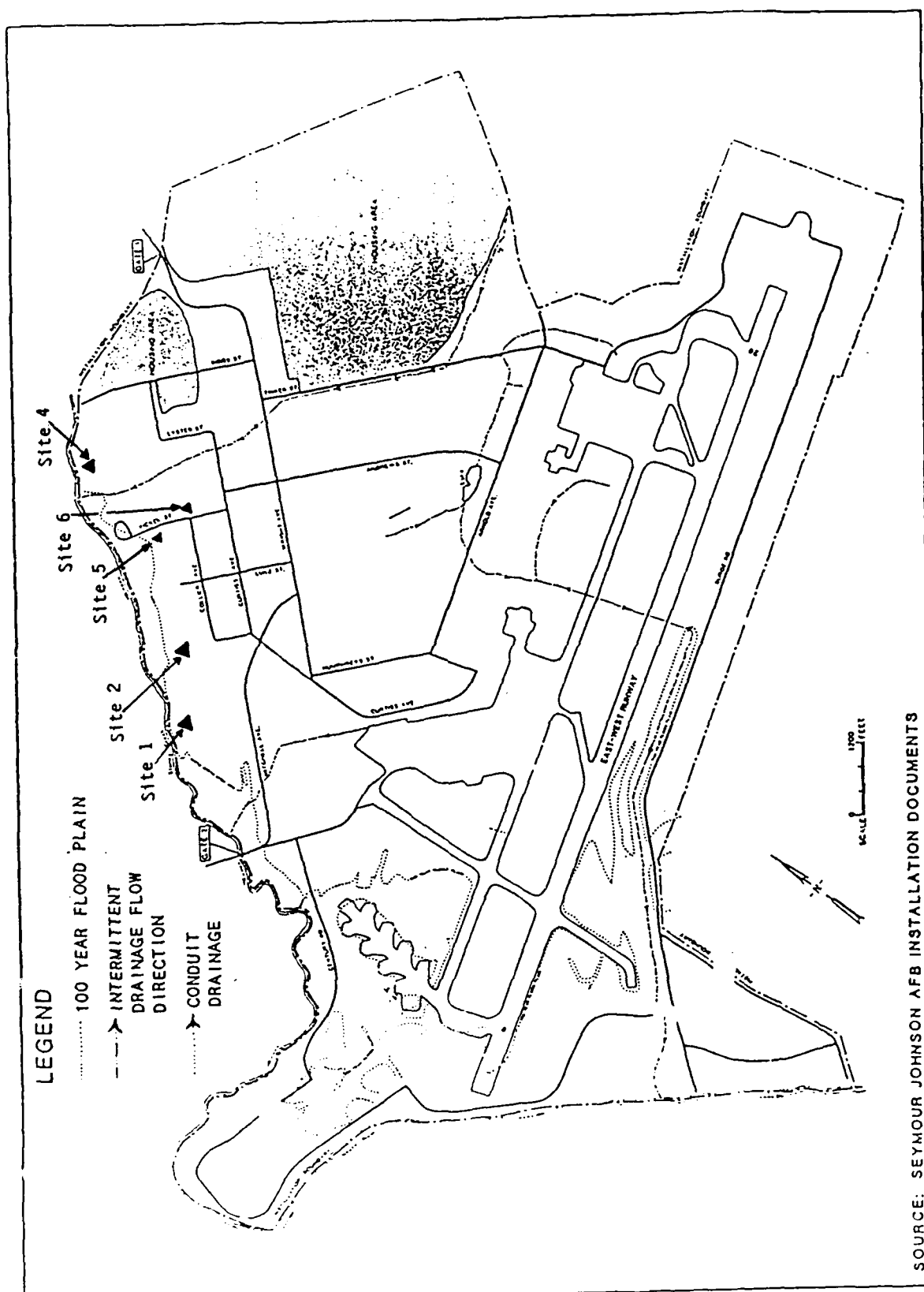
2.2 STRATIGRAPHY AND HYDROGEOLOGY OF THE MIDDLE COASTAL PLAIN

2.2.1 Stratigraphy

The general geology of Wayne County is indicated in Figure 2-4. In most of the county, sedimentary deposits rest unconformably on a basement complex of pre-Cretaceous rocks. The sedimentary deposits are largely unconsolidated and dip and thicken to the east (Figure 2-2). Only sedimentary deposits are of interest in this report because the basement complex is not a significant source of groundwater in the area.

Sedimentary deposits that have been identified in this area of the middle Coastal Plain include, in descending order:

- Surficial deposits
- Yorktown formation
- Castle Hayne limestone
- Peedee formation
- Black Creek formation
- Middendorf formation
- Cape Fear formation





The lithology and water-bearing properties of these deposits are summarized in Table 2-1 and discussed in more detail in the following subsection. Of these sedimentary units, only the surficial deposits, the Black Creek formation, and the Cape Fear formation are known to exist beneath Seymour Johnson AFB.

2.2.2 Hydrogeology of Sedimentary Deposits

The following discussions pertaining to the geology and general water-bearing characteristics of the sedimentary deposits are based on information provided in Robinson and Mann (1977), Pusey (1960), Zastrow (1982), Winner (1984), and Daniels, Gamble, and Wheeler (1971).

2.2.2.1 Surficial Deposits--In the Goldsboro area, surficial deposits of Holocene and Pliocene ages have been identified by Daniels, Gamble, and Wheeler (1971) as the Sunderland surface and Goldsboro sands, respectively. The deposits are predominantly sands or sandy clays and rest on the disconformable surface of the Black Creek formation. These deposits are of primary interest for this stage of the Phase II Survey and are further described in Section 4.

Groundwater occurs at shallow depths within the surficial deposits. The deposits supply small yields, typically less than 10 gallons per minute (gal/min) to domestic wells south of the Neuse River (Pusey, 1960). The groundwater in the surficial deposits contains objectionable amounts of iron and is soft and commonly corrosive to metals (Pusey, 1960).

2.2.2.2 Yorktown Formation--The Yorktown formation is composed of massive marine clays interbedded with thin shell beds. The formation occurs in the northern half of the county (Figure 2-4) and is not significant as a water supply in the context of this evaluation.

TABLE 2-1. LITHOLOGIC DESCRIPTIONS AND WATER-BEARING PROPERTIES OF GEOLOGIC DEPOSITS OR FORMATIONS IN THE WAYNE COUNTY AREA

System	Series	Geologic deposit or formation	Description of sediments	Aquifer designation and water-bearing properties
Quaternary	Holocene	Goldstboro sand	Gray to brown medium sand; few thin sandy clay lenses or beds	Surficial aquifer---supplies some domestic wells south of Neuse River. Yields typically <10 gal/min
		Pliocene	Clay to fine sandy clay to clay loam upper sediment; gradational contact to basal coarse sediments; coarse and fine gravel basal sediments	Surficial aquifer---supplies some domestic wells south of Neuse River. Yields typically <10 gal/min
		Miocene	Massive greenish-gray sticky, silty clay loam; sandy loam to loam beds. May be fossiliferous	Supplies some shallow wells (<60 ft deep) in northern Wayne County. Yields rarely >25 gal/min. Not present near Seymour Johnson AFB.
Tertiary	Eocene	Yorktown formation	Coarse, conglomeratic sandstone cemented by limy matrix grading to marl	Few water supplies developed in Wayne County. Yields <10 gal/min. Not present near Seymour Johnson AFB.
		Castle Hayne limestone	Gray to greenish-black calcareous, glauconitic clayey silts and fine-grained sands with thin beds of gray calcareous sand and hard sandy limestone	Not significant source of water in Wayne County. Not present near Seymour Johnson AFB. Yields range from 10 to 20 gal/min.
		Peedee	Gray to greenish-black calcareous, glauconitic clayey silts and fine-grained sands with thin beds of gray calcareous sand and hard sandy limestone	Black Creek aquifer. Used in conjunction with underlying Cape Fear aquifer. Supplies water to wells in southern and southeastern Wayne County. Well depths usually <150 ft. Yields range from 5 to 500 gal/min. Used at Seymour Johnson AFB.
Cretaceous	Upper Cretaceous	Black Creek	Gray to greenish montmorillonitic clays and thin beds of gray to white slightly glauconitic sand. Thin beds of hard, sandy limestone containing pyrite, lignite, and possibly colophane	Black Creek aquifer. Used in conjunction with underlying Cape Fear aquifer. Supplies water to wells in southern and southeastern Wayne County. Well depths usually <150 ft. Yields range from 5 to 500 gal/min. Used at Seymour Johnson AFB.
		Middendorf	Light-colored, cross-bedded, kaolinic sands with lenses of white massive kaolin. Lignite and pyrite common. Clays are non-calcareous	Not present in vicinity of Goldstboro
		Cape Fear	Light-colored, poorly sorted quartz sands and montmorillonitic clays with appreciable thicknesses of cross-bedded sands with delineated graded muds and sand-sandy mud complements thin upward into a structureless mud bed	Cape Fear aquifer. Used in conjunction with overlying Black Creek aquifer. Supplies water to municipal wells in central portion of Wayne County. Yields as high as 375 gal/min. Used at Seymour Johnson AFB.
Pre-Cretaceous		Basement	Basement rocks (metamorphic crystalline complex)	Produces low yields from fractures. Not an important source of groundwater in area.

--- Indicates discontinuity between deposits or formations.

2.2.2.3 Castle Hayne Limestone--The Castle Hayne limestone only occurs as isolated outliers of varying lithology in the southern part of Wayne County (Figure 2-4) and is not significant as a water supply in the context of this evaluation.

2.2.2.4 Peedee Formation--The Peedee formation is composed of dark gray to green even-textured quartz sand containing glauconite, mica, and clay. The Peedee exposed in the Goldsboro area represents the basal unit of the Peedee and interfingers with the Black Creek formation to the east.

The formation is thin and, therefore, is not a significant source of groundwater in the Goldsboro area, although it is an important aquifer in the lower Coastal Plain. The formation has not been recognized at the Seymour Johnson AFB. Most wells tapping the Peedee formation in the area are dug or driven wells that yield 10 to 20 gal/min. The water is alkaline, moderately hard, and low in iron.

2.2.2.5 Black Creek Formation--The Black Creek formation consists of black or dark gray thinly laminated montmorillonitic clay and lenses of sand. It contains abundant mica and lignite, as well as iron sulfides. The lower part of the formation contains minor amounts of glauconite.

The lower part of the Black Creek formation reflects both continental and marine deposition. The upper part of the Black Creek formation was deposited in shallow marine waters. Zastrow (1982) determined the Black Creek to contain fluvial, tidal flat, and estuarine facies. Detailed mapping done by Zastrow (1982) along the Neuse River at Goldsboro indicated that section of the river to be in the tidal flat facies of the Black Creek formation. Zastrow (1982) further divided the tidal flat facies into four subunits: mudflats, transitional flats, sandflats, and tidal channels. The mudflats and tidal channels compose the largest percentage of the outcrops, but transitional flats and sandflats are not uncommon. The lithology and textural parameters of the mudflat subunit showed it to be a laminated mudstone. The mudflat deposits consistently overlie and interfinger with transitional flat and sandflat sediments in the Seymour Johnson AFB area. Tidal channel scour and fill structures are common on the mudflat subfacies.

The formation thickens from a feathered edge along its western margin to about 200 feet at Clinton and probably is as thick as 400 feet near Ivanhoe. Because of its wide extent, shallow depth, and the presence of sand lenses, the Black Creek formation is the source of water for a large number of domestic and municipal wells in the Goldsboro area. Wells tapping the Black Creek aquifer system are commonly developed in conjunction with productive units of the Cape Fear aquifer. The productive units of the Black Creek aquifer are found at depths below 10 feet msl in the Seymour Johnson AFB area. Above these productive zones lies a unit of laminated sand and clay which is interpreted to have a thickness of more than 50 feet beneath the Base. The yield of wells tapping the Black Creek aquifer system ranges from 50 gal/min from small-diameter screened wells to 500 gal/min from large-diameter gravel-packed wells. The average specific capacity of the wells inventoried is about 5 gal/min per foot of drawdown (Pusey, 1960). According to Winner (1984), the transmissivity of the aquifer near the Base is 700 feet²/day (ft²/d).

The water from the Black Creek aquifer is not of uniform chemical quality. Near its outcrop area the aquifer contains water of low pH that is high in iron. The lower part of the aquifer contains slightly alkaline water low in iron in some areas.

2.2.2.6 Middendorf Formation--The Middendorf consists of poorly indurated quartzitic pale orange sands and lenses of light gray silty clay (Zastrow, 1982). The formation has not been recognized in the vicinity of Seymour Johnson AFB but is present west of Goldsboro. The formation is not significant as a water supply in the context of this evaluation.

2.2.2.7 Cape Fear Formation--The Cape Fear formation is comprised of cross-bedded, poorly sorted, immature quartz sands and montmorillonitic clays, with an appreciable feldspar content. Colors are commonly yellowish gray for the sands and light gray for the clays. Intraformational conglomerates of mudstone are common. Low-angle cross-bedding is recognized in the sandier units. Graded muddy sand-sandy mud couplets have been identified throughout the unit. The sequence is described as having a disconformity overlain by

gravelly sand with megaclasts of quartz and clay pebbles. This grades into a cross-bedded sand which fines upward into a structureless mud bed (Zastrow, 1982). The formation dips southeastward at 12 to 15 feet per mile in the outcrop area and probably attains a thickness of about 250 feet southwest of Wayne County (Pusey, 1960).

The Cape Fear formation is capable of yielding large supplies of groundwater and is an important aquifer in the Goldsboro area. In other areas, especially where the aquifer is less than 50 feet thick, it is capable of yielding only small to moderate domestic supplies. The transmissivity of the aquifer near the Base is 1,200 ft/d (Winner, 1984). The thin clay layers separating the aquifer from the overlying Black Creek aquifer have an effective confining thickness of 18 feet and a vertical conductivity of 7×10 ft/d (Winner, 1984).

The quality of water in the Cape Fear aquifer is not uniform. In the area near the fall zone where water table conditions exist, the water in the Cape Fear has a pH less than 7.0 and contains large amounts of iron. In the areas where artesian conditions exist, the water has a pH greater than 7.0 and is low in iron content (Pusey, 1960).

2.3 HYDROGEOLOGY OF SEYMOUR JOHNSON AIR FORCE BASE

Of those sedimentary units described in Section 2.2, only the surficial deposits, the Black Creek formation, and the Cape Fear formation are known to exist beneath Seymour Johnson AFB. The only water-bearing units of interest beneath the Base, therefore, include the uppermost water-bearing unit within the surficial deposits (herein called the surficial aquifer), and the water-bearing portions of the Black Creek and Cape Fear formations (herein called the principal aquifer system).

Groundwater flow in the surficial aquifer is influenced by topographic features. Recharge primarily occurs where precipitation infiltrates higher elevations and in areas where permeable deposits are exposed near the land surface. Discharge primarily occurs into wells, streams, and deeper drainage ditches in the area. At Seymour Johnson AFB, the overall direction of flow in the surficial aquifer is from the higher central portion of the Base to the north (into Stoney Creek), to the west (into the Neuse River), and to the

south (into the southern drainage ditch). The water table in the surficial aquifer occurs at very shallow depths along the northern portion of the Base near Stoney Creek. For wells in the flood plain of Stoney Creek, the water table is less than one foot below ground surface; for wells upgradient of the Stoney Creek flood plain, the average depth of the water table is about 12 feet.

The lithology of the surficial aquifer beneath the Base is quite variable from site to site as indicated in representative cross sections of the six sites studied in this project (Figures 2-5 through 2-10). The surficial aquifer is primarily composed of silty sand but also contains gravel beds and laminae of clay. The hydraulic properties of the surficial aquifer are also expected to be quite variable.

The surficial aquifer is underlain by a clayey stratum at the sites studied on the Base which is thought to represent the upper section of the Black Creek formation. In the one soil boring in the flood plain of Stoney Creek where its lithologic distribution and properties have been studied, the upper section of the Black Creek is continuous to a depth of about 40 to 45 feet below ground surface. At approximately 40 to 45 feet, the sand laminations dissipate leaving a highly dense gray clay which continues to at least 75 feet below ground surface (Figure 2-6). Detailed descriptions of the site-specific hydrogeology are provided in Section 4.

Although the horizontal flow component in the surficial aquifer is dominant, some downward leakage through the clay layers into the underlying aquifers likely occurs. The contribution of recharge from the surficial aquifer at the Base to the principal aquifer system is interpreted to be less significant than other sources of recharge described below. This situation has been well documented in other areas (Fetter, 1980). Directions of groundwater flow in the surficial aquifer at specific sites on the Base are described in more detail in Section 4. The principal aquifer system is primarily recharged in areas where these deeper formations crop out. Major streams that have dissected the surficial deposits may also serve as recharge or discharge areas to the deeper aquifers. Water levels measured in the Base wells reflect changes in the stage of the adjacent Neuse River (Winner, 1984) and indicate hydraulic connections between the river and the principal

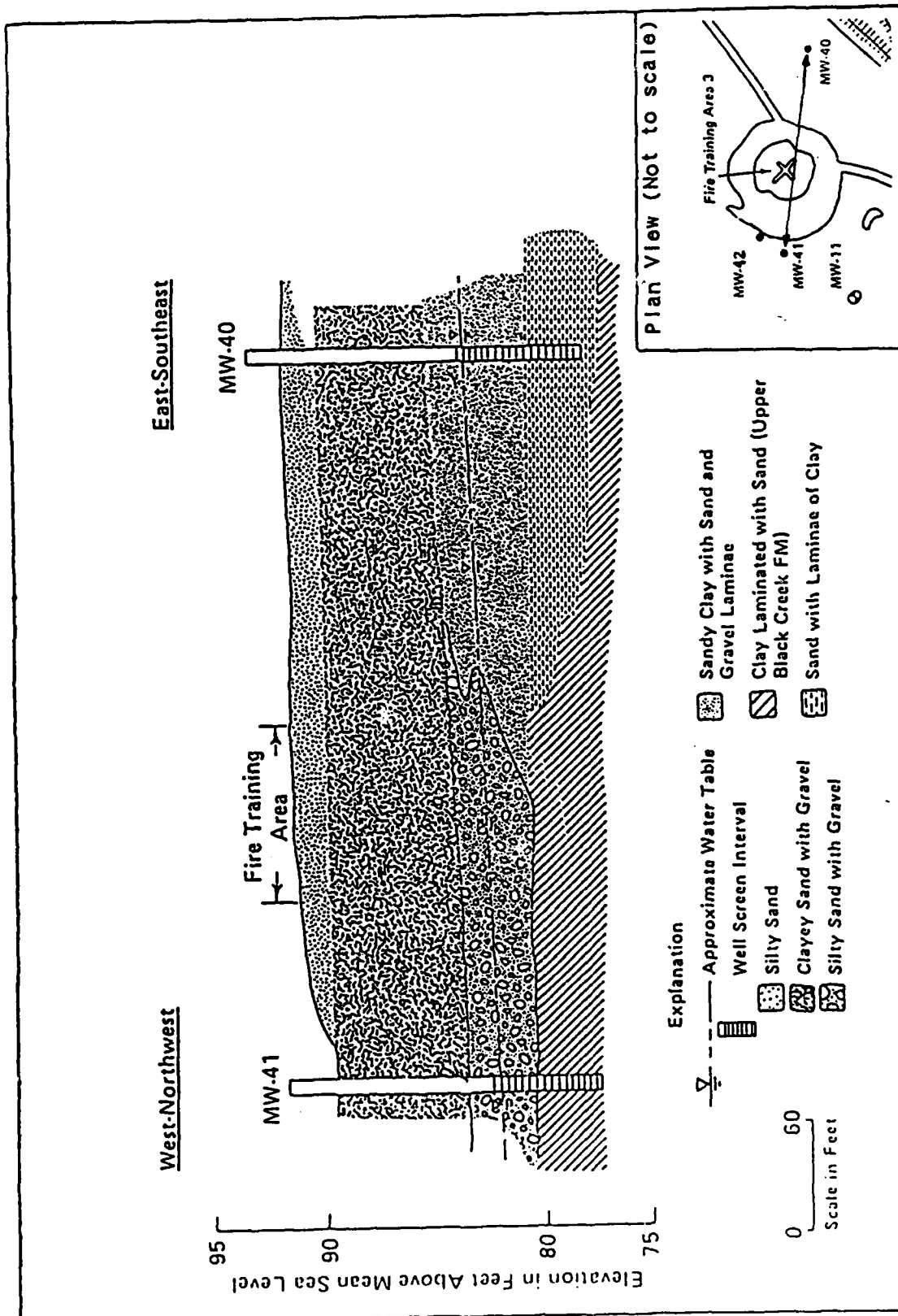


FIGURE 2-5. HYDROGEOLOGIC CROSS SECTION OF SITE 1 (FIRE TRAINING AREA NO. 3)
SEYMOUR JOHNSON AFB, NC

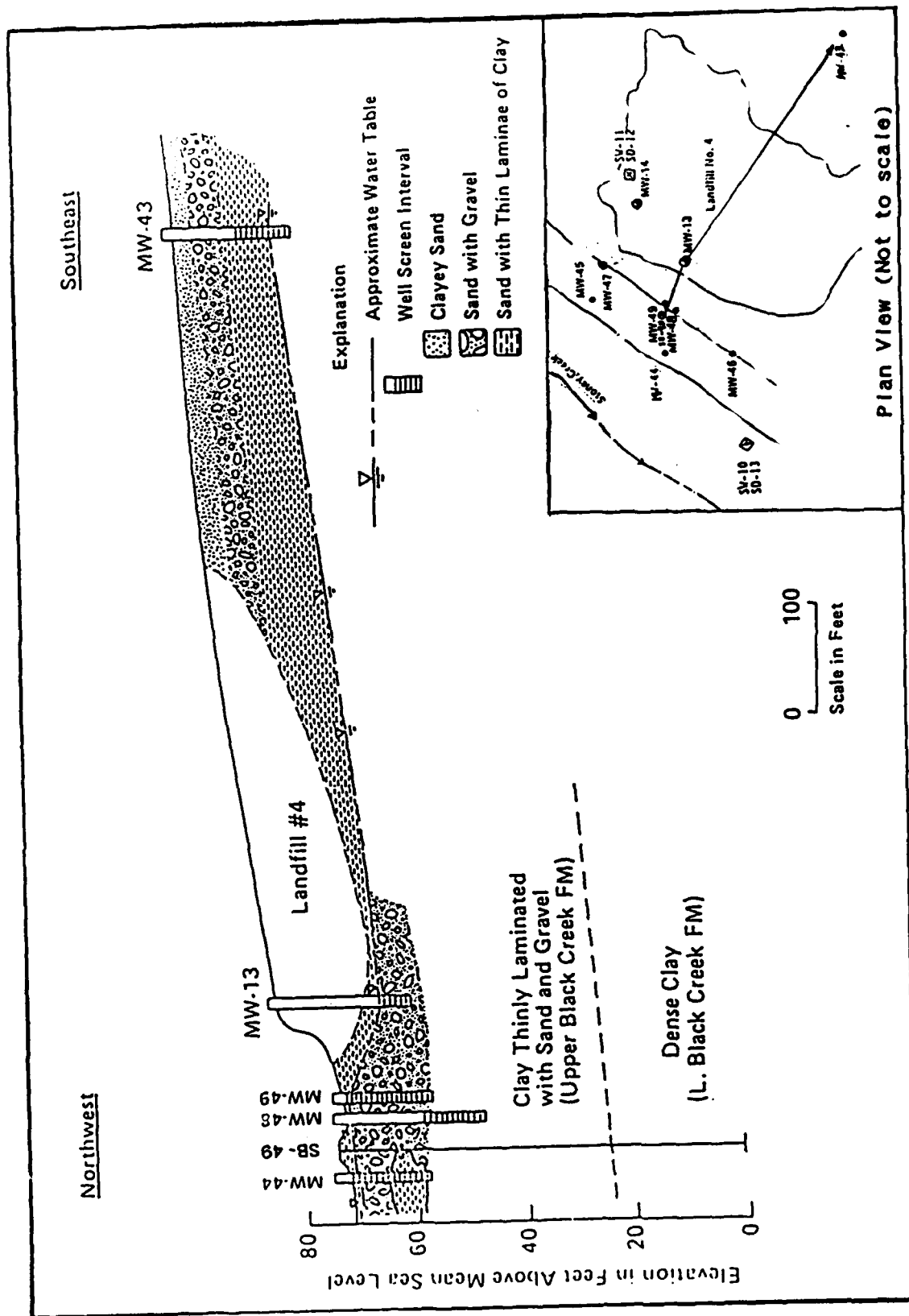


FIGURE 2-6. HYDROGEOLOGIC CROSS SECTION OF SITE 2 (LANDFILL NO. 4)

SEYMOUR JOHNSON AFB, NC

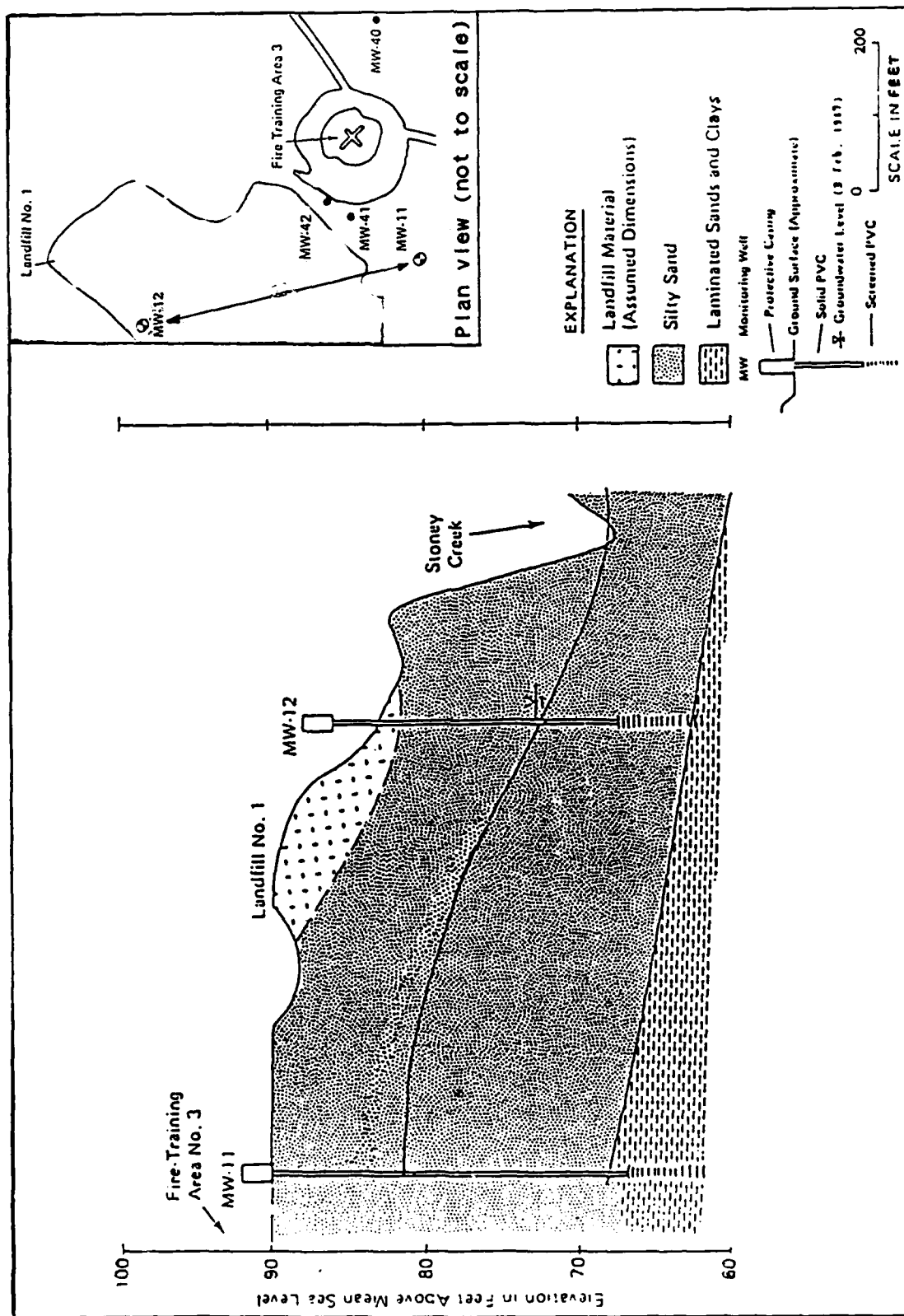


FIGURE 2-7. HYDROGEOLOGIC CROSS SECTION OF SITE 3 (LANDFILL NO. 1)

SEYMOUR JOHNSON AFB, NC

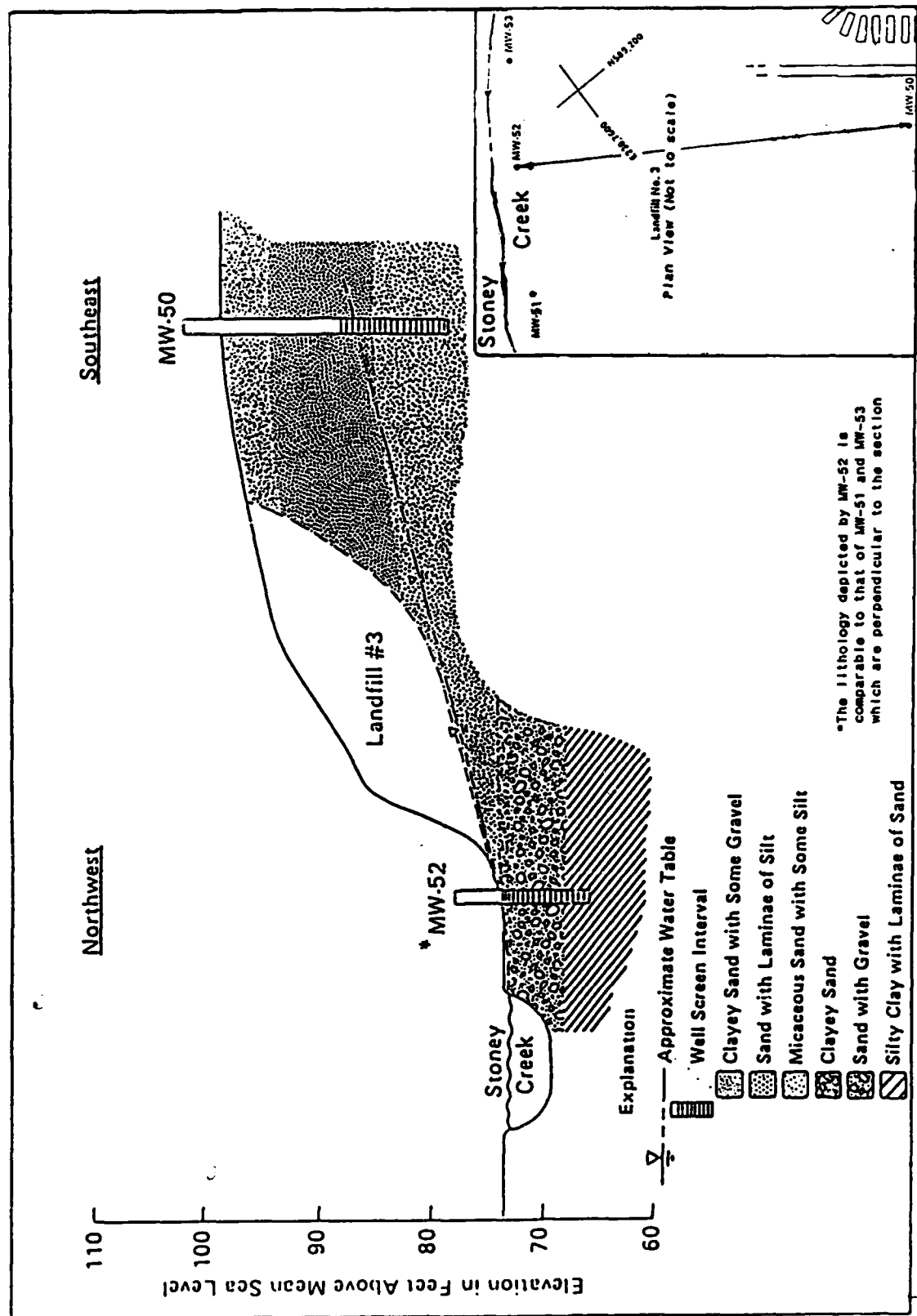


FIGURE 2-8. HYDROGEOLOGIC CROSS SECTION OF SITE 4 (LANDFILL NO. 3)

SEYMOUR JOHNSON AFB, NC

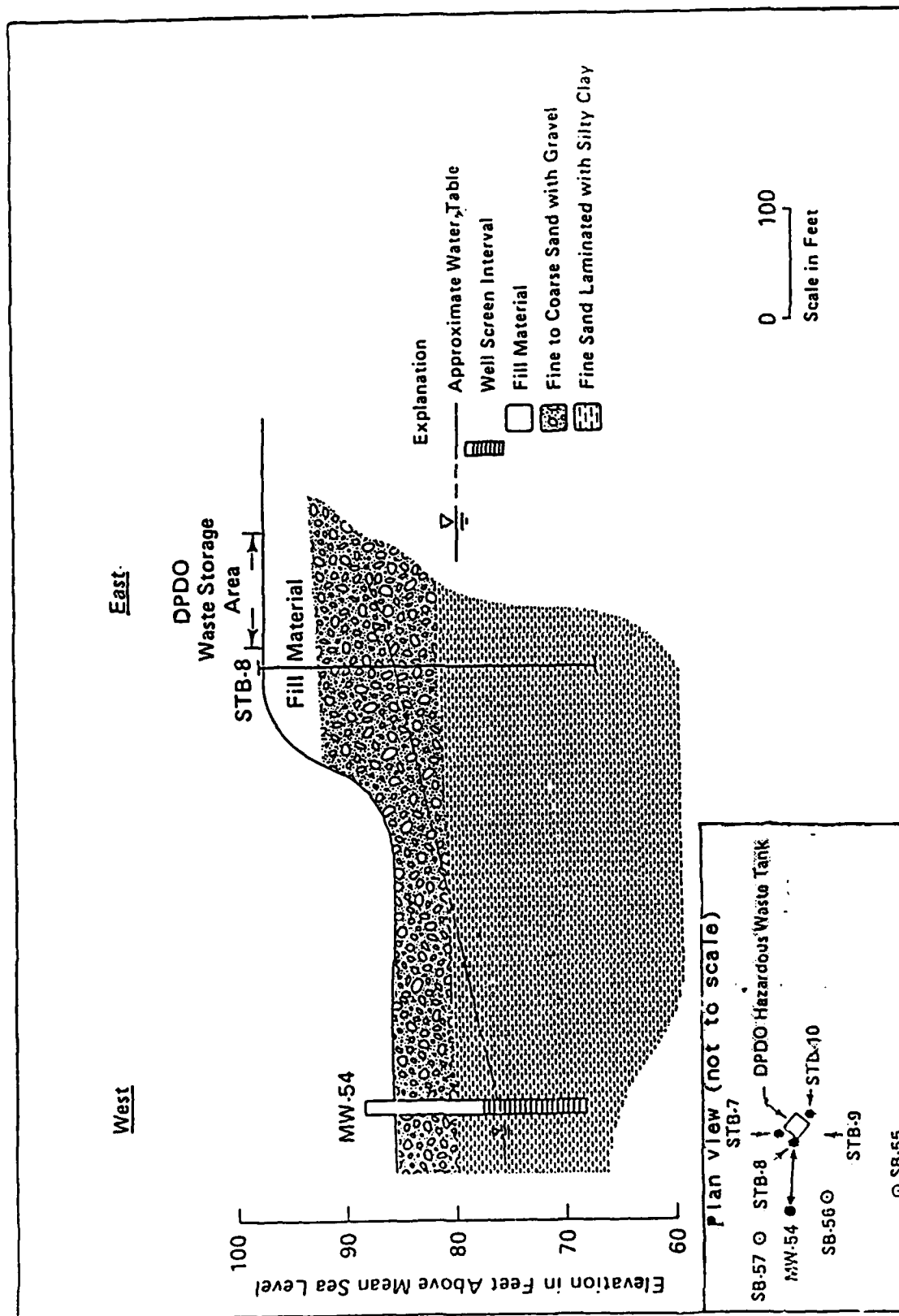


FIGURE 2-9. HYDROGEOLOGIC CROSS SECTION OF SITE 5 (DPDO WASTE STORAGE AREA)
SEYMOUR JOHNSON AFB, NC

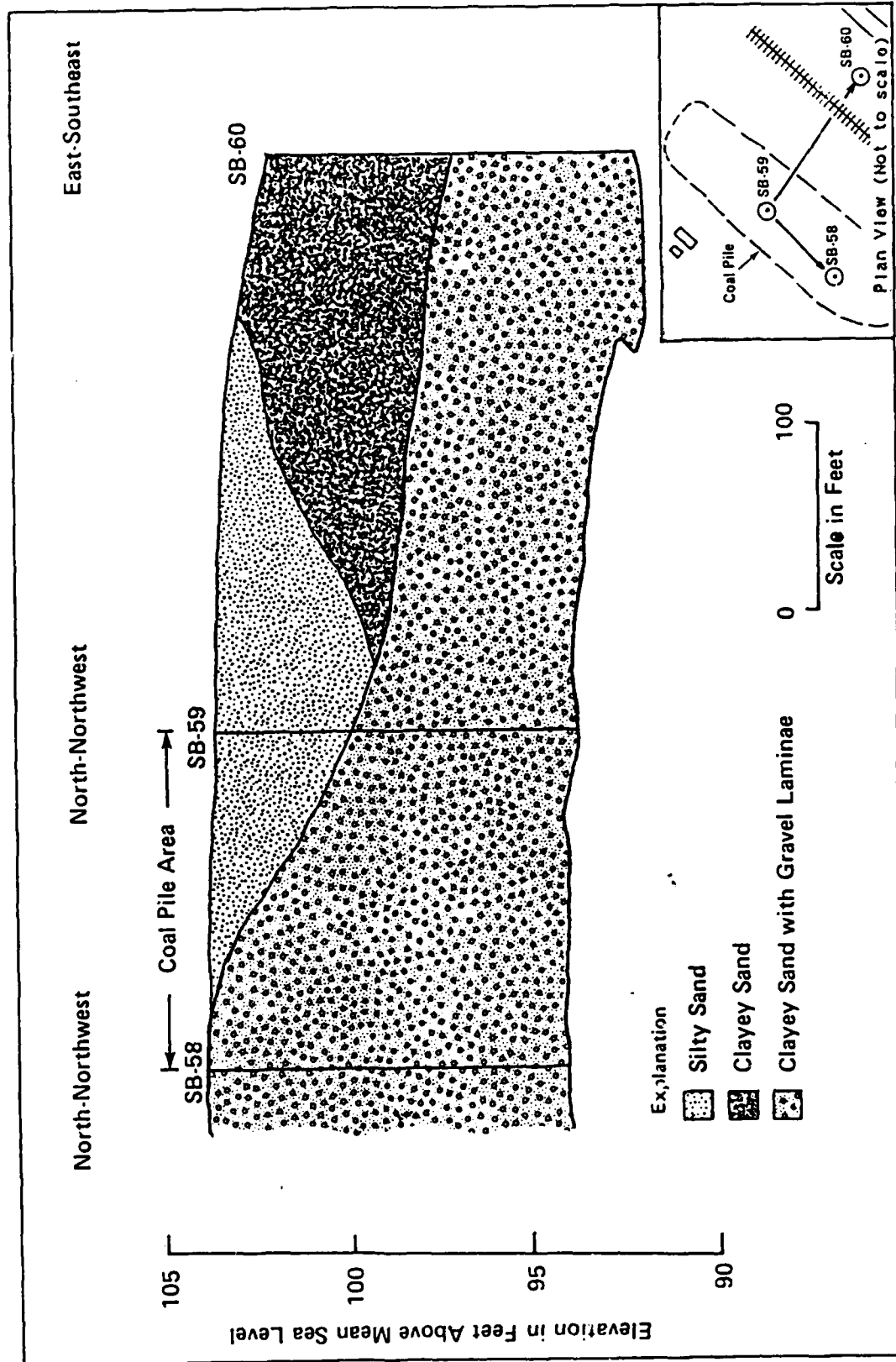


FIGURE 2-10. GEOLOGIC CROSS SECTION OF SITE 6 (COAL PILE STORAGE AREA)

SEYMOUR JOHNSON AFB, NC

aquifer system. From a regional perspective, the Goldsboro area is interpreted to be in a discharge area of the principal aquifer system (Winner, 1984). The complex interchange between aquifers and surface water features in the Goldsboro area is dependent on a variety of factors including the specific hydrogeology within a local area, the depth of streams or rivers, and the location and pumping patterns of well fields.

2.4 REGIONAL GROUNDWATER USAGE

Municipal and domestic water supplies in most of Wayne County (Figure 2-11) are obtained from groundwater resources. Goldsboro's municipal water supply is primarily derived from the Neuse River; the Little River is used only for emergency supply (Robinson and Mann, 1977). Groundwater usage in 1980 from the Black Creek aquifer was estimated to be 0.64 million gallons per day (Mgal/d) and from the Cape Fear aquifer to be 0.77 Mgal/d (Winner, 1984).

Seymour Johnson AFB recently derived all of its water supply from the principal aquifer system. According to Townsend (1986), portions of the Base (the older Base housing along the northern section of the Base) were recently connected to Goldsboro's municipal water supply. The Base's water wells are still used for other areas on the Base.

The Base well water supply and service wells are depicted in Figure 2-12 and data for these wells are provided in Appendix C. Information pertaining to water wells located adjacent to Seymour Johnson AFB is also provided in Appendix C and described in more detail below.

2.5 LOCAL WELL INVENTORY AND WATER USAGE

A well inventory was made for existing and abandoned wells within a one-mile radius of the six Phase II, Stage 2 survey sites. The primary area of interest was the residential area of Goldsboro northwest of Stoney Creek which is closest to the six sites studied (Figure 2-13). Information about wells and general water consumption in this search area was sought from Goldsboro municipality offices of Environmental Health, Department of Agriculture-Extension, City Planning and Public Utilities. Other government information sources were the U.S. Geological Survey-Water Resources Division (Raleigh) and

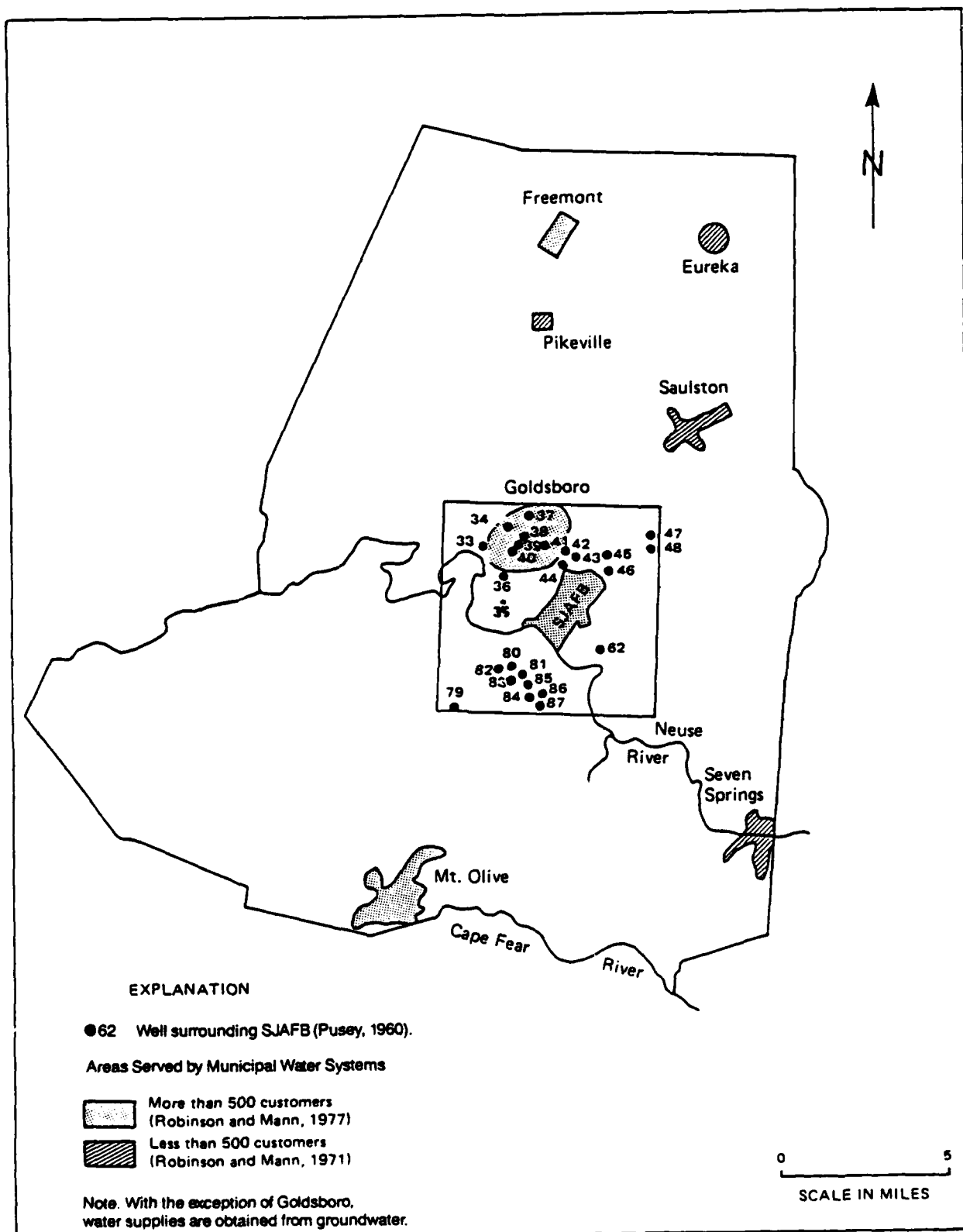


FIGURE 2-11. WATER USAGE IN WAYNE COUNTY, NC

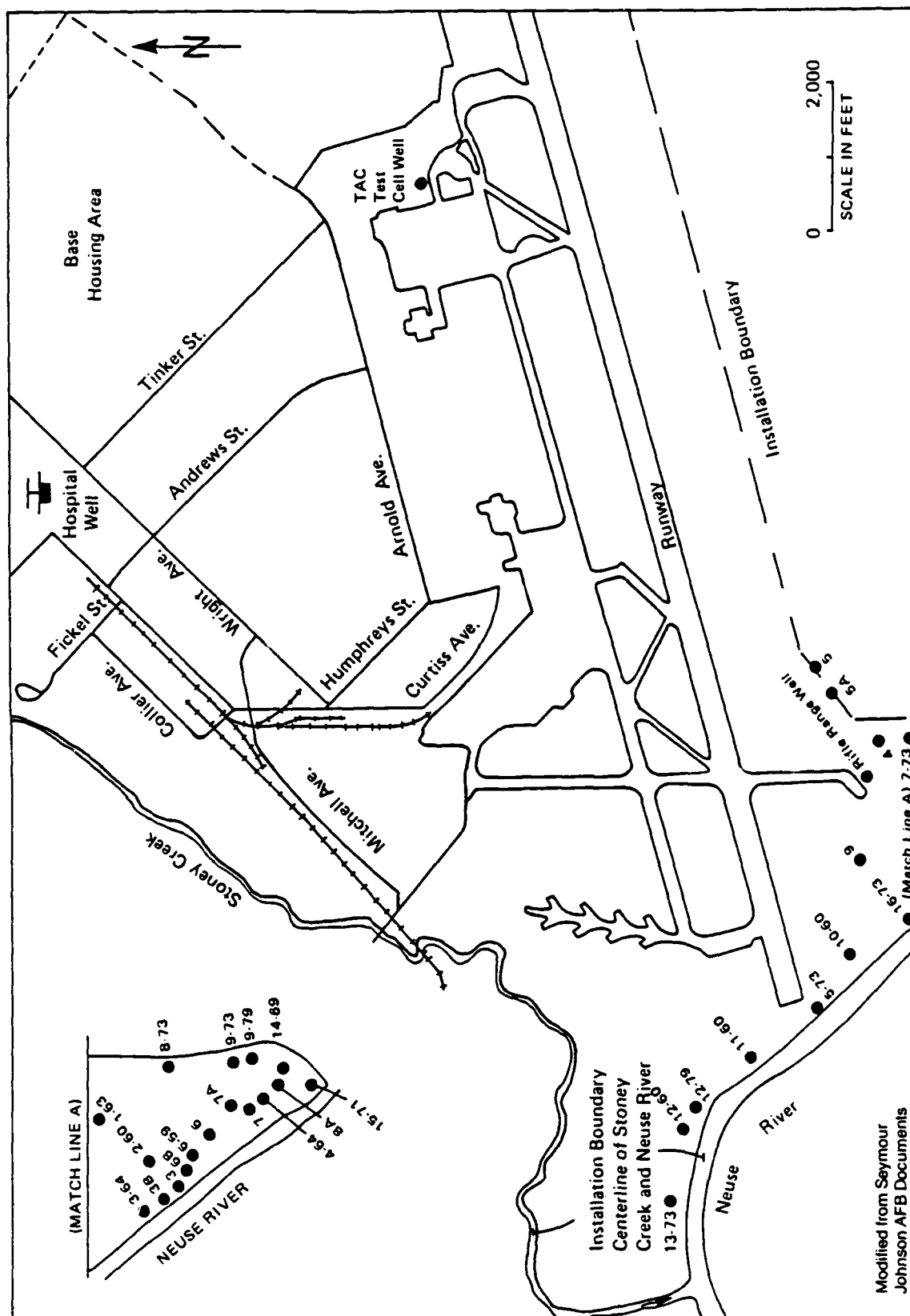


FIGURE 2-12. LOCATION OF BASE WATER-SUPPLY AND SERVICE WELLS
SEYMOUR JOHNSON AFB, NC

Modified from Seymour
Johnson AFB Documents

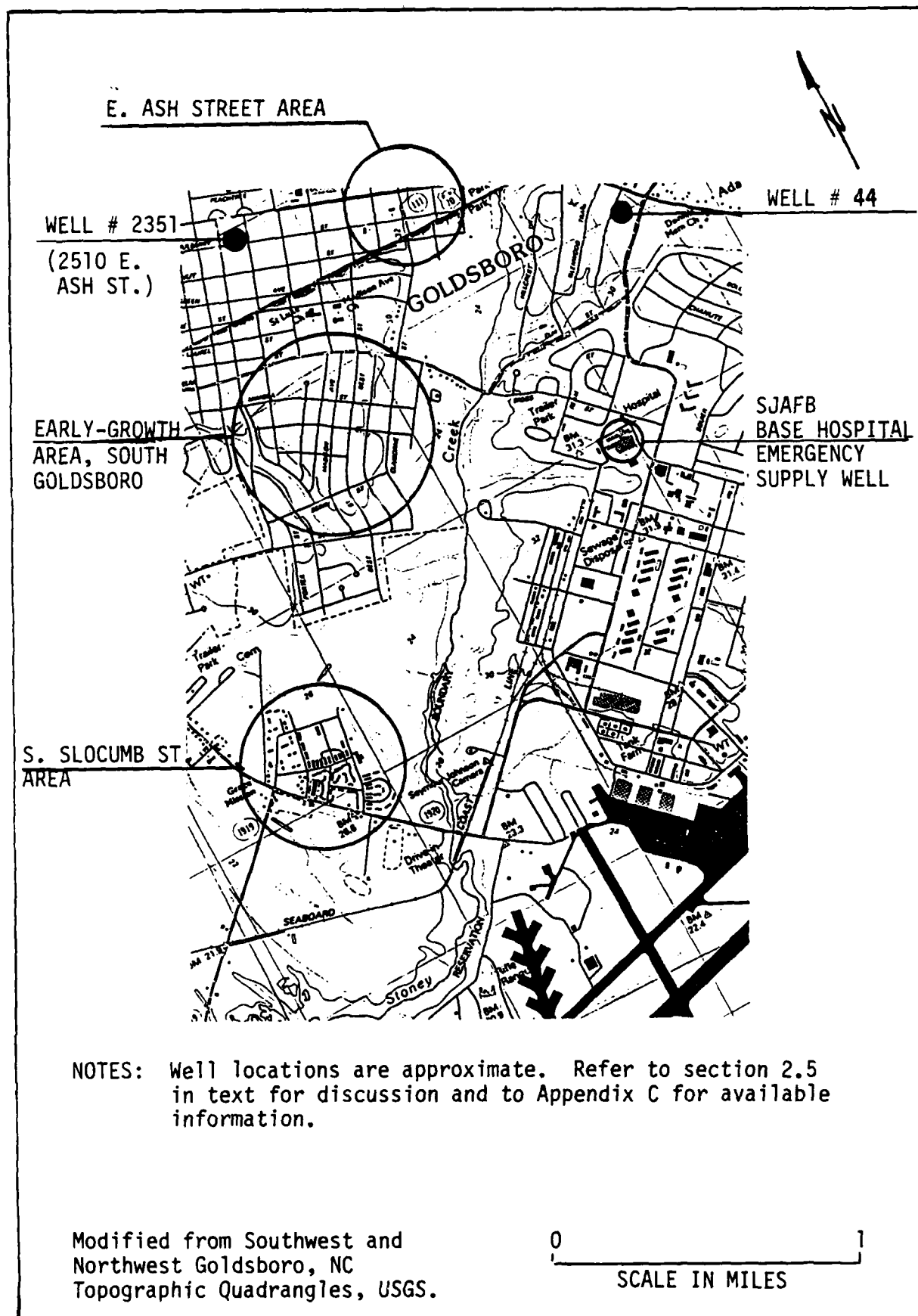


FIGURE 2-13. LOCATION OF WELL INVENTORY SEARCH AREA
SEYMOUR JOHNSON AFB, NC

the North Carolina Department of Natural Resources and Community Development (NCNRCD) Division of Environmental Management, Northeast Groundwater Section, Washington, NC. Records of Base wells were previously obtained from the U.S. Air Force and selected information confirmed during this Stage 2 Survey.

Private water well drillers that were known to have been active in the Goldsboro area were also contacted for knowledge of potential wells that might have been installed in the area of interest, particularly for older wells that were not required to be permitted by the State. Records for water wells were not required in the State of North Carolina prior to 1966. This lack of older well records prevents a comprehensive well inventory that could only be accomplished using a door-to-door canvassing approach, which was beyond the present scope of this survey. The following summarizes all that is currently known about water usage in the defined area of interest based upon these various information sources.

Groundwater development in south Goldsboro adjoining Stoney Creek and Seymour Johnson AFB has been relatively minimal. The U.S. Geological Survey, Ground Water Division, Water Data Storage and Retrieval System (WATSTORE) indicate no data or records for wells after 1971 in an area northwest of Seymour Johnson AFB defined by the following coordinates: Latitude E 35° 22'45", longitude N 77°59'38" and latitude E 35°20'16", longitude N 77°57'23" (Hill 1987). Information obtained from Goldsboro City offices (Department of Agriculture Extension and City Planning) indicates that during Goldsboro's early community development most of the area adjacent to Stoney Creek and Seymour Johnson AFB remained sparsely developed until 1960 (Chatman, 1987). In addition, this area has not been utilized for commercial agriculture (Jones, 1987). Due to increased community development in 1957, the city of Goldsboro began annexation of residential sections in the primary search area, just northwest of Stoney Creek. Before 1966, public utilities usually followed annexation (Townsend, 1987). Before annexation of an area, residents often favored paying double service rates to have city utilities supplied to them due to the objectionable amounts of iron and softness of the local groundwater (also noted on a regional basis as indicated in Section 2.2.2.1). Therefore, it is reported (Powell, 1987) that few wells (abandoned or existing) are present in this localized area. However, wells constructed

before 1966 could still exist in some areas that experienced early growth. These areas are primarily in the vicinity of East Ash Street, Hawthorn, Juniper and Pittman Streets, and in the area adjoining South Slocumb Street (Figure 2-13). Hand-dug, tile-lined wells have been reported in the area adjoining South Slocumb Street and well points are common in many areas within the city limits of Goldsboro that are used by residents as a nonpotable water supply (Powell, 1987). Well points constructed for private use without filing a construction record (following NCNRCD specification code 2C100) are not illegal in the state as long as they are installed by the property owner without the aid of a commercial driller (Hardison, 1987).

The only three wells specifically identified by the well inventory within a one-mile radius of the six Stage 2 sites are located on Figure 2-10. Available information about these wells is summarized in Appendix C. The Base hospital well is approximately 2,500 feet from the DPDO Storage Area (Site 5) and about 2,000 feet from Landfill No. 3 (Site 4). This well is only used for emergency drinking water purposes, and no well records exist for this well (Warren, 1987). Well No. 44 is located about 4,000 feet northeast of Landfill No. 3. This well was identified by Pusey (1960) and although some information is available about its construction (Appendix C) no current information is available about this well. The well is in an area that is currently serviced by city water so the well may be abandoned or used for nonpotable purposes. As previously noted by Townsend (1987) and Powell (1987), few wells exist in the area of RTI's well inventory and if present are used as nonpotable water supply. Well No. 2351 is located about one mile northwest of Landfill No. 3. Information about this well was obtained from Cox (1987) and the NCNRCD (Appendix C). This is a relatively new domestic water well (drilled in November 1985), that derives its water supply from shallow depths (approximately 20 to 40 feet). The permit for Well No. 2351 was issued to a local builder or residential developer to supply the total water needs of a new home (Appendix C; Table C-3.)

2.6 HISTORIC AND POTENTIAL GROUNDWATER PROBLEMS

The information available for this Stage 2 Survey did not reveal any significant historic groundwater problems in the vicinity of the Base. The iron content of the aquifers is variable and can limit the suitability of groundwater for potable supply and agricultural uses. As indicated in Section 2.5, many residents often favored city water (obtained from the Neuse River) over groundwater because of water quality preferences. Adequate supplies of high quality groundwater exist however, to meet local supply demands in the foreseeable future (Robinson and Mann, 1977).

In Coastal Plain settings, such as those found in the Wayne County area, surficial aquifers are commonly susceptible to contamination. Because these aquifers are within a few feet of the land surface, they commonly become contaminated locally from septic systems, surface spills, leaking underground storage tanks, or waste disposal practices. Principal aquifer systems are generally protected from contamination in areas where significant deposits of clay tend to confine the more permeable deposits used for water supply. Potential groundwater problems could arise in principal aquifers in areas where confining beds are thin or absent and direct hydraulic communications exist with surface sources of contamination.

SECTION 3

FIELD PROGRAM

3.1 INTRODUCTION

To implement the goals and objectives stated in Section 1.2, a field program was undertaken to characterize hydrogeologic and ground-water-quality conditions at selected sites at Seymour Johnson AFB. As required in the Statement of Work (Appendix A), a detailed Technical operations Plan (TOP) was developed prior to the initiation of the field program. The TOP provided specific procedures to be followed in the overall Stage 2 Survey with particular emphasis on the field program (Appendix D).

The following summarizes the major field activities conducted at Seymour Johnson AFB between October 1986 and April 1987.

Activity 1 (Mid-October 1986 to Mid-November 1986)

- Soil Sampling (Total of 7 borings) at Sites 5 and 6.
- Monitoring Well installation (total of 15 wells) at Sites 1, 2, 4, and 5.
- Refer to Table 3-1 for sequence of borings and well installations.
- Refer to Appendix E for lithologic descriptions.
- Refer to Appendix F for general well construction data.

Activity 2 (Late November 1986 to Early December 1986)

- Monitoring well development (total of 15 wells) at Sites 1, 2, 4, and 5.
- Refer to Appendix G for well development records.

Activity 3 (January 1987)

- Initial groundwater, surface water, and sediment sampling from Sites 1, 2, 3, 4, 5, and 6.
- Refer to Appendix I (Section 2) for January sampling records.
- Refer to Volume III for summary of all analytical data by site.

TABLE 3-1. SEQUENCE OF SOIL BORING AND MONITORING WELL INSTALLATION

Coal Pile Storage Area (Site 6)

1. SB-58	October 14, 1986
2. SB-60	October 14, 1986
3. SB-59	October 14, 1986

Upgradient or Background Monitoring Wells

4. MW-50	Landfill No. 3 (Site 4)	October 14, 1986
5. MW-43	Landfill No. 4 (Site 2)	October 22, 1986
6. MW-40	Fire Training Area (Site 1)	October 23, 1986

Downgradient Monitoring Wells and Soil Borings

7. MW-41	Fire Training Area (Site 1)	October 24, 1986
8. MW-42A*	Fire Training Area (Site 1)	October 27, 1986
9. MW-48	Landfill No. 4 (Site 2)	October 28, 31, 1986
10. SB-49	Landfill No. 4 (Site 2)	October 30, 1986
11. MW-42B**	Fire Training Area (Site 1)	November 3, 1986
12. MW-44	Landfill No. 4 (Site 2)	November 4, 1986
13. MW-45	Landfill No. 4 (Site 2)	November 4, 1986
14. MW-46	Landfill No. 4 (Site 2)	November 4, 1986
15. MW-47	Landfill No. 4 (Site 2)	November 5, 1986
16. MW-49	Landfill No. 4 (Site 2)	November 5, 1986
17. MW-53	Landfill No. 3 (Site 4)	November 11, 1986
18. MW-51	Landfill No. 3 (Site 4)	November 11, 1986
19. MW-52	Landfill No. 3 (Site 4)	November 11, 1986
20. SB-56	DPDO Area (Site 5)	November 12, 1986
21. MW-54***	DPDO Area (Site 5)	November 12, 1986
22. SB-57	DPDO Area (Site 5)	November 13, 1987
23. SB-55	DPDP Area (Site 5)	November 13, 1986

SB = Soil Boring

MW = Monitoring Well

* = Well Abandoned October 27, 1986 because of shallow resistance to drilling (concrete slab)

** = Replaced MW-42A, Henceforth Called MW-42

*** = Converted from SB-56

Activity 4 (February to Early March 1987)

- Resampled and analyzed water samples for selected organic parameters for which second column confirmation were omitted on the initial set of samples (January 1987) at sites 1, 2, 4, and 5.
- Refer to Appendix I (Section 3) for sampling records.
- Refer to Volume III for summary of all analytical data by site.

Activity 5 (April 1987)

- Resampled and analyzed water and soil samples for selected organic and inorganic parameters for which holding times had been exceeded at Sites 1, 2, 3, 4, and 5.
- Refer to Appendix I (Section 4) for sampling records.
- Refer to Volume III for summary of all analytical data by site.

The results of the April 1987 sampling (Activity 5) are used as the primary basis for conclusions and recommendations in this report regarding organic analytical data. Further details of the drilling and environmental sampling program at Seymour Johnson AFB are presented in the following sections.

3.2 DRILLING AND SOIL SAMPLING PROCEDURES

On September 25, 1986, a reconnaissance survey of the six potential contamination source areas was conducted for the purpose of finalizing monitoring well and soil boring locations in the field. Drilling locations were carefully chosen to conform to requirements set forth in the Statement of Work (Appendix A). Once locations were determined, inquiries to Base civil engineers were initiated to confirm that drilling would not intercept buried utilities or interfere with day-to-day Base operations.

All monitoring wells and soil borings were installed by an RTI sub-contractor, Bore and Core Drilling of Raleigh, NC, under the supervision of RTI hydrogeologists. Prior to commencing work, discussion among Air Force personnel, Bore and Core Drilling, and the RTI hydrogeology staff ensured that drilling activities would comply with current EPA and NCNRC requirements on the installation of monitoring wells.

Borings were advanced using a six-inch inner-diameter (ID) hollowstem auger mounted to an all-terrain drill rig. Auger flights split spoon samplers, tools, and the drill-head area were cleaned with a high pressure and temperature water and detergent spray and also rinsed with the high pressure and temperature water spray prior to mobilizing from one site to another. Drilling for monitoring wells was performed without the use of drilling fluids. To avoid problems associated with cross-contamination, the sequence of soil boring and monitoring well installation proceeded from sites where little or no contamination was known to exist, to sites suspected of being contaminated (Table 3-1). Similar procedures were used for the April 1987 sampling except that soil samples from the DPDO Waste Storage Area were collected using hand-auger techniques.

As specified in the TOP (Appendix D) subsurface soils were collected with pre-cleaned 18-inch long by two-inch outside-diameter (OD) split spoon samplers. These stainless steel samplers were driven using a 140-pound hammer. The number of blows required to drive the sampler 12 inches with the hammer freely falling from a height of 30 inches was recorded as an estimate of the penetration resistance. Data on penetration resistance are included in Appendix E. Soil for inorganic analyses was extracted from the sampler, homogenized in a large plastic bag and partitioned into 225-mL wide-mouth glass jars for replicate analysis. Soil for organic analyses was collected using pre-cleaned 1.5-inch OD by four-inch long brass tubes inserted within the split spoon sampler. The brass liners were precleaned by the RTI Environmental Chemistry Laboratory using a five step procedure:

1. Each brass tube was washed in a soap and water solution, followed by
2. A tap water rinse,
3. A methanol rinse,
4. A deionized water rinse, followed by,
5. An oven drying.

The ends of each tube were capped with aluminum foil and sealed in a paper-lined cardboard box for transfer to the field. During soil sampling

activities the pre-cleaned split spoon sampler was disassembled and all parts, including the spring retainer, were cleaned using the following procedures before retrieving the first sample:

1. All parts were brushed and sponged clean in a soap and water solution, followed by,
2. A tap water rinse,
3. A methanol rinse,
4. A deionized water rinse.

Due to the relatively large number of soil sample replicates needed for the survey, the following general procedures were used.

3.2.1 Soil Metals and Cyanide

Following an organic vapor analyzer (OVA) scan for gross contamination, soil from the bottom third of the sampler barrel was removed and inserted in a large plastic mixing bag. Once the soil was mixed, an aliquot was removed and placed in a small polyethylene bag. The polyethylene bag was then placed in a 225-mL jar, sealed and placed in a pre-refrigerated cooler. The first soil aliquot was given an uppercase letter identifier and designated for soil metals analyses (13 priority pollutant metals, total metals, screen, and total cyanide) by the RTI Environmental Chemistry Laboratory; the second aliquot was prepared in an identical manner but given a different letter identifier designated for analysis by the Air Force Occupational and Environmental Health Laboratories (OEHL), Brooks AFB, Texas. Soil from the middle third of the sampler barrel was bagged for later lithological examination at RTI.

3.2.2 Soil Organics

To eliminate atmospheric contact with the soil samples, four to five pre-cleaned thin-walled brass liners or tubes were placed within the sampler barrel to contain soil sample replicates for analysis. Using this method, soil samples could be collected from specified depths with no handling of the soil material, a feature important for volatile organics. The lowest tube (i.e., the tube nearest the sampler bottom for a given sampling depth interval) was designated for analysis by the RTI subcontract laboratory for

soil organic analyses, (IEA Laboratory, Inc.). Soil organic analyses included petroleum hydrocarbons (Method SW3550/E418.2), aromatic volatile organics (Method SW5030/E602), halogenated volatile organics (Method SW5030/E601), non-halogenated volatile organics (Method SW5030/SW8015), and extractable priority pollutants (SW3550/E625). Following the removal of the tube and its contents from the split spoon, the ends of the tube were covered with two sheets of aluminum foil and sealed with a tight-fitting rubber cap. The next higher tube was handled in an identical manner to the first replicate, but was given a different letter identifier and designated for analysis at the Air Force OEHL. Remaining tubes were sealed and retained by RTI for later lithological examination. In the case of the April 1987 sampling, the soils were collected using hand-auger techniques.

3.3 MONITORING WELL INSTALLATION

With the exception of the three soil borings at the Coal Pile, three soil borings at the DPDO area, and one soil boring at Landfill No. 4 that were backfilled and/or grouted upon completion, the remaining sixteen borings were completed as monitoring wells. Permission to install the wells at Seymour Johnson AFB for water-level and water-quality information was attained from the NCNRCD in September 1986 (Appendix H). Subsequent adaptations to well designs were also cleared with NCNRCD first by phone conversation and, later, more formally in written correspondence (Appendix H).

In general, two types of monitoring well designs were implemented on this project (Figure 3-1). The first design followed conventional well installation practices and consisted of two-inch Schedule 80 PVC casing with threaded screw-type joints. Well screens in all borings consisted of 0.010-inch slotted PVC. Screen length varied from 5 to 12 feet depending on depth to groundwater and depth to the top of Black Creek formation.

A second monitoring well design was also implemented in this survey for wells near Stoney Creek where depth to groundwater averaged eight inches below ground surface. Under these shallow water-table conditions, it was impossible to install a one-foot thick bentonite seal above a gravel pack set at least two feet above a well screen. The problem was resolved by raising the gravel pack above the water table, approximately two to six inches below ground

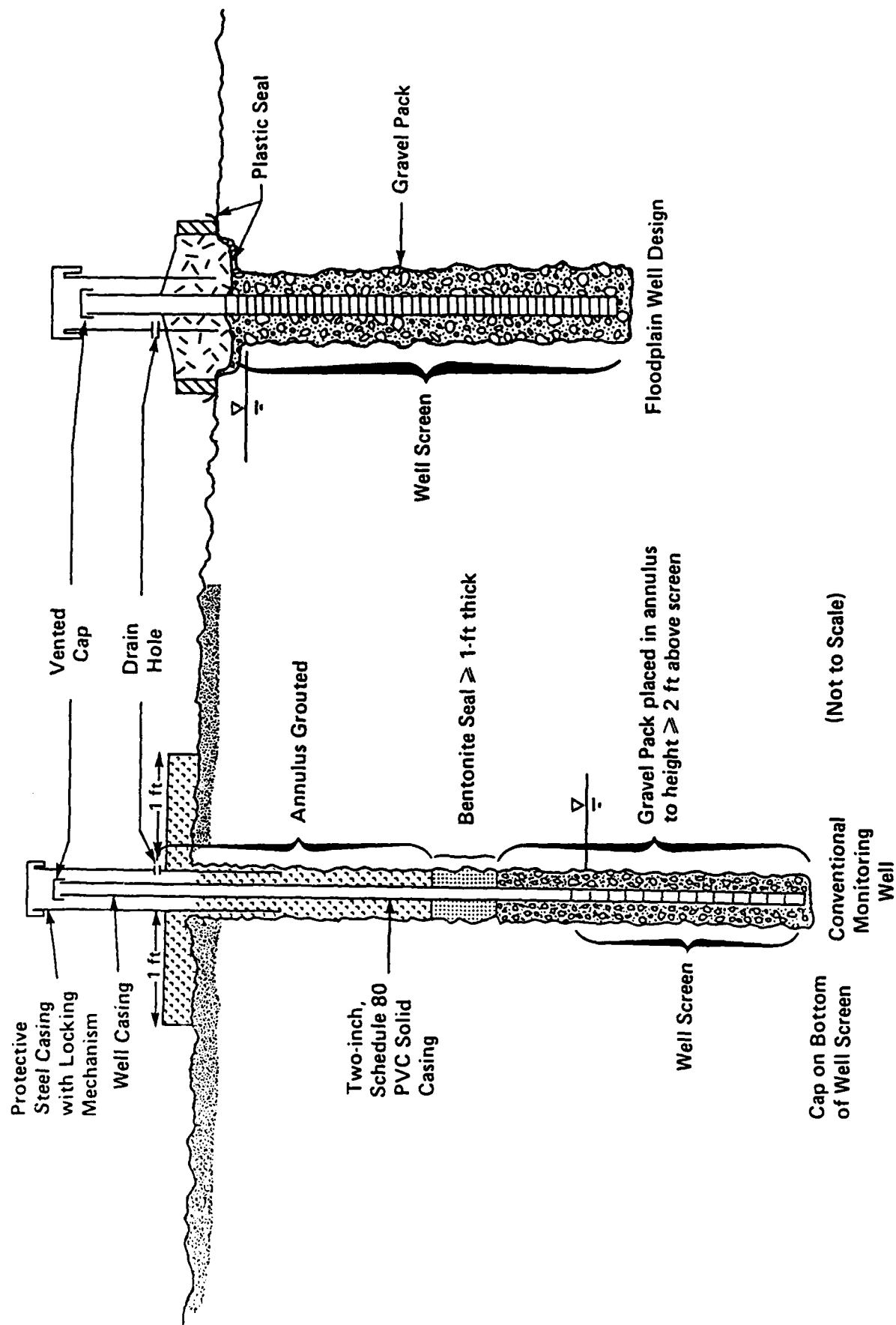


Figure 3-1. Monitoring Well Designs

surface, and replacing the bentonite with a sheet of heavy-duty plastic sheeting. An above-ground concrete pad, approximately three-feet square by one-foot thick and centered around the well casing, was next placed over the plastic. A conventional protective steel well cover was lastly set 1.5 to 2 feet into the boring annulus. When the concrete pad was set, the top of PVC casing elevations were surveyed to the nearest hundredth of a foot above mean sea level. The location of well and soil borings were also surveyed to the nearest foot horizontally. These survey data were provided by MAPS, Inc. and are provided in Appendix F.

3.4 MONITORING-WELL DEVELOPMENT PROCEDURES

Monitoring wells MW-40 through MW-54 received two stages of development. Each well was developed before placing the bentonite seal above the sand pack to ensure that breaching within the sand pack did not occur. Removing any voids within the sand pack was important to keep the bentonite seal from settling into the screen interval or allow collapse of the natural formation on the screen after well construction was complete. A second stage of development was done after completing the construction of monitoring wells MW-40 through MW-54 to remove fine sands and silt in the vicinity of the well screen increasing the porosity and permeability of the natural formation and establishing relatively unrestricted flow through the well screen.

All newly constructed monitoring wells, excluding monitoring well MW-43, were developed by a manual surging and pumping technique. The surging was done with a 1.88-inch OD wood and rubber solid plunger. A 15-gal/min centrifugal pump was used to remove silt, clay, and very fine sand (fines) drawn into the well and wash loose fines from the well screen. Water pumped from monitoring wells was discharged from the pump downgradient into a 30 gallon basin fitted with a gate valve on its lower half to govern the flow rate from the basin onto the ground surface. This collection basin or separator allowed visual monitoring of water discharging from the pump for the presence of floating contaminants. Floating contaminants were not observed coming from the discharge water of any well during Phase II, Stage 2 activities. Monitoring well 43 had a relatively deep water table (generally around 20 feet) that could not be pumped with a centrifugal pump. Monitoring well 43 was therefore developed using a manual surging and hand bailing technique substituting a teflon bailer for the centrifugal pump.

Existing monitoring wells from the Stage 1 Survey (MW-11, MW-12, MW-13, and MW-14) were also developed to remove silt and clay-sized sediment that may have accumulated within the wells and their screens since they were last sampled in May, 1984. Wells MW-11 and MW-12 were developed by overpumping using the centrifugal pump. Monitoring wells MW-13 and MW-14 were developed by hand bailing with a teflon bailer.

To minimize cross-contamination, the surge block with all extensions and handle, bailers, buckets, separator, water probe, intake and discharge hoses and exterior parts of the pump were thoroughly washed with laboratory soap and rinsed with tap water. A soap and water solution and rinse water were circulated through hoses and the pump. The specific conductance and pH were observed for rinse water discharged from the pump after completing development of wells that had high values of either parameter in order to ensure complete flushing.

Temperature, specific conductance, pH, yield and sand content were measured during all development activities (Appendix G). Well development was considered complete when the sand content became negligible by inspection. Water color, turbidity, pH, and conductivity were also measured on the newly constructed monitoring wells (MW-40 through MW-54) during the second stage development procedures (Table G-3, Appendix G).

3.5 WATER-QUALITY SAMPLING

Following monitoring-well development, groundwater-quality monitoring was initiated on January 7, 1987. Due to the large number of water-quality parameters to be sampled over the five groundwater monitoring sites at the Base, sample collection efforts were split for organic and inorganic parameters. Although this necessitated visiting each surface water and groundwater sampling site twice, logistical, bookkeeping and potential cross-contamination problems were significantly minimized.

Samples for groundwater quality analyses were collected and prepared in a three-staged process:

- 1) The monitoring well was flushed or purged of its standing water and then stabilized in terms of the gross water-quality indicators pH, specific conductance, and temperature;

- 2) A groundwater sample was extracted and (if necessary) stored temporarily in a precleaned glass mixing vessel prior to sample splitting for Air Force or RTI laboratory analyses;
- 3) Samples were returned to RTI's mobile laboratory for filtering, preservation, and refrigeration.

As with the soil-boring and monitoring-well installations, groundwater, surface-water and sediment sampling proceeded from those sites known to have little or no known contamination to those sites with known or suspected contamination. Sampling of wells or surface water and sediment within a site similarly proceeded from assumed least contaminated areas to most contaminated areas.

Since the details of water sample collection for organic and inorganic analyses differ significantly, a separate description of sampling procedures for organics and inorganics is presented below. A summary of the sample media, containers used, preservation, holding times, and methods used for the analyses are provided in Table 3-2.

3.5.1 Procedures for Organic Groundwater Sample Collection

Well sampling equipment for organics consisted of strictly of teflon bailers. All equipment was decontaminated prior to use and between sites to avoid sample cross-contamination. Decontamination of field equipment for organic sampling involved a thorough washing with Alconox detergent, a tap-water rinse, a second rinse with reagent-grade methanol, and a final rinse with laboratory deionized water.

After measuring depth to groundwater, a decontaminated teflon bailer was used to purge the monitoring well of standing water. New nylon bailer cords were rinsed in deionized water prior to use and discarded after sampling a well. A close examination of the first two to three bails of water was conducted to determine the presence of a floating organic phase on the water table. These observations were included in the purging records. Wells were purged until at least three casing volumes were removed and pH, temperature and specific conductance had stabilized. Stabilization of these parameters was considered achieved if pH varied by ± 0.1 unit, temperature by $\pm 0.5^{\circ}\text{C}$, and specific conductance by $\pm 10 \mu\text{mhos/cm}$. (Well purging and stabilization data are tabulated in Appendix G.)

TABLE 3-2. SUMMARY OF FIELD AND LABORATORY PROCEDURES

PARAMETER	SAMPLE MEDIA	CONTAINER	PRESERVATIVE	MAXIMUM HOLDING TIME	METHOD USED
Petroleum Hydrocarbons	Water Soil/ Sediment	1 litre amber glass 1.5" x 4" brass tube (or) 225ml glass jars	4 C 4 C	2 days *1) (not specified)	E418.1 SW5030/E418.
Aromatic Volatile Organics Xylene (8010)	Water Soil/ Sediment	40 ml Septum vial 1.5" x 4" brass tube (or) 225 ml glass jar w/gasket	4 C 4 C	7 days* 14 days	602 602
Halogenated Volatile Organics	Water Soil/ Sediment	40 ml Septum vial 1.5" x 4" brass tube (or) 225 ml glass jar	4 C 4 C	10 days* 14 days	601 601
Non-Halogenated Volatile Organics	Water Sediment	40 ml Septum vial 1.5" x 4" brass tube	4 C 4 C	10 days 14 days	8015 8015
Extractable Priority Pollutant	Water Soil/ Sediment	1 litre amber glass 1.5" x 4" brass tube (or) 225 ml glass jar	4 C 4 C	7 days (water) and 14 days (soil) to ext. 40 day from extraction to analysis	SW3550/E625 SW3550/E635
13 Priority Pollutant Metals	Water(Mercury) Soil/Sediment (Mercury)	250 ml Polyethylene bottle 225 ml glass jar with inner polyethylene plastic bag (or) 1.5" x 4" brass tube	HNO ₃ @ 4 C 4 C	6 months (38 days) 2) not specified (28 days)	**
Total Metals Screen Antimony Thallium	Soil	225 ml glass jar with inner polyethylene plastic bag (or) 1.5" x 4" brass tube	4 C	(not specified)	SW3050/SW60 SW3050/SW70 SW3050/SW78
Common Anions NO ₃ , PO ₄ , NO ₂ Total	Water Water	500 ml polyethylene 1 litre polyethylene	H ₂ SO ₄ @ 4 C @ 4 C	48 hours 28 days	429A 429A
Total Dissolved Solids	Water	250 ml polyethylene	HNO ₃ @ 4 C	7 days	E160.1
Alkalinity	Water	1 litre polyethylene	4 C	14 days	A403
Cyanide	Water	1 litre polyethylene	NaOH @ 4 C	24 hrs	335.2
Lead	Water	1 litre black teflon	HNO ₃ @ 4 C	28 days	E239.2

* No pH adjustment

** Parameter Dependent (Table 1-13)

1) EPA-600/4-79-020 Methods for Chemical Analysis of Water and Wastes, September 1986.

2) Aliquots were decanted from the 13 Priority Pollutant Samples into glass containers for storage until analysis.

The bailer cord length was adjusted for each well so that a groundwater sample was extracted from the approximate middle of the water column. Analytical requirements for organic samples mandated the collection of approximately 6.75 L per well (or surface-water station).

Since such a large volume of water could not be collected with a single one-liter bailer, four-liter glass "mixing" vessels were used for all organic parameters except volatiles to hold a water sample prior to partitioning it to a labeled sample bottle. For monitoring wells MW-11 through MW-13 and MW-40 through MW-53 (and surface-water stations SW-10 and SW-11) the following partitioning scheme was used:

- 1) Four 40-mL head-space free samples for aromatic volatile organics (Method E602) and halogenated volatile organics (Method E601) were partitioned from a single bailer. Two 40-mL replicates were designated for IEA laboratory analysis; the remaining two were designated for OEHL analysis;
- 2) Groundwater for petroleum hydrocarbon analysis (Method E418.1) was first collected in a pre-cleaned glass mixing vessel. One-liter replicates were designated for IEA Laboratory and OEHL analysis;
- 3) Samples for extractable priority pollutants (Method E625) were collected first in four L glass mixing vessels. Two one L replicates were designated for IEA Laboratory and OEHL analysis;

Water analyses from the DPDO Waste Storage Area (i.e., MW-54, SW-12, and SW-13) required an additional four 40-mL samples for non-halogenated volatile organics (Method SW5030/SW8015) and constituted the only deviation from the above partitioning scheme. As with the aromatic and halogenated organic samples, the additional 40-mL samples for non-halogenated volatiles were designated for IEA Laboratory and OEHL analysis.

Following sample labeling, all organic samples were stored at 4°C in the RTI mobile laboratory refrigerator prior to shipment for laboratory analysis. (For a complete record of replicate labeling for each monitoring well and surface water sampling site, refer to the Chain of Custody Records, Appendix I.)

3.5.2 Procedures for Inorganic Groundwater Sample Collection

Groundwater sampling for inorganic constituents followed the same general procedures as for organics, but with the following deviations:

- 1) Monitoring wells were purged and the samples were collected using a peristaltic pump;
- 2) The methanol rinse step during decontamination was eliminated since dedicated tygon tubing was used for each well;
- 3) Samples were transported in glass mixing vessels from the monitoring well or surface-water site to the RTI mobile laboratory for a filtering and preservation step.

Filtering was performed for all samples in which the dissolved phase of inorganic species was required; i.e., on samples for lead (Method E239.2), EPA's thirteen priority pollutant metals (Methods E200.7, E206.2, E245.1, and E270.2), common anions (Method A429), total cyanide (Method 335.2), and total dissolved solids (Method E160.1). Alkalinity samples (Method A403) were not filtered. For most waters collected, filtering did not add a significant amount of time needed to process a given water sample. However, in some turbid surface waters and groundwaters with high concentrations of aqueous humic material, extended filtering time (e.g., three to four hours per sample) forced a decrease in the volume of sample provided to the laboratory for analysis. (Data on sample volumes are provided in the Chain of Custody Records, Appendix I.)

Sampling for inorganic constituents at monitoring sites MW-12 and MW-13, MW-43 through MW-53 and SW-11 and SW-12 were in accordance with the following procedures:

- 1) After stabilization of the monitoring well, two four-liter mixing vessels were filled and capped and returned to the RTI mobile lab. Samples for dissolved constituents were filtered with 0.45 micrometer membrane filter under suction using a Buchner-style filtration unit.
- 2) If the sample was not excessively turbid and a sufficient volume of water was obtained, two one-liter aliquots were prepared for common anion analysis, one going to RTI's Environmental Chemistry Laboratory, the other to OEHL. No preservatives were added to these samples, however, they were stored at 4°C until and during shipment.
- 3) The one-liter samples for EPA's thirteen priority pollutants metals were next prepared, one going to RTI, the other to OEHL. Approximately five mL of concentrated reagent-grade nitric acid was added to the one-liter samples. Samples were stored at 4°C until and during shipment.

- 4) Two 250-mL samples were prepared for total dissolved solids analysis. Approximately 2.5 mL concentrated nitric acid was added to the sample bottles and stored at 4°C until and during shipment.

Water samples from the Fire Training Area and the DPDO Waste Storage Area differed significantly from the above procedure. Lead was the only inorganic constituent analyzed in the Fire Training Area wells MW-11, and MW-41 through MW-43. The two samples required for this parameter were filtered, acidified with 2.5 mL concentrated nitric acid and stored at 4°C until shipment in 250-L teflon bottles. Sampling requirements for monitoring well MW-54 and surface water stations SW-12 and SW-13 at the DPDO site specified additional samples for total alkalinity and total cyanide. Two one-liter unfiltered, unacidified samples were prepared for total alkalinity; two one-liter filtered and baseified samples were prepared for total cyanide. Basification consisted of adding five mL concentrated sodium hydroxide per one L of water sample. As with all other samples, samples for alkalinity and total cyanide were chilled at 4°C until and during shipment.

Replicate samples for blind duplicates and field blanks were prepared in the manner specified in the Statement of Work. For every 10 field samples collected, one additional sample (soil or water) was submitted to the appropriate laboratory for a duplicate analysis. Duplicates were prepared in such that they were indistinguishable from other analytical samples. An aqueous field blank for every analytical parameter was also submitted for analysis. Field blanks were indistinguishable from other samples and consisted of ultra-pure reagent-grade water purchased from Fischer Scientific, Raleigh, NC.

SECTION 4

DISCUSSION OF RESULTS AND SIGNIFICANCE OF FINDINGS

This section of the report provides a detailed discussion of the results of field and laboratory analyses (subsection 4.1), a summary of the field sampling quality assurance procedures and quality control data (subsection 4.8), and a discussion of the significance of the findings (subsection 4.9). The laboratory quality assurance/quality control data are provided in Appendix J. The results of all data collected at the sites at the various activity periods indicated in Section 3.1, including second-column confirmation analyses and duplicate analyses, are provided in Appendix K through U (Volume 3). All duplicates indicated in Appendix K through U are field duplicates, unless specifically noted as laboratory or "in-house" duplicates. A listing of acronyms and scientific units used in this and other sections of the report is provided in Appendix V, and references are provided in Appendix W.

4.1 DISCUSSION OF RESULTS

The results of field and laboratory analyses are discussed by site in the following subsections. The organic analytes reported as detected herein are those for which second-column confirmation by gas chromatography has been performed on samples that were within specified holding times. The quantification of confirmed analytes is based on the first-column analysis of the samples. Data regarded as invalid, on the basis of exceeded holding times or lack of confirmation by second-column confirmation, are indicated in footnotes in Appendix K through U (Volume 3). Similarly, the actual laboratory reports of analytical data provided in Volume 4 are separated into valid and invalid data. Reports of valid organic data are provided in Appendix X; invalid organic data are provided in Appendix Y; and inorganic laboratory reports are provided in Appendix Z.

4.2 SITE 1 - FIRE TRAINING AREA NO. 3

A description and history of the site was provided in Subsection 1.5.1.

4.2.1 Hydrogeology

The topography in the vicinity of the Fire Training Area is generally level and free of most vegetation. Beyond the northwest fence, however, brush thickens and the ground surface becomes somewhat hummocky and slopes moderately to the northwest toward Stoney Creek.

Three new monitoring wells were installed at the Fire Training Area during this field program: MW-40, MW-41, and MW-42. Soil boring data from these wells indicate that sediments to approximately 12 to 14 feet beneath the Fire Training Area are predominately medium to coarse silty sand interlayered with minor amounts of gravel (Appendix E). Beneath the medium to coarse sands at approximately 13 feet below grade, a black, moderately dense silty clay with laminated gray and white sands was observed, henceforth to be referred to as the Black Creek formation. A hydrogeologic cross section of Site 1 is provided in Figure 4-1.

Measurements of static water levels in monitoring wells MW-11, MW-40, MW-41, and MW-42 from early November 1986 to February 1987 indicate that the general direction of groundwater flow beneath the Fire Training Area is west-northwest (Figure 4-2). This general direction of flow was also maintained following the heavy rains of January and February, 1987 (Table 4-1).

4.2.2 Groundwater/Quality

The results of all Stage 2 inorganic and organic analytical testing for Site 1 are provided in Appendix K and L, respectively.

4.2.2.1 Field Measurements--On-site measurements of pH, temperature and specific conductance were taken during development activities at background well MW-40 and downgradient wells MW-11, MW-41 and MW-42 (Table G-1; Appendix G). In addition, waters from these wells were visually examined for floating hydrocarbons. No significant differences in pH and temperature in upgradient and downgradient wells were observed during the field work. The specific conductance of the groundwater at the time of the early January 1987 sampling

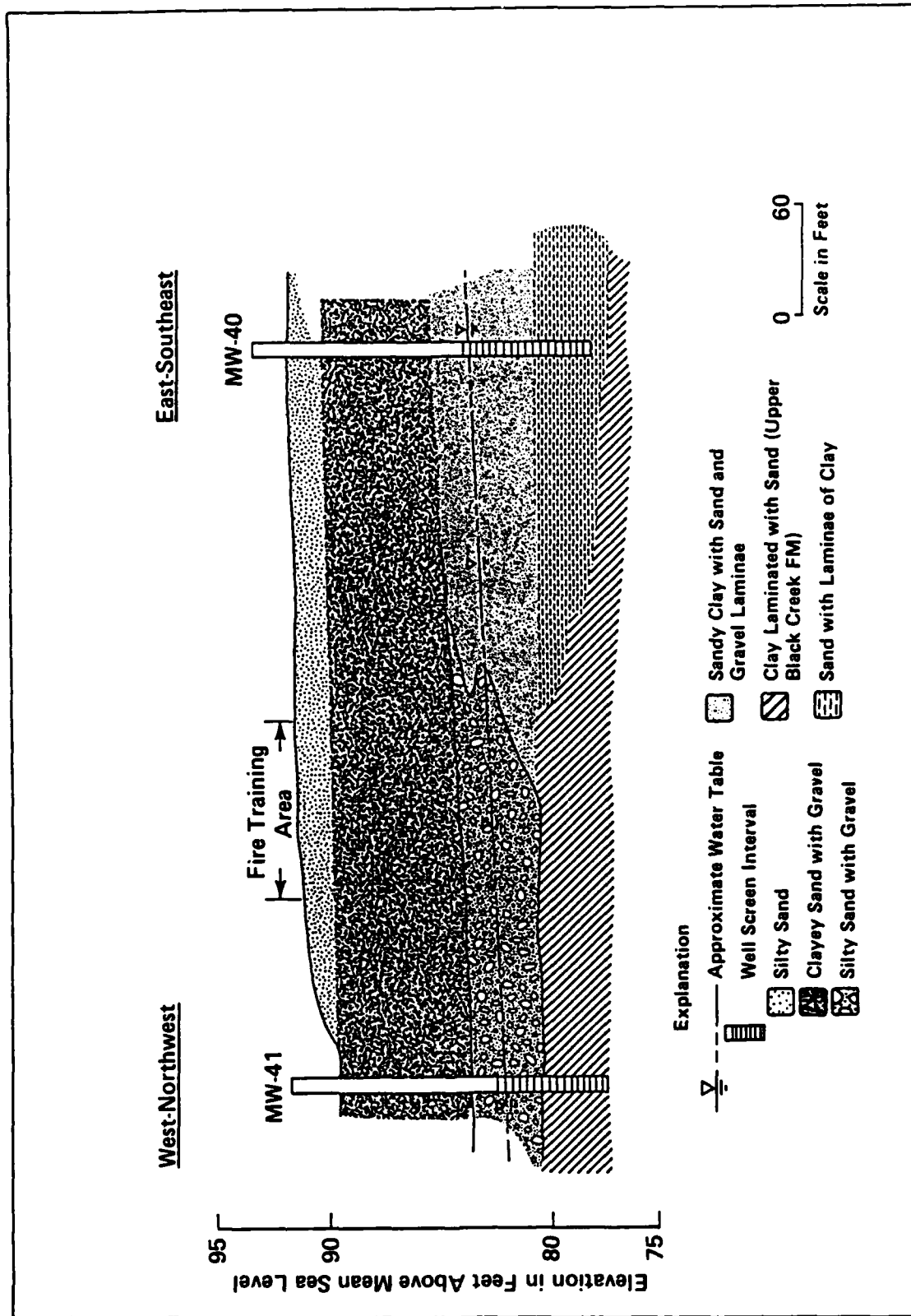


FIGURE 4-1. HYDROGEOLOGIC CROSS SECTION OF SITE 1 (FIRE TRAINING AREA NO. 3)
SEYMOUR JOHNSON AFB, NC

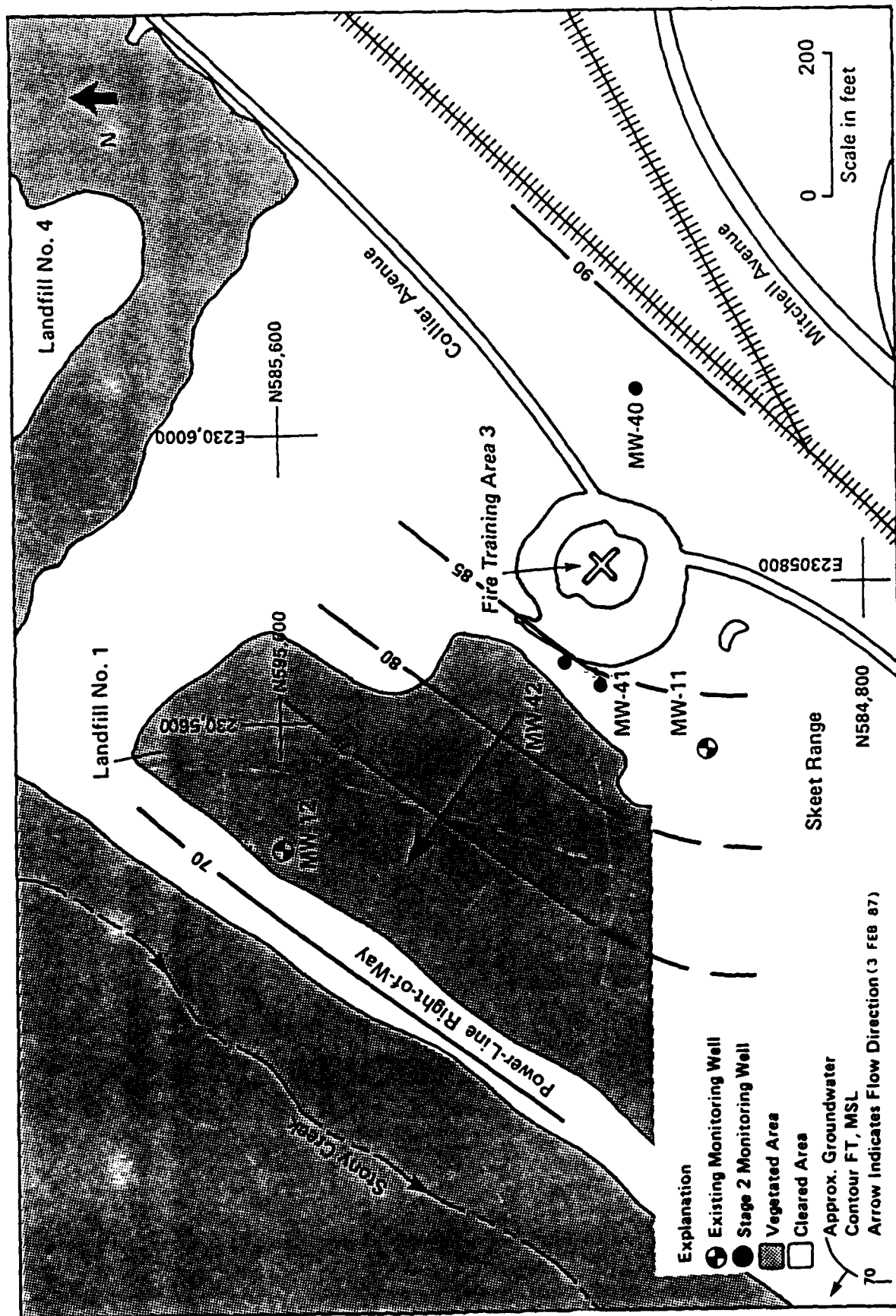


FIGURE 4-2. APPROXIMATE GROUNDWATER FLOW DIRECTION, SITE 1 (FIRE TRAINING AREA NO. 3)

SEYMOUR JOHNSON AFB, NC

TABLE 4-1. Groundwater Elevations, Site 1 (Fire Training Area No. 3)

Monitoring Well Number	Well Casing Elev.	GROUND WATER LEVELS							
		10 NOV 86		22 DEC 86		21 JAN 87		3 FEB 87	
		1) Depth	2) Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.
MW-40	93.74	10.71	83.03	9.64	84.10	6.00	87.74	4.98	88.76
MW-41	91.52	10.55	80.97	9.67	81.85	6.78	84.74	6.55	84.97
MW-42	93.69	12.61	81.08	11.92	81.77	10.00	83.69	9.10	84.59
MW-11	91.62	---	---	12.95	78.67	16.40	75.22	10.00	81.62
MW-12	85.85	---	---	17.25	68.60	10.60	75.25	14.10	71.75

1) Depth Below Top of Well Casing

2) Elevation Relative to M.S.L. (ft)

for organics ranged from background conditions in wells MW-40 and MW-11 (51 and 45 μ mhos/cm respectively) to above background measurements in downgradient wells MW-42 and MW-41 (185 and 320 μ mhos/cm respectively). Floating hydrocarbons were not observed in any of the wells.

The organic vapor analyzer (OVA) scan of soil samples from Site 1 were generally not detectable except for those measured in boring MW-41. High OVA readings (300 to 500 ppm) were measured from soil samples obtained below the water table (at depths of 9 to 12 feet) at the time of boring in MW-41 (Appendix E).

4.2.2.2 Inorganic Results--Inorganic water-quality analyses were limited to the field measurement of pH and specific conductance (discussed above) and the laboratory analysis of lead. Laboratory analyses for lead were negative in all wells at the Fire Training Area (Table 4-2).

4.2.2.3 Organic Results--Waters from the Fire Training Area wells were analyzed for three organic water-quality parameters: aromatic volatile organics, halogenated volatile organics and petroleum hydrocarbons. A summary of the positive organic analyses for the Fire Training Area No. 3 is provided in Table 4-3. Chlorobenzene was only detected in one downgradient well (MW-41) by two different methods at concentrations of 8 and 23 μ g/L (Table 4-3). These concentrations are lower than the proposed Recommended Maximum Contaminant Levels (RMCLs) published (Table 4-3) for chlorobenzene (i.e., monochlorobenzene). No other aromatic volatile organics or halogenated volatile organics were detected in valid analytical data for Site 1 (Tables 4-4 and 4-5, respectively). Petroleum hydrocarbons were not detected in well MW-11 (Table 4-6).

4.2.2.4 Stage 1 Results--No indications of groundwater contamination were noted based on the analytical results of nitrate, oil and grease, total organic carbon, total organic halogen, or phenols in well MW-11 (Table 4-7). Because of the 30-foot depth of well MW-11, however, the water quality results measured in the well may not be a true reflection of the water quality in the very shallow surficial sands.

TABLE 4-2. RESULTS OF WATER ANALYSES; FIRE TRAINING AREA NO. 3; p. 1 of 1
Lead (Water); Method E239.2; Concentrations in mg/L

Sampling Point:		MW-11	MW-40	MW-41	MW-42
Date Sampled:		15 JAN 87	13 JAN 87	15 JAN 87	15 JAN 87
Date Analyzed:		12 FEB 87	12 FEB 87	12 FEB 87	12 FEB 87
Sticker No., ID:		325, J	392, J	327, J	329, J
Depth Interval (ft):		20	11.5	12	13
<u>Compound</u>	<u>Detection Limit (mg/L)</u>				
Lead	0.002	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

TABLE 4-3. RESULTS OF POSITIVE ORGANIC ANALYSES (WATER); SITE 1 (FIRE TRAINING AREA NO. 3)

Results of Groundwater Analyses; Concentrations in ug/L

Sampling Point:		MW-41	
Date Sampled:		25 FEB 87	
Sticker No., ID:		579, AI	
	<u>Detection Limit (ug/L)</u>		<u>Recommended Maximum Contaminant Levels (RMCLs)</u>
AROMATIC VOLATILE ORGANICS (Method 602)			
Chlorobenzene	1.0	8.0	60 ug/L ¹⁾
HALOGENATED VOLATILE ORGANICS (Method 601)			
Chlorobenzene	1.0	23.0	60 ug/L ¹⁾

¹⁾Proposed RMCLs for Monochlorobenzene Reported in the Federal Register, Vol. 50, No. 219, Wednesday, November 13, 1985, p. 46981.

Note: Each value of chlorobenzene was obtained using a different method.

Note: The results reported as positive on this table are those for which second-column confirmation by gas chromatography has been performed on samples.

TABLE 4-4. RESULTS OF WATER ANALYSES; FIRE TRAINING AREA NO. 3; p. 1 of 1
Aromatic Volatile Organics (Water); Method 602; Concentrations in ug/L

Sampling Point:		MW-41
Date Sampled:		25 FEB 87
Date Analyzed:		4 MAR 87
Sticker No., ID:		579, AI
Depth Interval (ft):		12.5
Compound	Detection Limits (ug/L)	
Benzene	1.0	BDL
Chlorobenzene	1.0	8.0
1,2-Dichlorobenzene	1.0	BDL
1,3-Dichlorobenzene	1.0	BDL
1,4-Dichlorobenzene	1.0	3.0*
Ethylbenzene	1.0	BDL
Toluene	1.0	BDL
Xylene 1)	1.0	BDL

BDL = Below Detection Limits

1) = Quantitated as Ethylbenzene

* = Compound Not Confirmed in Second Column Analysis
(See Table L-1, Appendix L)

TABLE 4-5. RESULTS OF WATER ANALYSES; FIRE TRAINING AREA NO. 3; p. 1 of 1

Halogenated Volatile Organics (Water); Method 601; Concentrations in ug/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):		MW-11 7 JAN 87 16 JAN 87 118, A2 20	MW-40 7 JAN 87 16 JAN 87 81, A2 15	MW-41 25 FEB 87 1 MAR 87 579, A1 12.5	MW-42 8 JAN 87 16 JAN 87 130, A2 13
Compound	Detection Limit (ug/L)				
Bromodichloromethane	1.0	BDL	BDL	BDL	BDL
Bromoform	1.0	BDL	BDL	BDL	BDL
Bromomethane	1.0	BDL	BDL	BDL	BDL
Carbon Tetrachloride	1.0	BDL	BDL	BDL	BDL
Chlorobenzene	1.0	BDL	BDL	23.0	BDL
Chloroethane	1.0	BDL	BDL	BDL	BDL
2-Chlorethylvinyl Ether	1.0	BDL	BDL	BDL	BDL
Chloroform	1.0	BDL	BDL	BDL	BDL
Chloromethane	1.0	BDL	BDL	BDL	BDL
Dibromochloromethane	1.0	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL
Dichlorodifluoromethane	1.0	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1.0	BDL	BDL	BDL	BDL
1,2-Dichloroethane	1.0	BDL	BDL	BDL	BDL
1,1-Dichloroethene	1.0	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethene	1.0	BDL	BDL	BDL	BDL
1,2-Dichloropropene	1.0	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropene	1.0	BDL	BDL	BDL	BDL
trans-1,3-Dichloropropene	1.0	BDL	BDL	BDL	BDL
Methylene Chloride	1.0	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1.0	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1.0	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1.0	BDL	BDL	BDL	BDL
Tetrachloroethene	1.0	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1.0	BDL	BDL	BDL	BDL
Vinyl Chloride	1.0	BDL	BDL	BDL	BDL
Trichloroethene	1.0	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

TABLE 4-6. RESULTS OF WATER ANALYSES; FIRE TRAINING AREA NO. 3; p. 1 of 1

Petroleum Hydrocarbons (Water); Method E418.1; Concentrations in mg/L

Sampling Point:		MW-11
Date Sampled:		12 JAN 87
Date Extracted:		13 JAN 87
Date Analyzed:		13 JAN 87
Sticker No., ID:		121, C
Depth Interval (ft):		20
<u>Compound</u>	<u>Detection Limit (mg/L)</u>	
Hydrocarbons	2.0	BDL

BDL = Below Detection Limit

**TABLE 4-7. SUMMARY OF STAGE 1 GROUNDWATER ANALYSES;
SITE 1 (FIRE TRAINING AREA)**

		Sampling Point: Date Sampled:	MW-11 4 APR 84
<u>Indicator Parameters</u>	<u>(Units)</u>		
pH			5.5
Specific Conductance	(umhos/cm)		50
<u>Organic Parameters</u>			
Oil and Grease	(mg/l)		1.85
Total Organic Carbon	(mg/l)		0.60

Note: Analyses for nitrate, total organic halogen
and phenol were below detection limits.

4.2.3 Conclusions

Based on the results of analyses on waters from the Fire Training Area wells, MW-41 is the only well to indicate that slight contamination of groundwater by organics has occurred at this site. Other supportive data suggesting contamination of groundwater in well MW-41 include a high conductivity (320 $\mu\text{mhos/cm}$) relative to background (51 $\mu\text{mhos/cm}$) and high OVA readings in soil samples (300 to 500 ppm) below the water table at the time of boring in MW-41. The Stage 1 and 2 data obtained from well MW-11 do not indicate any contamination at the sampled depth. The groundwater contamination appears to be of limited extent and volume downgradient of Site 1 based on the absence of trace-level organics in the other wells near MW-41. Since the Fire Training Area No. 3 has an underdrain system to drain the pit to an underground oil/water separator (Subsection 1.5.1), it is unlikely that an extensive contaminant plume presently exists in the vicinity of this site.

4.3 SITE 2 - LANDFILL NO. 4

A description and history of the site was provided in Subsection 1.5.2.

4.3.1 Hydrogeology

The present Landfill No. 4 topography is generally flat with a slight slope to the northwest. The northwestern limit of the landfill is marked by an abrupt escarpment as the landfill extends onto a flat-lying flood plain near Stoney Creek.

Landfill No. 4 was the site of the most intensive drilling of the field program. A total of six shallow monitoring wells and one deep soil boring were installed in the flood plain immediately northwest of the landfill. One up-gradient monitoring well (MW-43) was installed near Collier Avenue. Boring records indicate that subsurface sediments consist of silty to clayey fine to medium sands with some gravel to about 5 to 7 feet; from about 5 to 13 feet, gravel content tends to increase, until the occurrence of the Black Creek formation, at approximately 13 feet below grade. All wells at Landfill No. 4 were terminated in the top of the Black Creek formation. In the deep soil boring SB-49, the Black Creek formation was also encountered at about 10 feet below ground surface. The laminated clay and fine sand, appeared to dissipate at approximately 40 feet leaving a gray, very dense clay that continued in SB-49 until the boring was terminated approximately 75 feet below ground surface. A hydrogeologic cross section of Site 2 is provided in Figure 4-3.

The approximate groundwater flow direction for Site 2 is indicated in Figure 4-4. In general, groundwater flow is from the southeast to northwest beneath the site, where the ultimate discharge of groundwater is into Stoney Creek. There are some unusual conditions revealed by the water-level data, however, that make it difficult to interpret the precise direction of groundwater flow on a smaller-scale basis along the northwest section of the landfill. For example, water levels from MW-13 and MW-14 consistently indicate (Table 4-8) that this section of Landfill No. 4 acts as a groundwater sink which receives water from both the southeast and from the flood plain near Stoney Creek

TABLE 4-8. Groundwater Elevations, Site 2 (Landfill No. 4)

Monitoring Well Number	Well Casing Elev.	GROUND WATER LEVELS							
		10 NOV 86		22 DEC 86		21 JAN 87		3 FEB 87	
		1) Depth	2) Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.
MW-43	104.02	19.75	84.27	19.45	84.57	18.22	85.80	16.60	87.42
MW-44	75.76	4.50	71.26	5.00	70.76	4.50	71.26	4.70	71.06
MW-45	75.14	4.75	70.39	4.50	70.64	4.18	70.96	4.33	70.81
MW-46	75.84	4.68	71.16	4.40	71.44	3.89	71.95	4.10	71.74
MW-47	76.76	5.60	71.16	5.25	71.51	4.45	72.31	4.90	71.86
MW-48	75.52	3.30	72.22	2.90	73.88	1.44	74.08	2.48	73.04
MW-49	76.78	4.40	72.38	5.00	70.52	4.05	72.73	4.45	72.33
MW-13	86.00	---	---	19.60	66.40	19.05	66.95	19.18	66.82
MW-14	74.94	---	---	8.30	66.64	7.88	67.06	8.18	66.76

1) Depth Below Top of Well Casing

2) Elevation Relative to M.S.L. (ft)

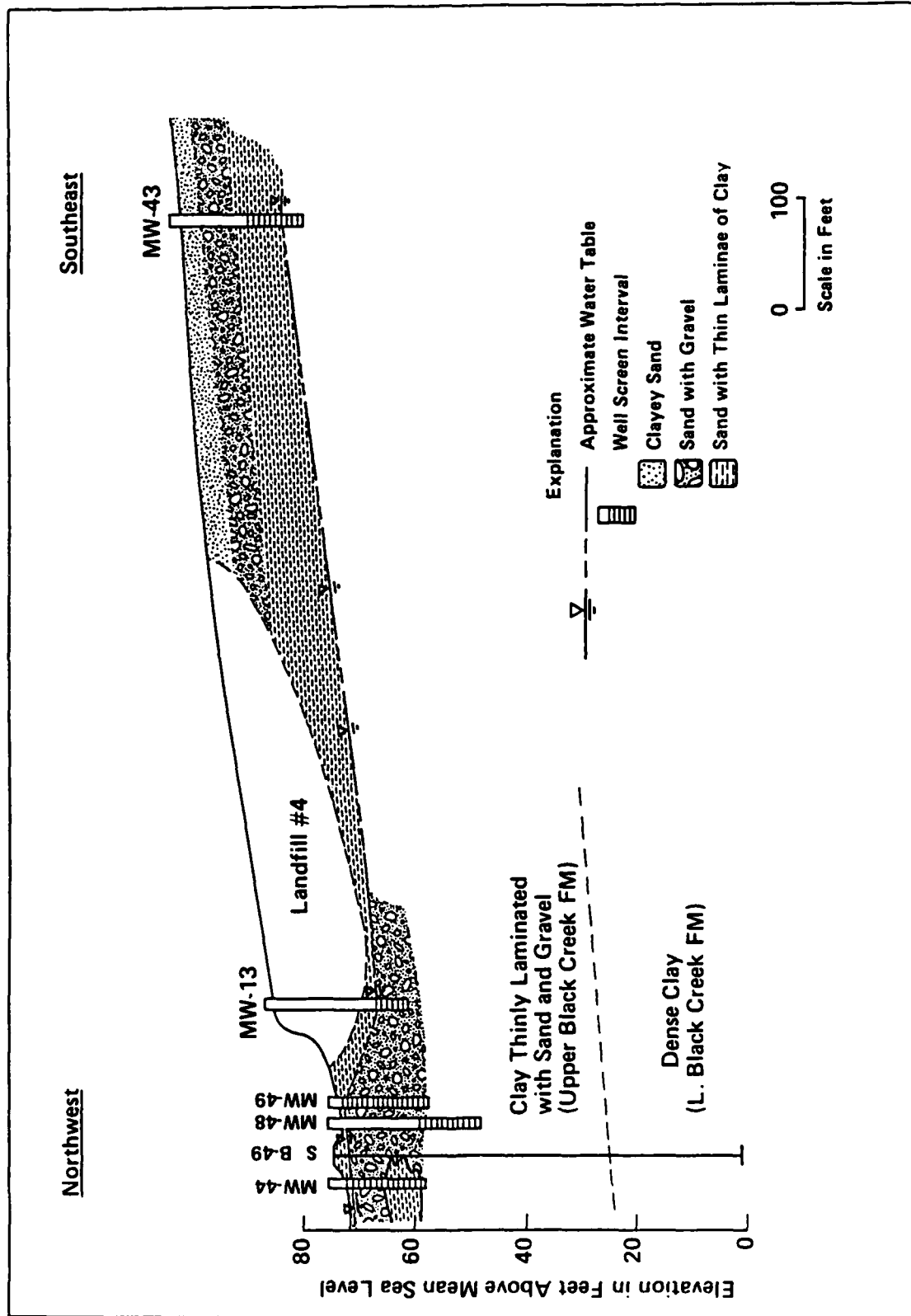


FIGURE 4-3. HYDROGEOLOGIC CROSS SECTION OF SITE 2 (LANDFILL NO. 4)
SEYMOUR JOHNSON AFB, NC

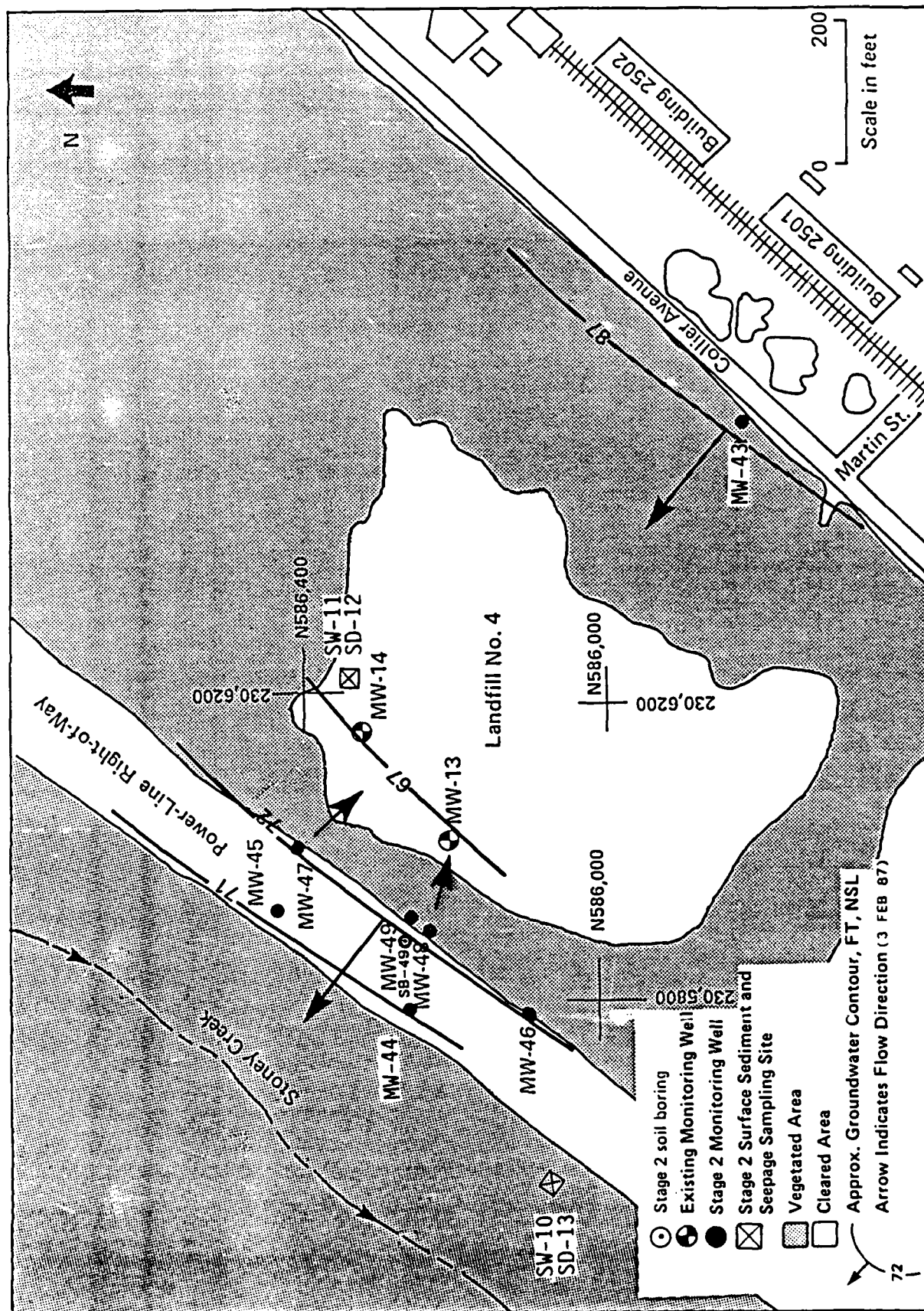


FIGURE 4-4. APPROXIMATE GROUNDWATER FLOW DIRECTION, SITE 2 (LANDFILL NO. 4)

SEYMOUR JOHNSON AFB, NC

(Figures 4-3 and 4-4). Several factors may be contributing to this unusual condition:

- 1) High levels (flood conditions) in Stoney Creek may generate conditions such that groundwater levels decrease for a distance inland from the creek due to the creek recharging the water table.
- 2) Water-table elevation data from MW-48 (Table 4-8) suggests that upward vertical hydraulic gradients tend to increase with depth in the flood plain due to the confining nature of the overlying silty sands. The data provided in Table 4-8 indicate that groundwater elevations in well MW-48 are typically higher than adjacent wells that are screened at shallower depths. Upward vertical gradients in the flood plain could raise water-table elevations there relative to the landfill wells MW-13 and MW-14. Also, groundwater recharge is probably less directly beneath the landfill due to the thick cover of the landfill material (Figure 4-3).
- 3) Water-quality data tend to confirm that the prevailing ground-water gradient is from the landfill toward Stoney Creek (see discussion below on groundwater quality at Landfill No. 4).

4.3.2 Groundwater Quality

The results of all Stage 2 inorganic and organic analytical testing for Site 2 are provided in Appendix M and N, respectively.

4.3.2.1 Field Measurements--During the course of the field work, the specific conductance ranged from approximately 20 $\mu\text{mhos/cm}$ at background well MW-43 to 2,000 $\mu\text{mhos/cm}$ at MW-13 (Appendix G). In the January 1987 sampling, the specific conductance ranged from 52 to 490 $\mu\text{mhos/cm}$ at wells MW-43 and MW-46, respectively. During the course of the April 1987 sampling the stabilized specific conductance ranged from 40 to 276 $\mu\text{mhos/cm}$ at wells MW-43 (background) and MW-13, respectively. Of those wells downgradient of the landfill, MW-49 and MW-46 showed the highest initial specific conductance measurements of approximately 1,500 and 1,100 $\mu\text{mhos/cm}$, respectively (Appendix G). Temperature and pH measurements were within the range expected for these waters. No floating hydrocarbons were observed in any of the Landfill No. 4 wells, although waters from MW-44, MW-45, and MW-46 possessed strong "organic odors."

The organic vapor analyzer (OVA) scan of soil samples from Site 2 were generally below or near detection limits in the background boring (MW-43) and in boring MW-45. OVA readings of soil samples obtained from borings MW-44, MW-46, MW-47, and MW-48 were generally less than 10 ppm at the time of boring. The highest OVA readings at Site 2 (70 ppm) were measured from shallow soil samples obtained below the water table at a depth of 3 to 5 feet from MW-49 (Appendix E).

4.3.2.2 Inorganic Results--Waters from Landfill No. 4 were analyzed for common ions, thirteen priority pollutant metals, and total dissolved solids. A summary of selected inorganic groundwater analyses at Landfill No. 4 is provided in Table 4-9 and results of valid inorganic water analyses are provided in Table 4-10 through 4-13. A general indication of the extent of groundwater contamination at Landfill No. 4 is indicated by examining concentrations of conservative inorganic ions such as chloride and bromide. Conservative inorganic ions are those ions whose abundance relative to each other remain constant in natural water. Higher than background levels of chloride and bromide downgradient of the landfill (relative to the background, upgradient well) appear to be dispersed along the southwest-northeast axis of the landfill (Table 4-9). For example, the first, second, and third highest chloride concentrations are observed in MW-46, MW-47, and MW-45, respectively, and are spatially separated by more than 400 feet (Table 4-9). All values of chloride are well below the secondary Drinking Water Standard of 250 mg/L.

Analyses for EPA's thirteen priority pollutant metals indicate four of the eight downgradient wells at Landfill No. 4 possess waters that exceed relevant standards or criterion for lead, nickel, or silver (Table 4-9). Silver was detected in well MW-45 at almost three times the relevant standard (Table 4-9). Other wells, which exceed the relevant standards for priority pollutants are MW-48 for lead and silver; and MW-49, for lead. One surface water (seepage) sample (SW-11) had a detectable concentration of cadmium (0.013 mg/L; Table 4-13) which exceeds primary drinking water standards of 0.01 mg/L as well as proposed RMCLs of 0.005 mg/L. The results of priority pollutant metal analyses for the two sediment samples obtained in the vicinity of Landfill No. 4 (Figure 4-4) are provided in Table 4-14. In general, higher concentrations of metals were observed at sediment location SD-13 than at SD-12. Sediment location SD-13 is also downgradient of Landfill No. 4 within the floodplain of Stoney Creek. As no background sediment sampling station is located at Landfill No. 4, a portion of the results are compared with the background soil boring (SB-60) from Site 6 (Coal Pile Storage Area). The common metals analyzed by the two analytical methods (priority pollutant metals and total metals screen) include antimony, beryllium, cadmium, chromium, copper, lead, nickel, silver,

TABLE 4-9. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 2 (LANDFILL NO. 4); p. 1 of 3

GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

Sampling Point: Date Sampled:			MW-13 21 JAN 87	MW-14 20 JAN 87	MW-43 14 JAN 87
<u>Relevant Standard or Criterion</u>					
<u>SELECTED INDICATOR PARAMETERS</u>					
	(Units)				
pH			5.60	4.40	4.70
Specific Conductance	(umhos/cm)		230	60	52
<u>SELECTED ANIONS</u>					
	(Detection Limits)				
Chloride	(0.01 mg/L)	250 mg/L ¹⁾	14.7	3.7	3.6
Bromide	(0.05 mg/L)		0.55	BDL	BDL
<u>SELECTED PRIORITY POLLUTANTS</u>					
	(Detection Limits)				
Lead	(0.053 mg/L)	0.05 mg/L ²⁾	0.070	BDL	BDL
Nickel	(0.010 mg/L)	0.0134 mg/L ³⁾	0.020	BDL	BDL
Silver	(0.007 mg/L)	0.05 mg/L ²⁾	0.025	BDL	BDL

BDL = Below Detection Limit

1) = Secondary Drinking Water Standards

2) = Maximum Contaminant Levels Reported in 40CFR141.11,
Inorganic Chemicals, Revised July 1, 1985, p. 523.

3) = EPA, "No Adverse Effect Level", 1980.

TABLE 4-9. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 2 (LANDFILL NO. 4); p. 2 of 3

GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

Sampling Point: Date Sampled:			MW-44 16 JAN 87	MW-45 16 JAN 87	MW-46 16 JAN 87
Relevant Standard or Criterion					
<u>SELECTED INDICATOR PARAMETERS</u>					
	(Units)				
pH			4.25	5.10	6.3
Specific Conductance	(umhos/cm)		60	80	490
<u>SELECTED ANIONS</u>					
	(Detection Limits)				
Chloride	(0.01 mg/L)	250 mg/L ¹⁾	11.5	17.3	38.5
Bromide	(0.05 mg/L)		0.61	0.46	0.89
<u>SELECTED PRIORITY POLLUTANTS</u>					
	(Detection Limits)				
Lead	(0.053 mg/L)	0.05 mg/L ²⁾	BDL	BDL	BDL
Nickel	(0.010 mg/L)	0.0134 mg/L ³⁾	BDL	BDL	BDL
Silver	(0.007 mg/L)	0.05 mg/L ²⁾	BDL	0.134	BDL

BDL = Below Detection Limit

1) = Secondary Drinking Water Standards

2) = Maximum Contaminant Levels Reported in 40CFR141.11,
Inorganic Chemicals, Revised July 1, 1985, p. 523.

3) = EPA, "No Adverse Effect Level", 1980.

TABLE 4-9. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 2 (LANDFILL NO. 4); p. 3 of 3

GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

			Sampling Point: Date Sampled:	MW-47 20 JAN 87	MW-48 20 JAN 87	MW-49 20 JAN 87
			<u>Relevant Standard or Criterion</u>			
<u>SELECTED INDICATOR PARAMETERS</u>						
	(Units)					
pH				5.0	5.05	5.40
Specific Conductance	(umhos/cm)			315	330	430
<u>SELECTED ANIONS</u>						
	(Detection Limits)					
Chloride	(0.01 mg/L)	250 mg/L ¹⁾		19.7	3.6	15.8
Bromide	(0.05 mg/L)			0.19	BDL	0.14
<u>SELECTED PRIORITY POLLUTANTS</u>						
	(Detection Limits)					
Lead	(0.053 mg/L)	0.05 mg/L ²⁾		BDL	0.109	0.068
Nickel	(0.010 mg/L)	0.0134 mg/L ³⁾		BDL	BDL	0.028
Silver	(0.007 mg/L)	0.05 mg/L ²⁾		BDL	0.062	BDL

BDL = Below Detection Limit

1) = Secondary Drinking Water Standards

2) = Maximum Contaminant Levels Reported in 40CFR141.11,
Inorganic Chemicals, Revised July 1, 1985, p. 523.

3) = EPA, "No Adverse Effect Level", 1980.

TABLE 4-10. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 3

Anions (Water); Method 429A; Concentrations in mg/L

Sampling Point:		MW-13	MW-13	MW-14	MW-14	MW-43	MW-43
Date Sampled:		21 JAN 87	22 APR 87	20 JAN 87	14 APR 87	14 JAN 87	14 APR 87
Date Analyzed:		3 FEB 87	23 APR 87	2 FEB 87	15 APR 87	30 JAN 87	15 APR 87
Sticker No., ID:		424, J	671, J	417, J	677, M	395, J	683, K
Depth Interval (ft):		22	21	11	14	18	18
Compound	Detection Limit (mg/L)						
Fluoride	0.01	BDL		0.012		BDL	
Chloride	0.01	14.747		3.687		3.565	
Nitrate	0.03		BDL		BDL		3.493
Phosphate	0.60		BDL		BDL		BDL
Bromide	0.05	0.550		BDL		BDL	
Nitrite	0.05		BDL		BDL		BDL
Sulfate	0.05	6.775		11.872		0.306	

BDL = Below Detection Limits

TABLE 4-10. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 2 of 3

Anions (Water); Method 429A; Concentrations in mg/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):		MW-44 16 JAN 87 2 FEB 87 338, J 10	MW-44 16 APR 87 17 APR 87 687, K 5.5	MW-45 16 JAN 87 3 FEB 87 344, J 9	MW-45 16 APR 87 17 APR 87 691, K 5.5	MW-46 16 JAN 87 3 FEB 87 350, J 9	MW-46 16 APR 87 17 APR 87 695, K 5
Compound	Detection Limit (mg/L)						
Fluoride	0.01	BDL		0.066		0.461	
Chloride	0.01	11.541		17.259		38.54	
Nitrate	0.03		BDL		BDL		BDL
Phosphate	0.60		BDL		BDL		BDL
Bromide	0.05	0.607		0.460		0.886	
Nitrite	0.05		BDL		BDL		BDL
Sulfate	0.05	11.572		7.936		33.957	

BDL = Below Detection Limits

TABLE 4-10 . RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 3 of 3

Anions (Water); Method 429A; Concentrations in mg/L

Sampling Point:
 Date Sampled:
 Date Analyzed:
 Sticker No., ID:
 Depth Interval (ft):

Compound	Detection Limit (mg/L)
Fluoride	0.01
Chloride	0.01
Nitrate	0.03
Phosphate	0.60
Bromide	0.05
Nitrite	0.05
Sulfate	0.05

MW-47 20 JAN 87 3 FEB 87 401, K 10	MW-47 16 APR 87 17 APR 87 699, K 5.5	MW-48 20 JAN 87 2 FEB 87 411, J 8	MW-48 22 APR 87 23 APR 87 703, K 6	MW-49 20 JAN 87 3 FEB 87 405, J 8	MW-49 22 APR 87 23 APR 87 770, K 6
BDL		BDL		BDL	
19.739		3.621		15.848	
	BDL		BDL		BDL
	BDL		BDL		BDL
0.198		BDL		0.143	
	BDL		BDL		BDL
44.978		11.701		48.252	

BDL = Below Detection Limits

TABLE 4-11. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 1

Anions (Surface Water); Method 429A; Concentrations in mg/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID:		SW-10 21 JAN 87 3 FEB 87 431, J	SW-10 14 APR 87 15 APR 87 739, K	SW-11 21 JAN 87 3 FEB 87 456, J	SW-11 14 APR 87 15 APR 87 743, K
Compound	Detection Limit (mg/L)				
Fluoride	0.01	0.208		0.056	
Chloride	0.01	16.192		8.150	
Nitrate	0.03		0.217		BDL
Phosphate	0.60		BDL		BDL
Bromide	0.05	0.173		BDL	
Nitrite	0.05		BDL		BDL
Sulfate	0.05	40.174		17.955	

BDL = Below Detection Limits

TABLE 4-12. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 2

Thirteen Priority Pollutant Metals (Water); Concentrations in mg/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):			MW-13 21 JAN 87 8 FEB 87 426, M 22	MW-14 20 JAN 87 8 FEB 87 419, L 11	MW-43 14 JAN 87 29 JAN 87 397, L 18	4 16 87 29 JAN 87 L 10	MW-45 16 JAN 87 29 JAN 87 355, L 9
Compound	Detection Limit (mg/L)	Methods					
Arsenic	0.002	E206.2	BDL	BDL	BDL	BDL	BDL
Antimony	0.009	E204.2	BDL	BDL	BDL	BDL	BDL
Beryllium	0.0012	E200.7	BDL	BDL	BDL	BDL	BDL
Cadmium	0.006	E200.7	BDL	BDL	BDL	BDL	BDL
Chromium	0.008	E200.7	BDL	BDL	BDL	BDL	BDL
Copper	0.014	E200.7	BDL	0.031	BDL	BDL	0.040
Lead	0.005	E200.7	0.070	BDL	BDL	BDL	BDL
Mercury	0.0002	E245.1	BDL	BDL	BDL	BDL	BDL
Nickel	0.004	E200.7	0.020	BDL	BDL	BDL	BDL
Selenium	0.004	E270.2	BDL	BDL	BDL	BDL	BDL
Silver	0.007	E200.7	0.025	BDL	BDL	BDL	0.134
Thallium	0.002	E200.7	BDL	BDL	BDL	BDL	BDL
Zinc	0.003	E200.7	BDL	0.010	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Blind Duplicate of 352, L (MW-46)

TABLE 4-12. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 2 of 2

Thirteen Priority Pollutant Metals (Water); Concentrations mg/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):			MW-46 16 JAN 87 29 JAN 87 352, L 9	1) MW-56 16 JAN 87 29 JAN 87 432, M 21	MW-47 20 JAN 87 29 JAN 87 403, L 10	MW-48 20 JAN 87 8 FEB 87 413, L 8	MW-49 20 JAN 87 8 FEB 87 407, L 8
Compound	Detection Limit (mg/L)	Methods					
Arsenic	0.002	E206.2	BDL	BDL	BDL	BDL	BDL
Antimony	0.009	E204.2	BDL	BDL	BDL	BDL	BDL
Beryllium	0.0012	E200.7	BDL	BDL	BDL	BDL	BDL
Cadmium	0.006	E200.7	BDL	BDL	BDL	BDL	BDL
Chromium	0.008	E200.7	BDL	BDL	BDL	BDL	BDL
Copper	0.014	E200.7	BDL	0.024	BDL	BDL	0.060
Lead	0.005	E200.7	BDL	BDL	BDL	0.109	0.068
Mercury	0.0002	E245.1	BDL	BDL	BDL	BDL	BDL
Nickel	0.004	E200.7	BDL	BDL	BDL	BDL	0.028
Selenium	0.004	E270.2	BDL	BDL	BDL	BDL	BDL
Silver	0.007	E200.7	BDL	BDL	BDL	0.062	BDL
Thallium	0.002	E200.7	BDL	BDL	BDL	BDL	BDL
Zinc	0.003	E200.7	BDL	BDL	BDL	0.013	0.014

BDL = Below Detection Limit

TABLE 4-13. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 1

Thirteen Priority Pollutant Metals (Surface Water); Concentrations in mg/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID:			SW-10 21 JAN 87 2 FEB 87 434, J	SW-11 21 JAN 87 2 FEB 87 458, L
Compound	Detection Limit (mg/L)	Methods		
Arsenic	0.002	E206.2	BDL	BDL
Antimony	0.009	E204.2	BDL	BDL
Beryllium	0.0012	E200.7	BDL	BDL
Cadmium	0.006	E200.7	BDL	0.013
Chromium	0.008	E200.7	BDL	BDL
Copper	0.014	E200.7	BDL	BDL
Lead	0.005	E200.7	BDL	BDL
Mercury	0.0002	E245.1	1)	BDL
Nickel	0.004	E200.7	BDL	BDL
Selenium	0.004	E270.2	BDL	BDL
Silver	0.007	E200.7	BDL	BDL
Thallium	0.002	E200.7	BDL	BDL
Zinc	0.003	E200.7	0.029	0.024

BDL = Below Detection Limit

1) = Insufficient Volume for Analysis

TABLE 4-14. RESULTS OF SEDIMENT ANALYSES; LANDFILL NO. 4; p. 1 of 1

Thirteen Priority Pollutant Metals (Sediment); Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID:			SD-12 20 JAN 87 10 FEB 87 341, C	SD-13 20 JAN 87 10 FEB 87 358, C
Compound	Detection Limit (mg/Kg)	Methods		
Arsenic	0.13	SW7060	1.81	1.29
Antimony	0.9	SW7041	BDL	BDL
Beryllium	0.12	SW6010	0.199	0.298
Cadmium	0.34	SW6010	BDL	BDL
Chromium	0.8	SW6010	5.17	6.05
Copper	0.9	SW6010	BDL	6.35
Lead	3.5	SW6010	BDL	108
Mercury	0.1	SW7471	BDL	0.246
Nickel	1.0	SW6010	3.28	13.0
Selenium	0.22	SW7740	0.30	0.99
Silver	0.6	SW6010	BDL	BDL
Thallium	0.20	SW7841	BDL	BDL
Zinc	0.30	SW6010	11.0	104

BDL = Below Detection Limit

thallium, and zinc. The metal analyses at the two sediment locations are generally within the range of background conditions as measured over four soil sampling intervals in boring SB-60, with the following exceptions at site SD-13 which were above the range of background conditions:

	<u>SD-13</u>	<u>Range at SB-60</u>
Copper (mg/Kg)	6.35	BDL - 3.3
Lead (mg/Kg)	108	4.60 - 15.7
Nickel (mg/Kg)	13.0	BDL - 8.8
Zinc (mg/Kg)	104	2.80 - 9.70

4.3.2.3 Organic Results--Landfill No. 4 groundwaters and surface waters were tested for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, and extractable priority pollutants. A summary of the positive organic groundwater analyses for Landfill No. 4 is provided in Table 4-15 and results for valid organic water analyses are provided in Tables 4-16 through 4-23.

Benzene was the only aromatic volatile organic compound detected in the groundwater downgradient of Landfill No. 4. Positive findings of benzene were measured in wells MW-13 and MW-46, at concentrations of 7.0 and 5.0 $\mu\text{g/L}$, respectively (Table 4-15). These concentrations equal or exceed RMCLs for benzene (Table 4-15). Halogenated volatile organic compounds detected in the groundwater included 1,1-dichloroethane; trans-1,2-dichloroethene; or trichloroethene. The most prevalent and concentrated of these halogenated volatile organic compounds observed in the groundwater downgradient of Landfill No. 4 was trans-1,2 dichloroethene (1,2-DCE). Positive results for 1,2-DCE were observed at five wells ranging from at or near the detection limit (1 $\mu\text{g/L}$) at well MW-45 to 41.0 $\mu\text{g/L}$ at MW-13. Although prevalent in the groundwater, these 1,2-DCE concentrations are below proposed RMCLs (Table 4-13). Organic analyses on surface water obtained in the vicinity of Landfill No. 4 were negative (Tables 4-21 through 4-23).

The results of valid organic sediment analyses are provided in Tables 4-24 through 4-30. Landfill No. 4 sediments were sampled for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, and extractable priority pollutants organics. Two sampling sites were chosen at

TABLE 4-15. RESULTS OF POSITIVE ORGANIC ANALYSES (WATER); SITE 2 (LANDFILL NO. 4)

Results of Groundwater Analyses; Concentrations in ug/L

Sampling Point: Date Sampled: Sticker No., ID:		MW-13 26 FEB 87 589, A1	MW-44 26 FEB 87 581, A1	MW-45 26 FEB 87 583, A1	MW-46 26 FEB 87 585, A1	MW-49 26 FEB 87 587, A1	Recommended Maximum Contaminant Levels (RMCLs)
Detection Limit (ug/L)							
AROMATIC VOLATILE ORGANICS (Method 602)							
Benzene	1.0	7.0	BDL	BDL	5.0	BDL	5 ug/L ¹⁾
HALOGENATED VOLATILE ORGANICS (Method 601)							
1,1-Dichloroethane	1.0	BDL	BDL	6.0	BDL	BDL	--2)
Trans-1,2-Dichloroethane	1.0	41.0	3.6	1.0	13.0	1.7	70 ug/L ³⁾
Trichloroethane	1.0	3.8	BDL	BDL	3.6	BDL	5 ug/L ¹⁾

BDL = Below Detection Limit

¹⁾ Final RMCLs for Benzene, and Trichloroethylene Reported in the Federal Register, Vol. 52, No. 130, Wednesday, July 8, 1987, p. 25691.

²⁾ No RMCLs Have Been Proposed at this Time for 1,1-Dichloroethane.

³⁾ Proposed RMCLs for Trans-1,2-Dichloroethylene Reported in the Federal Register, Vol. 50, No. 219, Wednesday, November 13, 1985, p. 46981.

Note: The results reported as positive on this table are those for which second-column confirmation by gas chromatography has been performed on samples.

TABLE 4-16. RESULTS OF WATER ANALYSES; LANDFILL NO. 4, p. 1 of 2

Acid Extractables (Water); Method 625 A; Concentrations in ug/L

Sampling Point:		MW-13	MW-14	MW-43	MW-44	MW-45
Date Sampled:		22 APR 87	14 APR 87	14 APR 87	14 APR 87	16 APR 87
Date Extracted:		28 APR 87	16 APR 87	15 APR 87	23 APR 87	23 APR 87
Date Analyzed:		29 MAY 87	15 MAY 8	14 MAY 87	20 MAY 87	18 MAY 87
Sticker No., ID:		668, E1	672, E1	680, E3	684, E1	688, E1
Depth Interval (ft):		21	14	18	5.5	5.5
Compound	Detection Limits (ug/L)					
4-Chloro-3-Methylphenol	25	BDL	BDL		BDL	BDL
2-Chlorophenol	25	BDL			BDL	BDL
2,4-Dichlorophenol	25	BDL			BDL	BDL
2,4-Dimethylphenol	25	BDL			BDL	BDL
2,4-Dinitrophenol	250	BDL			BDL	BDL
2-Methyl-4,6-Dinitrophenol	250	BDL			BDL	BDL
2-Nitrophenol	25	BDL			BDL	BDL
4-Nitrophenol	25	BDL			BDL	BDL
Pentachlorophenol	25	BDL			BDL	BDL
Phenol	25	BDL			BDL	BDL
2,4,6-Trichlorophenol	25	BDL			BDL	BDL

BDL = Below Detection Limits

TABLE 4-16. RESULTS OF WATER ANALYSES; LANDFILL No. 4; p. 2 of 2

Acid Extractables (Water); Method 625 A; Concentrations In ug/L

		MW-46	MW-47	MW-48	MW-49
Sampling Point:		16 APR 87	16 APR 87	22 APR 87	22 APR 87
Date Sampled:		23 APR 87	23 APR 87	28 APR 87	28 APR 87
Date Extracted:		19 MAY 87	18 MAY 87	28 MAY 87	29 MAY 87
Date Analyzed:		692, EI	696, EI	700, EI	706, E3
Sticker No., ID:		5	5.5	6	6
Depth Interval (ft):					
Compound	Detection Limits (ug/L)				
4-Chloro-3-Methylphenol	25	BDL	BDL	BDL	BDL
2-Chlorophenol	25	BDL	BDL	BDL	BDL
2,4-Dichlorophenol	25	BDL	BDL	BDL	BDL
2,4-Dimethylphenol	25	BDL	BDL	BDL	BDL
2,4-Dinitrophenol	250	BDL	BDL	BDL	BDL
2-Methyl-4,6-Dinitrophenol	250	BDL	BDL	BDL	BDL
2-Nitrophenol	25	BDL	BDL	BDL	BDL
4-Nitrophenol	25	BDL	BDL	BDL	BDL
Pentachlorophenol	25	BDL	BDL	BDL	BDL
Phenol	25	BDL	BDL	BDL	BDL
2,4,6-Trichlorophenol	25	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-17. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 1

Aromatic Volatile Organics (Water); Method 602; Concentrations in ug/L

Sampling Point:		MW-13	MW-44	MW-45	MW-46	MW-49
Date Sampled:		26 FEB 87	25 FEB 87	26 FEB 87	26 FEB 87	26 FEB 87
Date Analyzed:		2 MAR 87	2 MAR 87	2 MAR 87	2 MAR 87	2 MAR 87
Sticker No., ID:		589, AI	581, AI	583, AI	585, AI	587, AI
Depth Interval (ft):		22	8	8	8	8.5
Compound	Detection Limit (ug/L)					
Benzene	1.0	7.0	BDL	BDL	5.0	BDL
Chlorobenzene	1.0	BDL	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL	BDL
Ethylbenzene	1.0	BDL	BDL	BDL	BDL	BDL
Toluene	1.0	BDL	BDL	BDL	BDL	BDL
Xylene ¹⁾	1.0	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

¹⁾ = Quantitated as Ethylbenzene

TABLE 4-18. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 3

Base/Neutral Extractables (Water); Method 625B/N; Concentrations in ug/L

Sampling Site: Date Sampled: Date Extracted: Date Analyzed: Sticker No., ID: Depth Interval (ft):		MW-13 22 APR 87 28 APR 87 29 MAY 87 668, E1 21	MW-14 14 APR 87 16 APR 87 15 MAY 87 672, E1 14	MW-43 14 APR 87 15 APR 87 14 MAY 87 680, E3 18
Compound	Detection Limit (ug/L)			
Acenaphthene	25	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	25*	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL
Di-N-Octylphthalate	10	11*	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL

BDL = Below Detection Limit

* = Compound Not Confirmed in Second Column Analysis
(See Table N-4, Appendix N)

TABLE 4-18. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 2 of 3

Base/Neutral Extractables (Water); Method 625B/N; Concentrations in ug/L

Sampling Site: Date Sampled: Date Extracted: Date Analyzed: Sticker No., ID: Depth Interval (ft):		MW-44 16 APR 87 23 APR 87 20 MAY 87 684, EI 5.5	MW-45 16 APR 87 23 APR 87 18 MAY 87 688, EI 5.5	MW-46 16 APR 87 23 APR 87 19 MAY 87 692, EI 5
Compound	Detection Limit (ug/L)			
Acenaphthene	25	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL	21*
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL

BDL = Below Detection Limit

* = Compound Not Confirmed in Second Column Analysis
(See Table N-4, Appendix N)

TABLE 4-18. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 3 of 3

Base/Neutral Extractables (Water); Method 625B/N; Concentrations in ug/L

Sampling Site: Date Sampled: Date Extracted: Date Analyzed: Sticker No., ID: Depth Interval (ft):		MW-47 16 APR 87 23 APR 87 18 MAY 87 596, EI 5.5	MW-48 22 APR 87 28 APR 87 28 MAY 87 700, EI 6	MW-49 22 APR 87 28 APR 87 29 MAY 87 706, E3 6
Compound	Detection Limit (ug/L)			
Acenaphthene	25	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL

BDL = Below Detection Limit

TABLE 4-19. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 1

Halogenated Volatile Organics (Water); Method 601; Concentrations in ug/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):		MW-13 26 FEB 87 1 MAR 87 589, A1 22	MW-43 7 JAN 87 16 JAN 87 94, A2 21	MW-44 26 FEB 87 1 MAR 87 581, A1 8	MW-45 26 FEB 87 1 MAR 87 583, A1 8	MW-46 26 FEB 87 1 MAR 87 585, A1 8	MW-49 26 FEB 87 1 MAR 87 587, A1 8.5
Compound	Detection Limit (ug/L)						
Bromodichloromethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Bromoform	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Bromomethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Carbon Tetrachloride	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Chloroethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
2-Chloroethylvinyl Ether	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Chloroform	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Chloromethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Dibromochloromethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Dichlorodifluoromethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
1,1-Dichloroethane	1.0	BDL	BDL	BDL	6.0	BDL	BDL
1,2-Dichloroethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
1,1-Dichloroethene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethene	1.0	41.0	BDL	3.6	1.0	13.0	1.7
1,2-Dichloropropene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
cis-1,3-Dichloropropene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
trans-1,3-Dichloropropene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Methylene Chloride	1.0	BDL	BDL	BDL	6.0*	BDL	BDL
1,1,2,2-Tetrachloroethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Tetrachloroethene	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Trichlorofluoromethane	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Vinyl Chloride	1.0	BDL	BDL	BDL	BDL	BDL	BDL
Trichloroethene	1.0	3.8	BDL	BDL	BDL	3.6	BDL

BDL = Below Detection Limit

* = Compound Not Confirmed in Second Column Analysis
(See Table N-5, Appendix N)

TABLE 4-20. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 2

PCB's and Pesticides (Water); Method 625P; Concentrations in ug/L

Sampling Point:		MW-13	MW-14	MW-43	MW-44	MW-45
Date Sampled:		22 APR 87	14 APR 87	14 APR 87	16 APR 87	16 APR 87
Date Extracted:		28 APR 87	16 APR 87	15 APR 87	23 APR 87	23 APR 87
Date Analyzed:		29 MAY 87	15 MAY 87	14 MAY 87	20 MAY 87	18 MAY 87
Sticker No., ID:		668, EI	672, EI	680, E3	684, EI	688, EI
Depth Interval (ft):		21	14	18	5.5	5.5
Compound	Detection Limit (ug/L)					
Aldrin	10	BDL	BDL	BDL	BDL	BDL
Alpha - BHC	10	BDL	BDL	BDL	BDL	BDL
Beta - BHC	10	BDL	BDL	BDL	BDL	BDL
Delta - BHC	10	BDL	BDL	BDL	BDL	BDL
Gamma - BHC	10	BDL	BDL	BDL	BDL	BDL
Chlordane	10	BDL	BDL	BDL	BDL	BDL
4,4'-DDD	10	BDL	BDL	BDL	BDL	BDL
4,4'-DDE	10	BDL	BDL	BDL	BDL	BDL
4,4'-DDT	10	BDL	BDL	BDL	BDL	BDL
Dieldrin	10	BDL	BDL	BDL	BDL	BDL
Endosulfan I	10	BDL	BDL	BDL	BDL	BDL
Endosulfan II	10	BDL	BDL	BDL	BDL	BDL
Endosulfan Sulfate	10	BDL	BDL	BDL	BDL	BDL
Endrin	10	BDL	BDL	BDL	BDL	BDL
Endrin Aldehyde	10	BDL	BDL	BDL	BDL	BDL
Heptachlor	10	BDL	BDL	BDL	BDL	BDL
Heptachlor Epoxide	10	BDL	BDL	BDL	BDL	BDL
Toxaphene	10	BDL	BDL	BDL	BDL	BDL
PCB 1016	10	BDL	BDL	BDL	BDL	BDL
PCB 1221	10	BDL	BDL	BDL	BDL	BDL
PCB 1232	10	BDL	BDL	BDL	BDL	BDL
PCB 1242	10	BDL	BDL	BDL	BDL	BDL
PCB 1248	10	BDL	BDL	BDL	BDL	BDL
PCB 1254	10	BDL	BDL	BDL	BDL	BDL
PCB 1260	10	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-20. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 2 of 2

PCB's and Pesticides (Water); Method 625P; Concentrations in ug/L

Sampling Point:		MW-46	MW-47	MW-48	MW-49
Date Sampled:		16 APR 87	16 APR 87	22 APR 87	22 APR 87
Date Extracted:		23 APR 87	23 APR 87	28 APR 87	28 APR 87
Date Analyzed:		19 MAY 87	18 MAY 87	28 MAY 87	29 MAY 87
Sticker No., ID:		692, E1	696, E1	700, E1	706, E3
Depth Interval (ft):		5	5.5	6	6
Compound	Detection Limit (ug/L)				
Aldrin	10	BDL	BDL	BDL	BDL
Alpha - BHC	10	BDL	BDL	BDL	BDL
Beta - BHC	10	BDL	BDL	BDL	BDL
Delta - BHC	10	BDL	BDL	BDL	BDL
Gamma - BHC	10	BDL	BDL	BDL	BDL
Chlordane	10	BDL	BDL	BDL	BDL
4,4'-DDD	10	BDL	BDL	BDL	BDL
4,4'-DDE	10	BDL	BDL	BDL	BDL
4,4'-DDT	10	BDL	BDL	BDL	BDL
Dieldrin	10	BDL	BDL	BDL	BDL
Endosulfan I	10	BDL	BDL	BDL	BDL
Endosulfan II	10	BDL	BDL	BDL	BDL
Endosulfan Sulfate	10	BDL	BDL	BDL	BDL
Endrin	10	BDL	BDL	BDL	BDL
Endrin Aldehyde	10	BDL	BDL	BDL	BDL
Heptachlor	10	BDL	BDL	BDL	BDL
Heptachlor Epoxide	10	BDL	BDL	BDL	BDL
Toxaphene	10	BDL	BDL	BDL	BDL
PCB 1016	10	BDL	BDL	BDL	BDL
PCB 1221	10	BDL	BDL	BDL	BDL
PCB 1232	10	BDL	BDL	BDL	BDL
PCB 1242	10	BDL	BDL	BDL	BDL
PCB 1248	10	BDL	BDL	BDL	BDL
PCB 1254	10	BDL	BDL	BDL	BDL
PCB 1260	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-21. RESULTS OF WATER ANALYSES; LANDFILL No. 4; p. 1 of 1

Acid Extractables (Surface Water); Method 625 A; Concentrations in ug/L

Sampling Point:		SW-10	SW-11
Date Sampled:		14 APR 87	14 APR 87
Date Extracted:		17 APR 87	17 APR 87
Date Analyzed:		14 MAY 87	18 MAY 87
Sticker No., ID:		736, EI	740, EI
Compound	Detection Limits (ug/L)		
4-Chloro-3-Methylphenol	25	BDL	BDL
2-Chlorophenol	25	BDL	BDL
2,4-Dichlorophenol	25	BDL	BDL
2,4-Dimethylphenol	25	BDL	BDL
2,4-Dinitrophenol	250	BDL	BDL
2-Methyl-4,6-Dinitrophenol	250	BDL	BDL
2-Nitrophenol	25	BDL	BDL
4-Nitrophenol	25	BDL	BDL
Pentachlorophenol	25	BDL	BDL
Phenol	25	BDL	BDL
2,4,6-Trichlorophenol	25	BDL	BDL

BDL = Below Detection Limits

TABLE 4-22. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 1

Base/Neutral Extractables (Surface Water); Method 625B/N; Concentrations in ug/L

		Sampling Site:	
		SW-10	SW-11
		14 APR 87	14 APR 87
		17 APR 87	17 APR 87
		14 MAY 87	18 MAY 87
		736, EI	740, EI
Compound	Detection Limit (ug/L)		
Acenaphthene	25	BDL	BDL
Acenaphthylene	10	BDL	BDL
Anthracene	10	BDL	BDL
Benzidine	10	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL
Chrysene	10	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL
Diethyl Phthalate	10	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL
Fluoranthene	10	BDL	BDL
Fluorene	10	BDL	BDL
Hexachlorobenzene	10	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL
Hexachloroethane	10	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL
Isophorone	10	BDL	BDL
Naphthalene	10	BDL	BDL
Nitrobenzene	10	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL
Phenanthrene	10	BDL	BDL
Pyrene	10	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL

BDL = Below Detection Limit

TABLE 4-23. RESULTS OF WATER ANALYSES; LANDFILL NO. 4; p. 1 of 1

PCB's and Pesticides (Surface Water); Method 625P; Concentrations in ug/L

Sampling Point:		SW-10	SW-11
Date Sampled:		14 APR 87	14 APR 87
Date Extracted:		17 APR 87	17 APR 87
Date Analyzed:		14 MAY 87	18 MAY 87
Sticker No., ID:		736, E1	740, E1
Compound	Detection Limit (ug/L)		
Aldrin	10	BDL	BDL
Alpha - BHC	10	BDL	BDL
Beta - BHC	10	BDL	BDL
Delta - BHC	10	BDL	BDL
Gamma - BHC	10	BDL	BDL
Chlordane	10	BDL	BDL
4,4'-DDD	10	BDL	BDL
4,4'-DDE	10	BDL	BDL
4,4'-DDT	10	BDL	BDL
Dieldrin	10	BDL	BDL
Endosulfan I	10	BDL	BDL
Endosulfan II	10	BDL	BDL
Endosulfan Sulfate	10	BDL	BDL
Endrin	10	BDL	BDL
Endrin Aldehyde	10	BDL	BDL
Heptachlor	10	BDL	BDL
Heptachlor Epoxide	10	BDL	BDL
Toxaphene	10	BDL	BDL
PCB 1016	10	BDL	BDL
PCB 1221	10	BDL	BDL
PCB 1232	10	BDL	BDL
PCB 1242	10	BDL	BDL
PCB 1248	10	BDL	BDL
PCB 1254	10	BDL	BDL
PCB 1260	10	BDL	BDL

BDL = Below Detection Limits

TABLE 4-24. RESULTS OF SEDIMENT ANALYSES; LANDFILL NO. 4; p. 1 of 1

Acid Extractables (Sediment); Method 625 A; Concentrations in mg/Kg

Sampling Point:		SD-12	SD-13
Date Sampled:		20 JAN 87	20 JAN 87
Date Extracted:		30 JAN 87	30 JAN 87
Date Analyzed:		3 FEB 87	3 FEB 87
Sticker No., ID:		371, A	375, A
Compound	Detection Limits (mg/Kg)		
4-Chloro-3-Methylphenol	6.250	BDL	BDL
2-Chlorophenol	6.250	BDL	BDL
2,4-Dichlorophenol	6.250	BDL	BDL
2,4-Dimethylphenol	6.250	BDL	BDL
2,4-Dinitrophenol	62.50	BDL	BDL
2-Methyl-4,6-Dinitrophenol	62.50	BDL	BDL
2-Nitrophenol	6.250	BDL	BDL
4-Nitrophenol	6.250	BDL	BDL
Pentachlorophenol	6.250	BDL	BDL
Phenol	6.250	BDL	BDL
2,4,6-Trichlorophenol	6.250	BDL	BDL

BDL = Below Detection Limits

TABLE 4-25. RESULTS OF SEDIMENT ANALYSES; LANDFILL NO. 4; p. 1 of 1

Aromatic Volatile Organics (Sediments); Method SW 5030/8020; Concentrations in mg/Kg

		Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID:	
		SD-12 25 FEB 87 3 MAR 87 806, AI	SD-13 25 FEB 87 3 MAR 87 807, AI
Compound	Detection Limit (mg/Kg)		
Benzene	0.001	BDL	5.0*
Chlorobenzene	0.001	BDL	BDL
1,2-Dichlorobenzene	0.001	BDL	BDL
1,3-Dichlorobenzene	0.001	BDL	BDL
1,4-Dichlorobenzene	0.001	BDL	BDL
Ethylbenzene	0.001	BDL	BDL
Toluene	0.001	BDL	BDL
Xylene 1)	0.001	BDL	BDL

BDL = Below Detection Limit

1) = Quantitated as Ethylbenzene

*Not confirmed by second column confirmation.

(Refer to Table N-9, Appendix N)

TABLE 4-26. RESULTS OF SEDIMENT ANALYSES; LANDFILL NO. 4; p. 1 of 1

Non-Halogenated Volatile Organics (Sediments); Method SW 5030/8015; Concentrations in mg/Kg

		Sampling Point:	SD-12	SD-13
		Date Sampled:	20 JAN 87	20 JAN 87
		Date Analyzed:	2 FEB 87	3 FEB 87
		Sticker No., ID:	371, A	375, A
Compound	Detection Limit (mg/Kg)			
Acrylamide	0.025	BDL	BDL	
Carbon Disulfide	0.025	BDL	BDL	
Diethyl Ether	0.025	BDL	BDL	
Methyl Ethyl Ketone	0.025	BDL	BDL	
Methyl Isobutyl Ketone	0.025	BDL	BDL	
Paraldehyde	0.025	BDL	BDL	

BDL = Below Detection Limit

TABLE 4-27. RESULTS OF SEDIMENT ANALYSES; LANDFILL NO. 4; p. 1 of 1

Base/Neutral Extractables (Sediment); Method SW3550/625; Concentrations in mg/Kg

		Sampling Site:	
		SD-12	
		SD-13	
		12 JAN 87	
		30 JAN 87	
		3 FEB 87	
		371, A	
		375, A	
Compound	Detection Limit (mg/Kg)		
Acenaphthene	6.25	BDL	BDL
Acenaphthylene	2.50	BDL	BDL
Anthracene	2.50	BDL	BDL
Benzidine	2.50	BDL	BDL
Benzo (a) Anthracene	2.50	BDL	BDL
Benzo (a) Pyrene	2.50	BDL	BDL
Benzo (b) Fluoranthene	2.50	BDL	BDL
Benzo (ghi) Perylene	6.25	BDL	BDL
Benzo (k) Fluoranthene	2.50	BDL	BDL
Bis (2-Chloroethoxy) Methane	2.50	BDL	BDL
Bis (2-Chloroethyl) Ether	2.50	BDL	BDL
Bis (2-Chloroisopropyl) Ether	2.50	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	2.50	BDL	BDL
4-Bromophenyl Phenyl Ether	2.50	BDL	BDL
Benzyl Butyl Phthalate	2.50	BDL	BDL
2-Chloronaphthalene	2.50	BDL	BDL
4-Chlorophenyl Phenyl Ether	2.50	BDL	BDL
Chrysene	2.50	BDL	BDL
Dibenzo (a,h) Anthracene	2.50	BDL	BDL
1,2-Dichlorobenzene	2.50	BDL	BDL
1,3-Dichlorobenzene	2.50	BDL	BDL
1,4-Dichlorobenzene	2.50	BDL	BDL
3,3-Dichlorobenzidine	2.50	BDL	BDL
Diethyl Phthalate	2.50	BDL	BDL
Dimethyl Phthalate	2.50	BDL	BDL
Di-N-Butyl Phthalate	2.50	BDL	BDL
2,4-Dinitrotoluene	2.50	BDL	BDL
2,6-Dinitrotoluene	2.50	BDL	BDL
Di-N-Octylphthalate	2.50	BDL	BDL
Fluoranthene	2.50	BDL	BDL
Fluorene	2.50	BDL	BDL
Hexachlorobenzene	2.50	BDL	BDL
Hexachlorobutadiene	2.50	BDL	BDL
Hexachlorocyclopentadiene	2.50	BDL	BDL
Hexachloroethane	2.50	BDL	BDL
Indeno (1,2,3-cd) Pyrene	6.25	BDL	BDL
Isophorone	2.50	BDL	BDL
Naphthalene	2.50	BDL	BDL
Nitrobenzene	2.50	BDL	BDL
N-Nitrosodimethylamine	2.50	BDL	BDL
N-Nitroso-Di-N-Propylamine	2.50	BDL	BDL
N-Nitrosodiphenylamine	2.50	BDL	BDL
Phenanthrene	2.50	BDL	BDL
Pyrene	2.50	BDL	BDL
1,2,4-Trichlorobenzene	2.50	BDL	BDL

BDL = Below Detection Limit

TABLE 4-28. RESULTS OF SEDIMENT ANALYSES; LANDFILL NO. 4; p. 1 of 1
Halogenated Volatile Organics (Sediments); Method 601; Concentrations in mg/Kg

		Sampling Point:	
		SD-12	SD-13
		25 FEB 87	25 FEB 87
		1 MAR 87	1 MAR 87
		806, A	807, AI
Compound	Detection Limit (mg/Kg)		
Bromodichloromethane	0.001	BDL	BDL
Bromoform	0.001	BDL	BDL
Bromomethane	0.001	BDL	BDL
Carbon Tetrachloride	0.001	BDL	BDL
Chlorobenzene	0.001	BDL	BDL
Chloroethane	0.001	BDL	BDL
2-Chloroethylvinyl Ether	0.001	BDL	BDL
Chloroform	0.001	BDL	BDL
Chloromethane	0.001	BDL	BDL
Dibromochloromethane	0.001	BDL	BDL
1,2-Dichlorobenzene	0.001	BDL	BDL
1,3-Dichlorobenzene	0.001	BDL	BDL
1,4-Dichlorobenzene	0.001	BDL	BDL
Dichlorodifluoromethane	0.001	BDL	BDL
1,1-Dichloroethane	0.001	BDL	BDL
1,2-Dichloroethane	0.001	BDL	BDL
1,1-Dichloroethene	0.001	BDL	BDL
trans-1,2-Dichloroethene	0.001	BDL	BDL
1,2-Dichloropropene	0.001	BDL	BDL
cis-1,3-Dichloropropene	0.001	BDL	BDL
trans-1,3-Dichloropropene	0.001	BDL	BDL
Methylene Chloride	0.001	BDL	BDL
1,1,2,2-Tetrachloroethane	0.001	BDL	BDL
1,1,1-Trichloroethane	0.001	BDL	BDL
1,1,2-Trichloroethane	0.001	BDL	BDL
Tetrachloroethene	0.001	BDL	BDL
Trichlorofluoromethane	0.001	BDL	BDL
Vinyl Chloride	0.001	BDL	BDL
Trichloroethene	0.001	BDL	BDL
1,1,2,2-Trichloro-1,2,2-Trifluoroethane	0.001		

BDL = Below Detection Limit

TABLE 4-29. RESULTS OF SEDIMENT ANALYSES; LANDFILL NO. 4; p. 1 of 1

PCB's and Pesticides (Sediment); Method 625P; Concentrations in mg/Kg

		SD-12	SD-13
Sampling Point:		20 JAN 87	20 JAN 87
Date Sampled:		30 JAN 87	30 JAN 87
Date Extracted:		3 FEB 87	3 FEB 87
Date Analyzed:		371, A	375, A
Sticker No., ID:			
Compound	Detection Limit (mg/Kg)		
Aldrin	2.50	BDL	BDL
Alpha - BHC	2.50	BDL	BDL
Beta - BHC	2.50	BDL	BDL
Delta - BHC	2.50	BDL	BDL
Gamma - BHC	2.50	BDL	BDL
Chlordane	2.50	BDL	BDL
4,4'-DDD	2.50	BDL	BDL
4,4'-DDE	2.50	BDL	BDL
4,4'-DDT	2.50	BDL	BDL
Dieldrin	2.50	BDL	BDL
Endosulfan I	2.50	BDL	BDL
Endosulfan II	2.50	BDL	BDL
Endosulfan Sulfate	2.50	BDL	BDL
Endrin	2.50	BDL	BDL
Endrin Aldehyde	2.50	BDL	BDL
Heptachlor	2.50	BDL	BDL
Heptachlor Epoxide	2.50	BDL	BDL
Toxaphene	2.50	BDL	BDL
PCB 1016	2.50	BDL	BDL
PCB 1221	2.50	BDL	BDL
PCB 1232	2.50	BDL	BDL
PCB 1242	2.50	BDL	BDL
PCB 1248	2.50	BDL	BDL
PCB 1254	2.50	BDL	BDL
PCB 1260	2.50	BDL	BDL

BDL = Below Detection Limits

TABLE 4-30. RESULTS OF SEDIMENT ANALYSES; LANDFILL NO. 4; p. 1 of 1

Petroleum Hydrocarbons (Sediment); Method SW3550/E418.1; Concentrations in mg/Kg

Sampling Point:		SD-12	SD-13
Date Sampled:		20 JAN 87	20 JAN 87
Date Extracted:		2 FEB 87	2 FEB 87
Date Analyzed:		3 FEB 87	3 FEB 87
Sticker No., ID:		371, A	375, A
Compound	Detection Limit (mg/Kg)		
Hydrocarbons	25	BDL	BDL

BDL = Below Detection Limit

Landfill No. 4: SD-12, within the landfill near MW-14; and SD-13, approximately 150 feet northwest of MW-46, near what appeared to be a spring-fed stream. The January and February 1987 sampling of sediment indicate no positive confirmation of organic analytes. The detection of benzene in sample SD-13 (Table 4-25) was not confirmed by second column confirmation (Table N-9; Appendix N).

4.3.2.4 Stage 1 Results--Summaries of Stage 1 analytical results are provided in Tables 4-31 and 4-32. The results of a leachate sample (SW-1) draining directly from the toe of the landfill had detectable concentrations of volatile organic compounds (Table 4-31). Two of the compounds detected in the leachate sample (benzene and trans-1,2-Dichloroethylene) were also detected in downgradient groundwater samples during the Stage 2 survey (Table 4-15). The leachate sample was also noted to have a high specific conductance (1,700 μ mhos/cm) comparable to that of the Stage 1 reading in well MW-13 (1,090 μ mhos/cm; Table 4-32). It is noted that the location of the Stage 1 and 2 surface water stations are not exactly the same and therefore the analytical results are not directly comparable. Surface water location SW-11 (Stage 2) is in the vicinity of, but not the exact same location as, leachate sample SW-1 (Stage 1). SW-1 seeps directly out of the southwestern portion of landfill No. 4. SW-11 is interpreted to receive not only seepage draining from the southwestern portion of the landfill but from the northeast. The water samples from SW-11 are expected to be more dilute than from the concentrated leachate sample (SW-1) and therefore offer an explanation as to the absence of organic compounds in SW-11 (Section 4.3.2.3).

Groundwater extracted from well MW-13 during the Stage 1 survey was noted to have high values of total organic carbon, total organic halogen, and phenol relative to well MW-14 (Table 4-32) and relative to other water samples collected during the 1984 Stage 1 survey. Groundwater extracted from well MW-14 exhibits water quality that appears to be unaffected by the landfill (Table 4-32).

4.3.3 Conclusions

Laboratory analyses show slight organic contamination of groundwater downgradient of Landfill No. 4 on the basis of Stage 1 and 2 analytical results.

TABLE 4-31. SUMMARY OF STAGE 1 SURFACE WATER ANALYSES;
SITE 2 (LANDFILL NO. 4)

Sampling Point: Date Sampled:		SW-1 4 APR 84
<u>Indicator Parameters</u>	<u>(Units)</u>	
pH		6.45
Specific Conductance	(umhos/cm)	1700
<u>Volatile Organic Compounds</u>	<u>(ug/l)</u>	
Benzene		30
Ethylbenzene		30
Trans-1,2-Dichloroethylene		19
Toluene		50
<u>Inorganic Parameters</u>	<u>(mg/L)</u>	
Lead (Filtered)		0.00211
Lead (Not Filtered)		0.00501
Cadmium (Filtered)		0.00052
Cadmium (Not Filtered)		0.00075
Chromium (Not Filtered)		0.00231
Nickel (Filtered)		0.0370
Nickel (Not Filtered)		0.0269

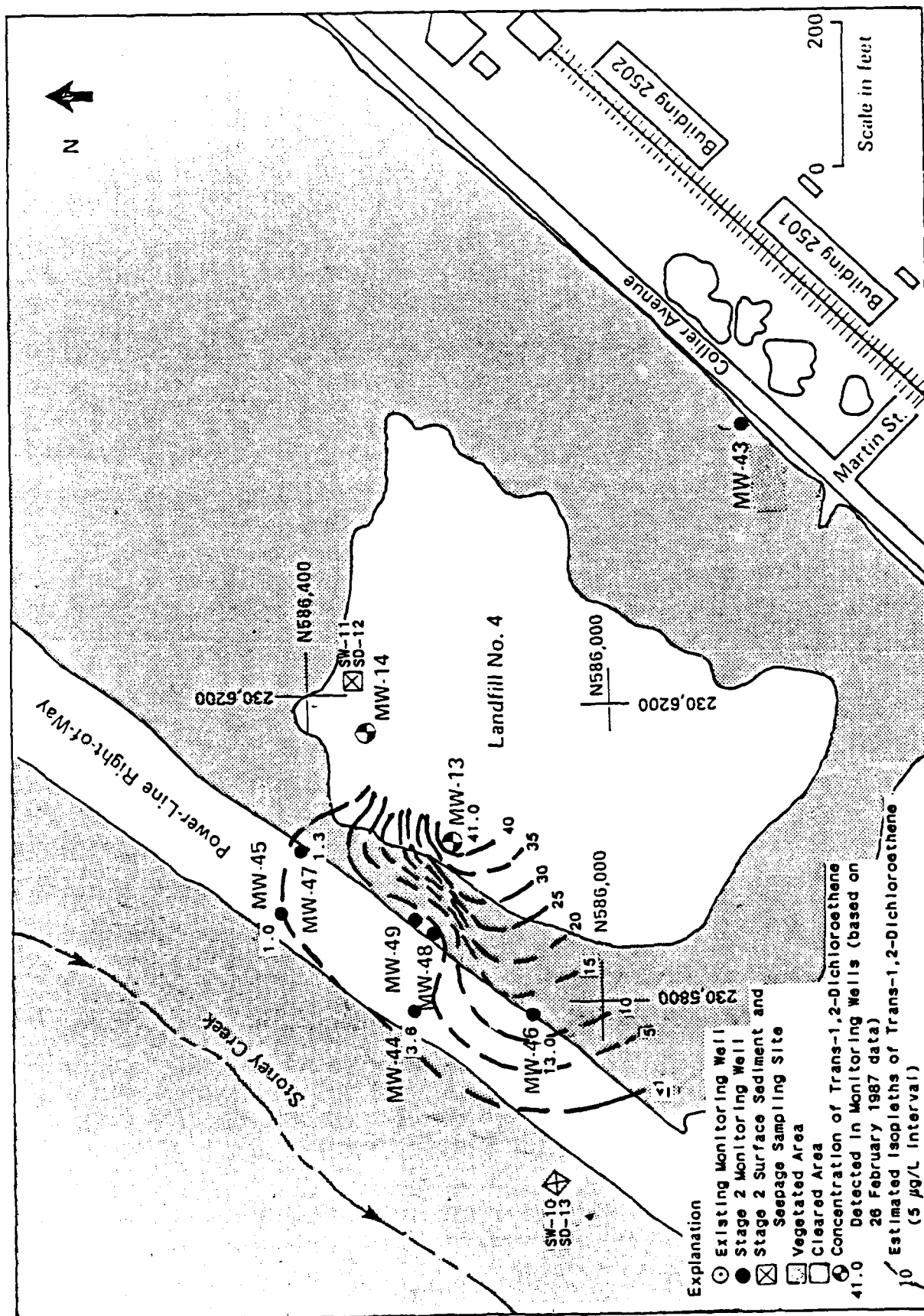
Note: Dissolved analysis for chromium was below detection limits. Also below detection limits were other volatile organic compounds delineated by method 624 (31 priority pollutants) not listed above.

**TABLE 4-32. SUMMARY OF STAGE 1 GROUNDWATER ANALYSES;
SITE 2 (LANDFILL NO. 4)**

Sampling Point: Date Sampled:		MW-13 4 MAR 84	MW-14 4 APR 84
<u>Indicator Parameters</u>	<u>(Units)</u>		
pH		6.20	4.95
Specific Conductance	(umhos/cm)	1090	50
<u>Organic Parameters</u>			
Total Organic Carbon	(mg/l)	40.9	1.0
Total Organic Halogen	(ug/l)	100.9	BDL
Phenol	(ug/l)	184	BDL

The field measurements support the analytical findings qualitatively, in that higher conductivity readings, OVA readings, and the observation of organic odors, correspond to those downgradient wells with measurable concentrations of organic constituents. The most contaminated well in terms of volatile organics, priority pollutant metals, and organic indicator parameters measured during the Stage 1 survey, is well MW-13, which is directly in the landfill. Water samples collected from monitoring wells MW-44, MW-45, MW-46 and MW-49 also detected slight organic contamination. Similar organic contamination was detected in a landfill leachate sample collected during the Stage 1 survey. Those wells that appear relatively free of organic contamination include wells MW-14, MW-43, MW-47 and MW-48.

The January and February 1987 sampling of two sediment locations (SD-12 and SD-13) indicate no positive confirmation of organic contamination. Organic analyses on surface water (SW-10 and SW-11) obtained in the same locations as the sediment samples were also negative. Based on available data, the contaminant distribution downgradient of Landfill No. 4 appears to be limited to the approximate width of the landfill and approximately 200 feet downgradient of the toe of the landfill, as generalized by the distribution of Trans-1,2-Dichloroethene in Figure 4-5.



4.4 SITE 3 - LANDFILL NO. 1

A description and history of the site was provided in Subsection 1.5.3. The approximate limits of Landfill No. 1 are indicated on Figure 4-6. A generalized hydrogeologic cross section through the site showing the relative position of the one downgradient well (MW-12) is provided in Figure 4-7.

4.4.1 Groundwater Quality

The results of all Stage 2 inorganic and organic analytical testing for Site 3 are provided in Appendix O and P, respectively.

4.4.1.1 Field Measurements--Landfill No. 1 is monitored by one well, MW-12. Specific conductance, pH, and temperature were measured at MW-12 and found normal for shallow groundwater at the base. The groundwater is characterized by a pH of 6.2 and a specific conductance of 120 μ mhos/cm at the time of the April 1987 sampling. Floating hydrocarbons were not observed in water from this well (Appendix G).

4.4.1.2 Inorganic Results--Groundwater from MW-12 was analyzed for common anions, thirteen priority pollutant metals, and total dissolved solids. The results of valid inorganic groundwater analyses are provided in Table 4-33 and 4-34. Results for anions and metals were low and at or very near background levels relative to other sites studied at the base. No priority pollutant metals exceeded relevant standards or criterion (Table 4-34).

4.4.1.3 Organic Results--Groundwater from MW-12 was analyzed for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, and extractable priority pollutants. The results of valid organic groundwater analyses for Landfill No. 1 are provided in Tables 4-35 through 4-39. Organic analytes were not detected in groundwater obtained from this well, with the exception of phthalate (Table 4-37). As indicated in Section 4.8, phthalates (plasticizers) are ubiquitous in small concentrations in many laboratories and based on the field QC results it is thought that the phthalates encountered in MW-12 (and all other water samples where detected) are a result of laboratory-induced contamination.

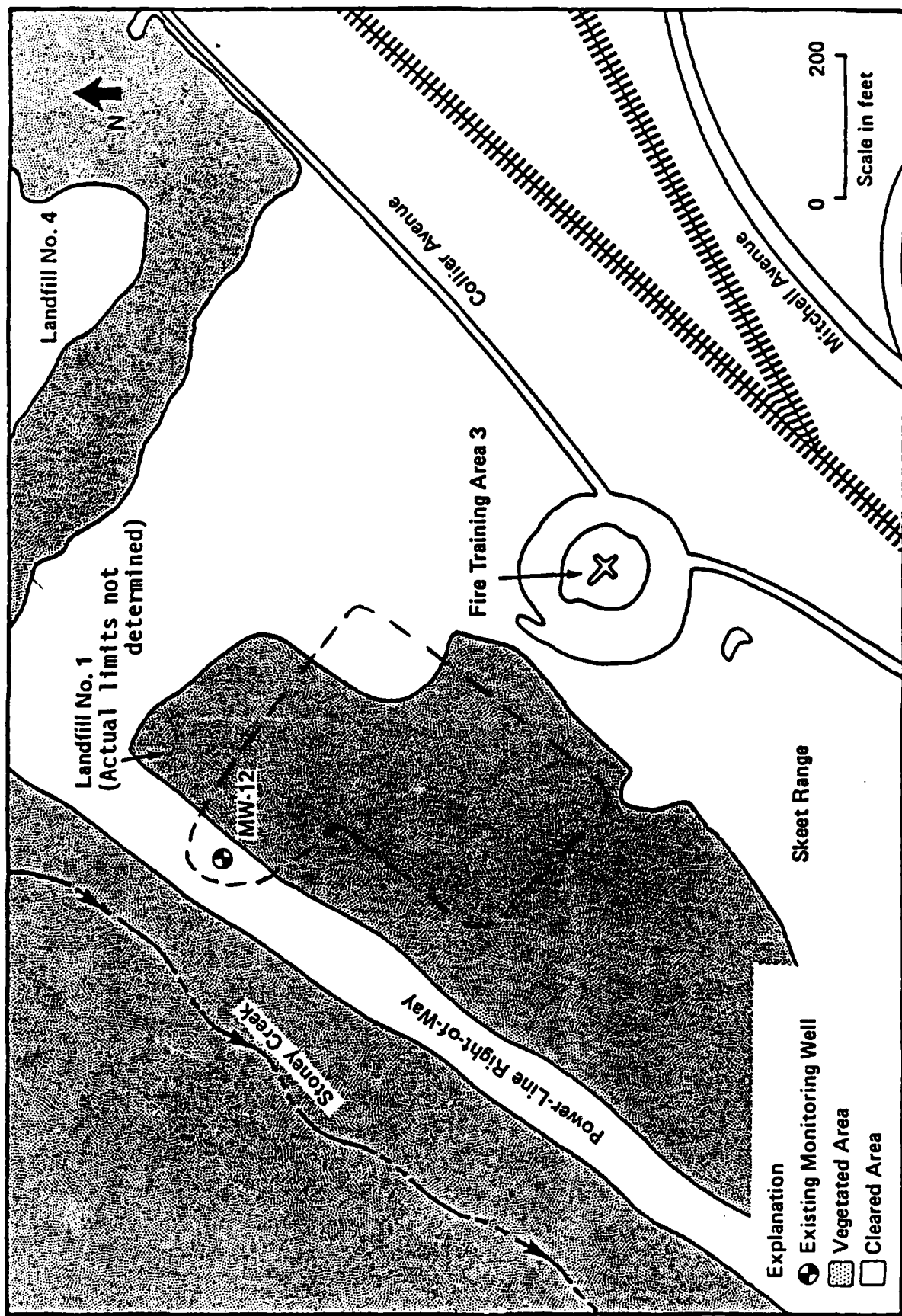


FIGURE 4-6. LOCATION OF SITE 3 (LANDFILL NO. 1)

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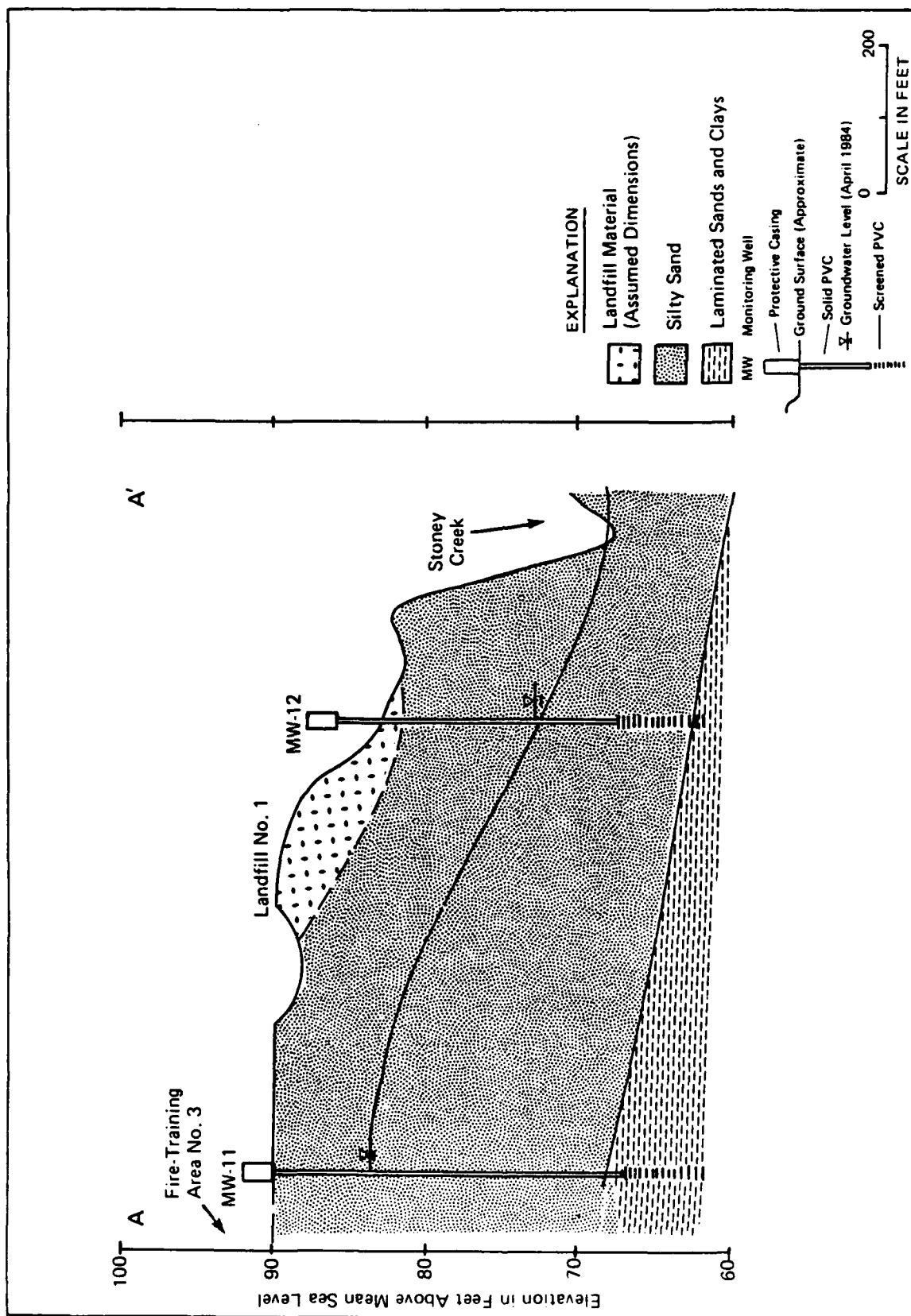


FIGURE 4-7. HYDROGEOLOGIC CROSS SECTION OF SITE 3 (LANDFILL NO. 1)

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TABLE 4-33. RESULTS OF WATER ANALYSES; LANDFILL NO. 1; p. 1 of 1
Anions (Water); Method 429A; Concentrations in mg/L

Sampling Point:		MW-12	MW-12
Date Sampled:		16 JAN 87	14 APR 87
Date Analyzed:		3 FEB 87	15 APR 87
Sticker No., ID:		331, J	667, L
Depth Interval (ft):		10	16
Compound	Detection Limit (mg/L)		
Fluoride	0.01	BDL	
Chloride	0.01	5.704	
Nitrate	0.03		BDL
Phosphate	0.60		BDL
Bromide	0.05	0.339	
Nitrite	0.05		0.086
Sulfate	0.05	12.688	

BDL = Below Detection Limits

TABLE 4-34. RESULTS OF WATER ANALYSES; LANDFILL NO. 1; p. 1 of 1

Thirteen Priority Pollutant Metals (Water); Concentrations in mg/L

Sampling Point:			MW-12
Date Sampled:			16 JAN 87
Date Analyzed:			29 JAN 87
Sticker No.:			333, L
Depth Interval (ft):			20
Compound	Detection Limit (mg/L)	Methods	
Arsenic	0.002	E206.2	BDL
Antimony	0.009	E204.2	BDL
Beryllium	0.0012	E200.7	BDL
Cadmium	0.006	E200.7	BDL
Chromium	0.008	E200.7	BDL
Copper	0.014	E200.7	0.035
Lead	0.005	E200.7	BDL
Mercury	0.0002	E245.1	BDL
Nickel	0.010	E200.7	BDL
Selenium	0.004	E270.2	BDL
Silver	0.007	E200.7	BDL
Thallium	0.002	E200.7	BDL
Zinc	0.003	E200.7	BDL

BDL = Below Detection Limit

TABLE 4-35. RESULTS OF WATER ANALYSES; LANDFILL NO. 1; p. 1 of 1

Acid Extractables (Water); Method 625 A; Concentrations in ug/L

Sampling Point:		MW-12
Date Sampled:		14 APR 87
Date Extracted:		16 APR 87
Date Analyzed:		15 MAY 87
Sticker No., ID:		664, EI
Depth Interval (ft):		16
Compound	Detection Limits (ug/L)	
4-Chloro-3-Methylphenol	25	BDL
2-Chlorophenol	25	BDL
2,4-Dichlorophenol	25	BDL
2,4-Dimethylphenol	25	BDL
2,4-Dinitrophenol	250	BDL
2-Methyl-4,6-Dinitrophenol	250	BDL
2-Nitrophenol	25	BDL
4-Nitrophenol	25	BDL
Pentachlorophenol	25	BDL
Phenol	25	BDL
2,4,6-Trichlorophenol	25	BDL

BDL = Below Detection Limits

TABLE 4-36. RESULTS OF WATER ANALYSES; LANDFILL NO. 1; p. 1 of 1

Aromatic Volatile Organics (Water); Method 602; Concentrations in ug/L

Sampling Point:		MW-12
Date Sampled:		12 JAN 87
Date Analyzed:		16 JAN 87
Sticker No., ID:		135, A1
Depth Interval (ft):		20.5
Compound	Detection Limit (ug/L)	
Benzene	1.0	BDL
Chlorobenzene	1.0	BDL
1,2-Dichlorobenzene	1.0	BDL
1,3-Dichlorobenzene	1.0	BDL
1,4-Dichlorobenzene	1.0	BDL
Ethylbenzene	1.0	BDL
Toluene	1.0	BDL

BDL = Below Detection Limit

TABLE 4-37. RESULTS OF WATER ANALYSES; LANDFILL NO. 1; p. 1 of 1

Base/Neutral Extractables (Water); Method 625B/N; Concentrations in ug/L

Sampling Site:		MW-12
Date Sampled:		14 APR 87
Date Extracted:		16 APR 87
Date Analyzed:		15 MAY 87
Sticker No., ID:		664, E1
Depth Interval (ft):		16
Compound	Detection Limit (ug/L)	
Acenaphthene	25	BDL
Acenaphthylene	10	BDL
Anthracene	10	BDL
Benzidine	10	BDL
Benzo (a) Anthracene	10	BDL
Benzo (a) Pyrene	10	BDL
Benzo (b) Fluoranthene	10	BDL
Benzo (ghi) Perylene	25	BDL
Benzo (k) Fluoranthene	10	BDL
Bis (2-Chloroethoxy) Methane	10	BDL
Bis (2-Chloroethyl) Ether	10	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL
Bis (2-Ethylhexyl) Phthalate	10	34
4-Bromophenyl Phenyl Ether	10	BDL
Benzyl Butyl Phthalate	10	BDL
2-Chloronaphthalene	10	BDL
4-Chlorophenyl Phenyl Ether	10	BDL
Chrysene	10	BDL
Dibenzo (a,h) Anthracene	10	BDL
1,2-Dichlorobenzene	10	BDL
1,3-Dichlorobenzene	10	BDL
1,4-Dichlorobenzene	10	BDL
3,3-Dichlorobenzidine	10	BDL
Diethyl Phthalate	10	BDL
Dimethyl Phthalate	10	BDL
Di-N-Butyl Phthalate	10	BDL
2,4-Dinitrotoluene	10	BDL
2,6-Dinitrotoluene	10	BDL
Di-N-Octylphthalate	10	BDL
Fluoranthene	10	BDL
Fluorene	10	BDL
Hexachlorobenzene	10	BDL
Hexachlorobutadiene	10	BDL
Hexachlorocyclopentadiene	10	BDL
Hexachloroethane	10	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL
Isophorone	10	BDL
Naphthalene	10	BDL
Nitrobenzene	10	BDL
N-Nitrosodimethylamine	10	BDL
N-Nitroso-Di-N-Propylamine	10	BDL
N-Nitrosodiphenylamine	10	BDL
Phenanthrene	10	BDL
Pyrene	10	BDL
1,2,4-Trichlorobenzene	10	BDL

BDL = Below Detection Limit

TABLE 4-38. RESULTS OF WATER ANALYSES; LANDFILL NO. 1; p. 1 of 1
Halogenated Volatile Organics (Water); Method 601; Concentrations in ug/L

Sampling Point:		MW-12
Date Sampled:		8 JAN 87
Date Analyzed:		16 JAN 87
Sticker No.:		136, A2
Depth Interval (ft):		20.5
Compound	Detection Limit (ug/L)	
Bromodichloromethane	1.0	BDL
Bromoform	1.0	BDL
Bromomethane	1.0	BDL
Carbon Tetrachloride	1.0	BDL
Chlorobenzene	1.0	BDL
Chloroethane	1.0	BDL
2-Chloroethyl Vinyl Ether	1.0	BDL
Chloroform	1.0	BDL
Chloromethane	1.0	BDL
Dibromochloromethane	1.0	BDL
1,2-Dichlorobenzene	1.0	BDL
1,3-Dichlorobenzene	1.0	BDL
1,4-Dichlorobenzene	1.0	BDL
Dichlorodifluoromethane	1.0	BDL
1,1-Dichloroethane	1.0	BDL
1,2-Dichloroethane	1.0	BDL
1,1-Dichloroethene	1.0	BDL
trans-1,2-Dichloroethene	1.0	BDL
1,2-Dichloropropene	1.0	BDL
cis-1,3-Dichloropropene	1.0	BDL
trans-1,3-Dichloropropene	1.0	BDL
Methylene Chloride	1.0	BDL
1,1,2,2-Tetrachloroethane	1.0	BDL
1,1,1-Trichloroethane	1.0	BDL
1,1,2-Trichloroethane	1.0	BDL
Tetrachloroethene	1.0	BDL
Trichlorofluoromethane	1.0	BDL
Vinyl Chloride	1.0	BDL
Trichloroethene	1.0	BDL
1,1,2,-Trichloro-1,2,2-	1.0	BDL
Trifluoroethane		

BDL = Below Detection Limit

TABLE 4-39. RESULTS OF WATER ANALYSES; LANDFILL NO. 1; p. 1 of 1

PCB's and Pesticides (Water); Method 625P; Concentrations in ug/L

Sampling Point:		MW-12
Date Sampled:		14 APR 87
Date Extracted:		16 APR 87
Date Analyzed:		15 MAY 87
Sticker No.:		664, E1
Depth Interval (ft):		16
Compound	Detection Limit (ug/L)	
Aldrin	10	BDL
Alpha - BHC	10	BDL
Beta - BHC	10	BDL
Delta - BHC	10	BDL
Gamma - BHC	10	BDL
Chlordane	10	BDL
4,4'-DDD	10	BDL
4,4'-DDE	10	BDL
4,4'-DDT	10	BDL
Dieldrin	10	BDL
Endosulfan I	10	BDL
Endosulfan II	10	BDL
Endosulfan Sulfate	10	BDL
Endrin	10	BDL
Endrin Aldehyde	10	BDL
Heptachlor	10	BDL
Heptachlor Epoxide	10	BDL
Toxaphene	10	BDL
PCB 1016	10	BDL
PCB 1221	10	BDL
PCB 1232	10	BDL
PCB 1242	10	BDL
PCB 1248	10	BDL
PCB 1254	10	BDL
PCB 1260	10	BDL

BDL = Below Detection Limits

4.4.1.4 Stage 1 Results--A summary of the Stage 1 field and analytical results are provided in Table 4-40. Except for measurement of total organic carbon in well MW-12 (3.8 mg/L) there were no indications of groundwater quality degradation downgradient of Landfill No. 1.

4.4.2 Conclusions

Site 3 (Landfill No. 1) appears to pose no environmental contamination problems based on the Stage 1 and 2 results of groundwater analyses from well MW-12.

TABLE 4-40. SUMMARY OF STAGE 1 GROUNDWATER ANALYSES;
SITE 3 (LANDFILL NO. 1)

Sampling Point: Date Sampled:		MW-12 4 MAR 84
<u>Indicator Parameters</u>	<u>(Units)</u>	
pH		5.5
Specific Conductance	(umhos/cm)	100
<u>Organic Parameters</u>		
Total Organic Carbon	(mg/l)	3.8

Note: Measurements of total organic halogen and phenol were below detection limits.

4.5 SITE 4 - LANDFILL NO. 3

A description and history of the site was provided in Subsection 1.5.4.

4.5.1 Hydrogeology

The topography of Landfill No. 3 is relatively flat with a minor slope to the northwest. Like Landfill No. 4, the northwest boundary is marked by an abrupt escarpment as the landfill extends onto a wooded flood plain near Stoney Creek.

No borings or monitoring wells exist within the landfill, nor were any new borings or wells proposed within the landfill for this field program. Consequently, subsurface hydrogeologic conditions within the landfill itself cannot be inferred. Three monitoring wells, MW-51, MW-52, and MW-53, however, were installed along the landfill's north-west boundary to monitor groundwater levels and to detect the presence of contaminants in waters as they migrate from the landfill. Water-level data from these wells and the background well MW-50 (Table 4-41) suggest groundwater flow is northwest toward Stoney Creek (Figure 4-8). Soil boring data from MW-51, MW-52, and MW-53 indicate that deposits from approximately four to eight feet below grade are medium to fine sands, grading to medium to coarse sands with medium gravel. All downgradient wells at Landfill No. 3 were terminated 7.5 to 9 feet below ground surface in the upper Black Creek formation (Figure 4-9).

4.5.2 Groundwater Quality

The results of all Stage 2 inorganic and organic analytical testing for Landfill No. 3 are provided in Appendix Q and R, respectively.

4.5.2.1 Field Measurements--On-site analysis of monitoring wells MW-51, MW-52, and MW-53 during the course of the field work show specific conductance readings 10 to 20 times above background measurements at MW-50 (Appendix G). Stabilized readings of specific conductance measured in the downgradient wells during the April 1987 sampling ranged from 315 to 1059 $\mu\text{mhos/cm}$ compared to 15 $\mu\text{mhos/cm}$ in the background well (Appendix G; Table G-3). During the January 1987 sampling, the conductivity of the groundwater ranged from 110 to 900 $\mu\text{mhos/cm}$ in wells MW-50 and MW-52, respectively. Temperature and pH readings were within an expected range for groundwaters in this area (Appendix G). Floating organic films were not observed in any groundwaters at Landfill No. 3.

TABLE 4-41. Groundwater Elevations, Site 4 (Landfill No. 3)

Monitoring Well Number	Well Casing Elev.	GROUND WATER LEVELS							
		10 NOV 86		22 DEC 86		21 JAN 87		3 FEB 87	
		1) Depth	2) Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.
MW-50	100.80	13.70	87.10	13.01	87.79	10.95	89.85	8.60	92.20
MW-51	77.20	---	---	4.40	72.80	under water	---	4.40	72.80
MW-52	77.49	---	---	4.18	73.31	under water	---	4.10	73.39
MW-53	77.60	---	---	4.20	73.40	3.60	74.00	4.05	73.55

1) Depth Below Top of Well Casing

2) Elevation Relative to M.S.L. (ft)

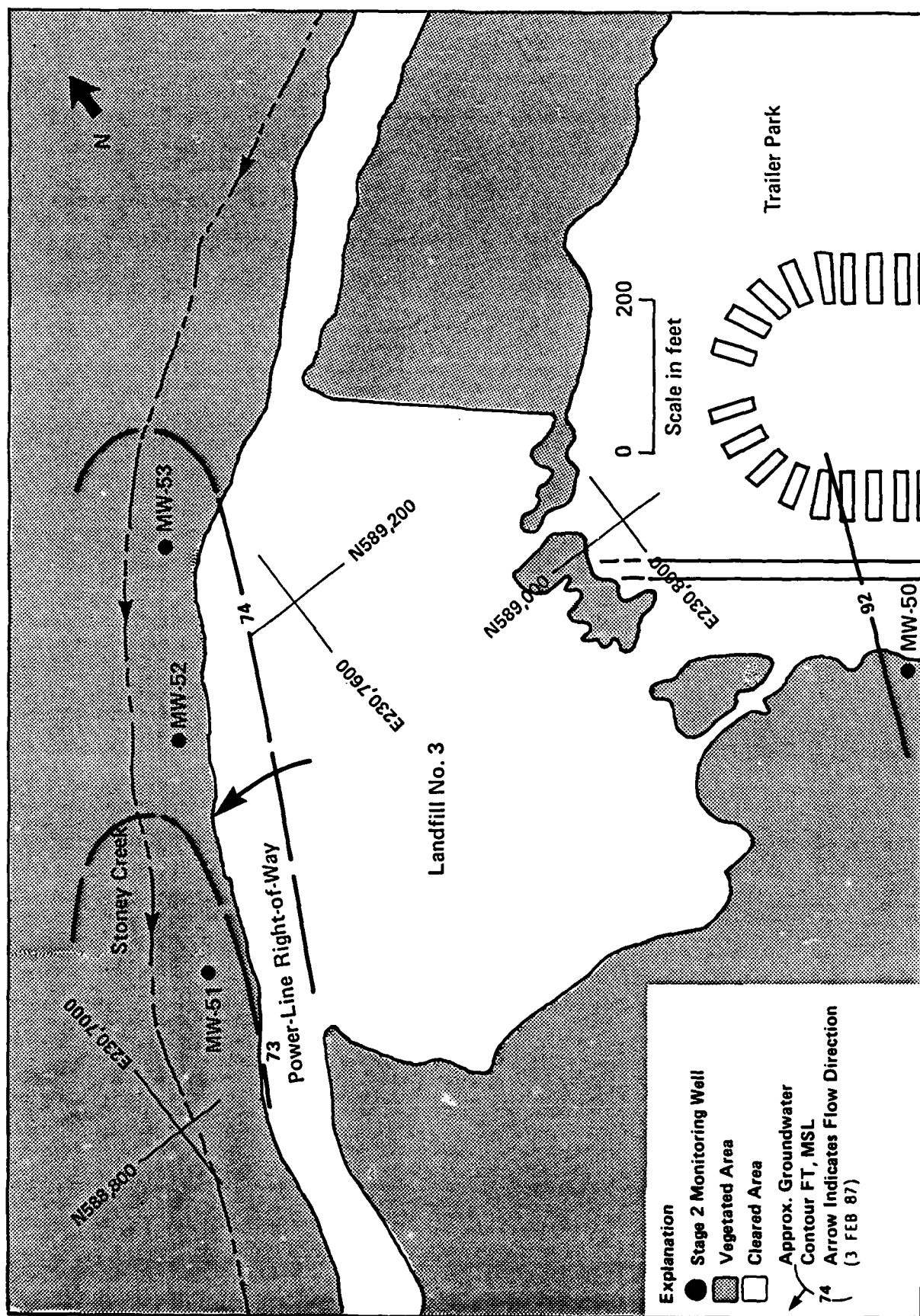


FIGURE 4-8. STATIC GROUNDWATER ELEVATIONS, SITE 4 (LANDFILL NO. 3)

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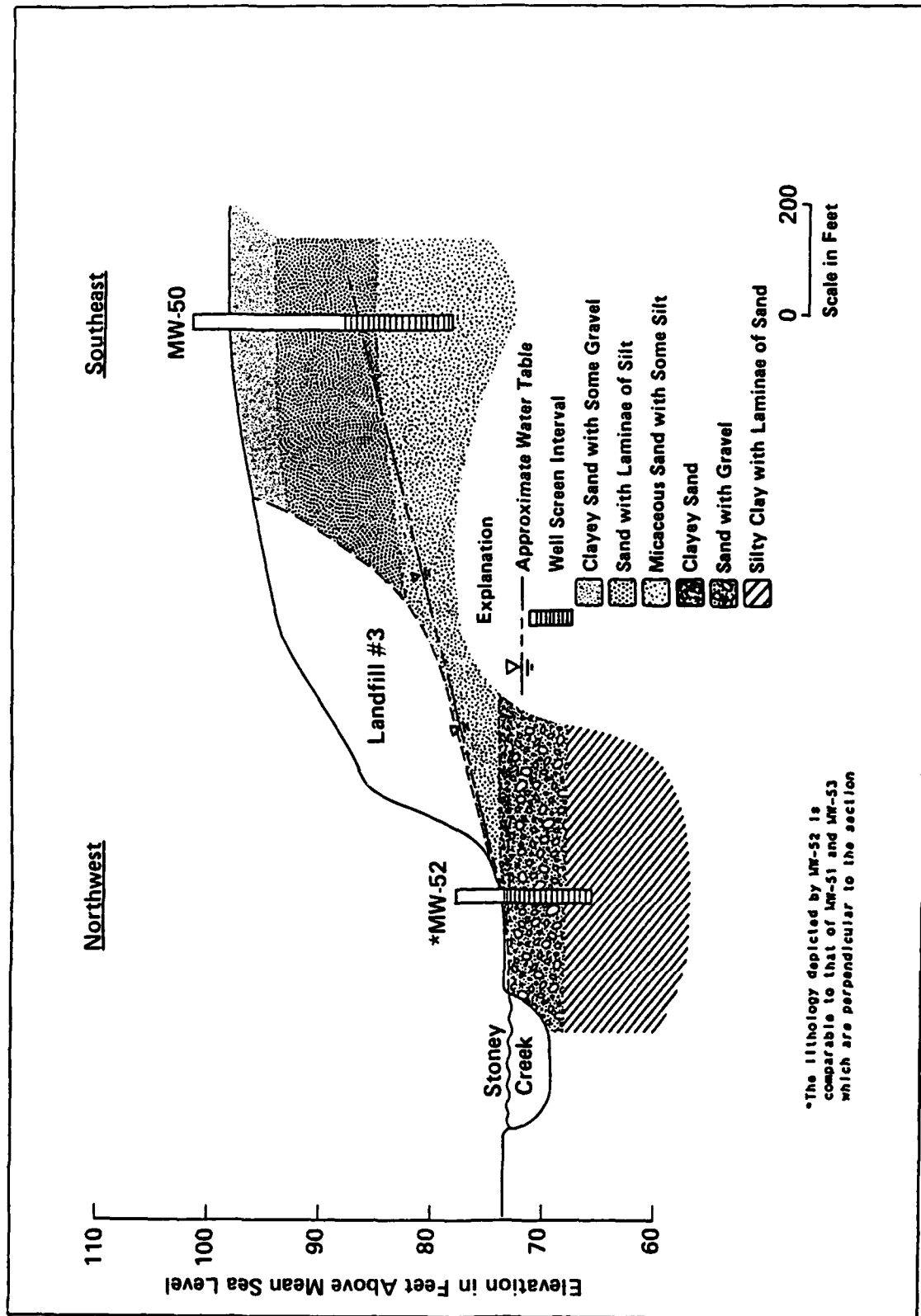


FIGURE 4-9. HYDROGEOLOGIC CROSS SECTION OF SITE 4 (LANDFILL NO. 3)

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The organic vapor analyzer (OVA) scan of soil samples from Site 4 were below detection limits in the background boring (MW-50). OVA readings of soil samples obtained from borings MW-52 and MW-53 were generally below 30 ppm. The highest OVA readings at Site 4 (300 ppm) were measured in shallow soil samples obtained below the water table (at a depth of 3 to 5 feet) at the time of boring in MW-51 (Appendix E).

4.5.2.2 Inorganic Results--Groundwater from Landfill No. 3 were analyzed for common ions, thirteen priority pollutant metals, and total dissolved solids. A summary of selected inorganic analyses and field measurements is provided in Table 4-42. Results of valid organic water analyses are provided in Tables 4-43 and 4-44. Elevated concentrations (relative to background well MW-50) for chloride and bromide support elevated field observations for specific conductance at MW-51, MW-52, and MW-53 (Table 4-42). Groundwater in down-gradient monitoring wells MW-51, MW-52, and MW-53 waters were all within relevant standards for EPA's thirteen priority pollutant metals (Table 4-44).

4.5.2.3 Organic Results--Groundwater from Landfill No. 3 was analyzed for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, and extractable priority pollutants. A summary of the positive organic analyses from Site 4 is provided in Table 4-45. Results of valid organic analyses are provided in Table 4-46 through 4-50. Positive organic findings were obtained for aromatic volatile organics, base-neutral extractables, or halogenated volatile organics in two of the three downgradient wells (Table 4-45). The most contaminated well was MW-51 with positive detections of benzene (2.0 $\mu\text{g/L}$), chlorobenzene (15.0 $\mu\text{g/L}$), 1,4-dichlorobenzene (7.0 and 26.0 $\mu\text{g/L}$) and toluene (4.0 $\mu\text{g/L}$). Well MW-52 contained chlorobenzene (8.0 $\mu\text{g/L}$) and 1,4-dichlorobenzene (13.0 $\mu\text{g/L}$). It is noted that these concentrations are significantly lower than proposed or final RMCLs for these compounds (Table 4-45).

4.5.3 Conclusions

Laboratory and on-site analyses show slight contamination of Site 4 (Landfill No. 3) groundwater. The concentrations detected are significantly lower than proposed for final RMCL's for these compounds. The most contaminated

TABLE 4-42. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 4 (LANDFILL NO. 3); p. 1 of 2

GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

		Sampling Point: Date Sampled:	MW-50 15 JAN 87	MW-51 21 JAN 87
		Relevant Standard or Criterion		
<u>SELECTED INDICATOR PARAMETERS</u>				
	(Units)			
pH			4.2	6.0
Specific Conductance	(umhos/cm)		110	495
<u>SELECTED ANIONS</u>				
	(Detection Limits)			
Chloride	(0.01 mg/L)		2.831	40.60
Bromide	(0.05 mg/L)		0.133	1.991

TABLE 4-42. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 4 (LANDFILL NO. 3); p. 2 of 2

GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

		Sampling Point: Date Sampled:	MW-52 28 JAN 87	MW-53 21 JAN 87
		Relevant Standard or Criterion		
<u>SELECTED INDICATOR PARAMETERS</u>				
	(Units)			
pH			6.45	6.0
Specific Conductance	(umhos/cm)		480	900
<u>SELECTED ANIONS</u>				
	(Detection Limits)			
Chloride	(0.01 mg/L)		22.98	30.01
Bromide	(0.05 mg/L)		1.034	1.376

TABLE 4-43. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 1 of 2

Anions (Water); Method 429A; Concentrations in mg/L

Sampling Point:		MW-50	MW-50	MW-51	MW-51
Date Sampled:		15 JAN 87	14 APR 87	21 JAN 87	15 APR 87
Date Analyzed:		30 JAN 87	15 APR 87	3 FEB 87	16 APR 87
Sticker No., ID:		319, J	712, K	438, J	718, M
Depth Interval (ft):		15.5	15	6	5.5
Compound	Detection Limit (mg/L)				
Fluoride	0.01	0.021		BDL	
Chloride	0.01	2.831		40.60	
Nitrite	0.03		BDL		BDL
Phosphate	0.60		BDL		BDL
Bromide	0.05	0.133		1.991	
Nitrate	0.05		2.014		BDL
Sulfate	0.05	1.053		10.717	

BDL = Below Detection Limits

TABLE 4-43. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 2 of 2

Anions (Water); Method 429A; Concentrations in mg/L

Sampling Point:		MW-52	MW-52	MW-53	MW-53
Date Sampled:		28 JAN 87	15 APR 87	21 JAN 87	15 APR 87
Date Analyzed:		3 FEB 87	16 APR 87	3 FEB 87	16 APR 87
Sticker No., ID:		524, J	722, O	449, J	726, K
Depth Interval (ft):		8	5	7.5	5
Compound	Detection Limit (mg/L)				
Fluoride	0.01	BDL		BDL	
Chloride	0.01	22.980		30.01	
Nitrite	0.03		BDL		BDL
Phosphate	0.60		BDL		BDL
Bromide	0.05	1.034		1.376	
Nitrate	0.05		BDL		BDL
Sulfate	0.05	10.780		15.564	

BDL = Below Detection Limits

TABLE 4-44. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 1 of 1

Thirteen Priority Pollutant Metals (Water); Concentrations in mg/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):			MW-50 15 JAN 87 29 JAN 87 221, N 15.5	MW-51 21 JAN 87 8 FEB 87 444, L 6	MW-52 28 JAN 87 8 FEB 87 526, L 8	MW-08 28 JAN 87 8 FEB 87 532, M 15	MW-53 21 JAN 87 8 FEB 87 451, L 5
Compound	Detection Limit (mg/L)	Methods					
Arsenic	0.002	E206.2	BDL	BDL	BDL	BDL	BDL
Antimony	0.009	E204.2	BDL	BDL	BDL	BDL	BDL
Beryllium	0.0012	E200.7	BDL	BDL	BDL	BDL	BDL
Cadmium	0.006	E200.7	BDL	BDL	BDL	BDL	BDL
Chromium	0.008	E200.7	BDL	BDL	BDL	BDL	BDL
Copper	0.014	E200.7	BDL	BDL	BDL	BDL	BDL
Lead	0.005	E200.7	BDL	BDL	BDL	BDL	BDL
Mercury	0.0002	E245.1	BDL	BDL	BDL	BDL	BDL
Nickel	0.004	E200.7	BDL	BDL	BDL	BDL	BDL
Selenium	0.004	E270.2	BDL	BDL	BDL	BDL	BDL
Silver	0.007	E200.7	BDL	BDL	BDL	BDL	BDL
Thallium	0.002	E200.7	BDL	BDL	BDL	BDL	BDL
Zinc	0.003	E200.7	BDL	BDL	0.021	0.023	BDL

BDL = Below Detection Limit

1) = Blind Duplicate of 526, L (MW-52)

TABLE 4-45. RESULTS OF POSITIVE ORGANIC ANALYSES (WATER); SITE 4 (LANDFILL NO. 3)

Results of Groundwater Analyses; Concentrations in ug/L

Sampling Point: Date Sampled: Sticker No., ID:		MW-51 5 MAR 87 69, AI	MW-51 15 APR 87 713, EI	MW-52 5 MAR 87 73, AI	Recommended Maximum Contaminant Levels (RMCLs)
<u>Detection Limit (ug/L)</u>					
AROMATIC VOLATILE ORGANICS (Method 602)					
Benzene	1.0	2.0	-	BDL	5 ug/L ¹⁾
Chlorobenzene	1.0	15.0	-	8.0	60 ug/L ²⁾
1,4-Dichlorobenzene	1.0	7.0	-	13.0	750 ug/L ¹⁾
Toluene	1.0	4.0	-	BDL	2000 ug/L ²⁾
BASE/NEUTRAL EXTRACTABLES (Method 625)					
1,4-Dichlorobenzene	10.0	-	26.0	-	750 ug/L ¹⁾
HALOGENATED VOLATILE ORGANICS (Method 601)					
Chlorobenzene	1.0	15.0	-	8.0	60 ug/L ²⁾
1,4-Dichlorobenzene	1.0	7.0	-	13.0	750 ug/L ¹⁾

BDL = Below Detection Limit

- = Compounds Not Analyzed on Date Indicated

¹⁾ Final RMCLs for Benzene and p-Dichlorobenzene Reported in the Federal Register, Vol. 52, No. 130, Wednesday, July 8, 1987, p. 25691.

²⁾ Proposed RMCLs for Monochlorobenzene and Toluene Reported in the Federal Register, Vol. 50, No. 219, Wednesday, November 13, 1985, p. 46981.

Note: The results reported as positive on this table are those for which second-column confirmation by gas chromatography has been performed on samples.

well in terms of volatile organics is well MW-51. Organic compounds were also detected in groundwater samples from well MW-52. Wells MW-51 and MW-52 are interpreted to be in a direct flow path downgradient of Landfill No. 3. The field measurements qualitatively support the organic analyses in that high conductivity reading and high OVA readings correspond to those downgradient wells positive detections of organics. The relatively high values for the gross contamination indicators (chloride and bromide) may also suggest that contamination within the flood plain area of Stoney Creek is from Landfill No. 3. Groundwater with the downgradient monitoring wells were all within relevant standards for EPA's thirteen priority pollutant metals.

TABLE 4-46. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 1 of 1

Acid Extractables (Water); Method 625 A; Concentrations in ug/L

Sampling Point:		MW-50	MW-51	MW-52	MW-53
Date Sampled:		14 APR 87	15 APR 87	15 APR 87	15 APR 87
Date Extracted:		15 APR 87	22 APR 87	22 APR 87	22 APR 87
Date Analyzed:		14 MAY 87	12 MAY 87	12 MAY 87	12 MAY 87
Sticker No., ID:		709, EI	713, EI	719, EI	723, EI
Depth Interval (ft):		15	5.5	5	5
Compound	Detection Limits (ug/L)				
4-Chloro-3-Methylphenol	25	BDL	BDL	BDL	BDL
2-Chlorophenol	25	BDL	BDL	BDL	BDL
2,4-Dichlorophenol	25	BDL	BDL	BDL	BDL
2,4-Dimethylphenol	25	BDL	BDL	BDL	BDL
2,4-Dinitrophenol	250	BDL	BDL	BDL	BDL
2-Methyl-4,6-Dinitrophenol	250	BDL	BDL	BDL	BDL
2-Nitrophenol	25	BDL	BDL	BDL	BDL
4-Nitrophenol	25	BDL	BDL	BDL	BDL
Pentachlorophenol	25	BDL	BDL	BDL	BDL
Phenol	25	BDL	BDL	BDL	BDL
2,4,6-Trichlorophenol	25	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-47. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 1 of 1

Aromatic Volatile Organics (Water); Method 602; Concentrations in ug/L

Sampling Point:		MW-51	MW-52
Date Sampled:		5 MAR 87	5 MAR 87
Date Analyzed:		12 MAR 87	12 MAR 87
Sticker No., ID:		69, AI	73, AI
Depth Interval (ft):		8	7
Compound	Detection Limit (ug/L)		
Benzene	1.0	2.0	BDL
Chlorobenzene	1.0	15.0	8.0
1,2-Dichlorobenzene	1.0	BDL	BDL
1,3-Dichlorobenzene	1.0	BDL	BDL
1,4-Dichlorobenzene	1.0	7.0	13.0
Ethylbenzene	1.0	BDL	BDL
Toluene	1.0	4.0	BDL
Xylene ¹	1.0	BDL	BDL

BDL = Below Detection Limit

¹) = Quantitated as Ethylbenzene

TABLE 4-48. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 1 of 2

Base/Neutral Extractables (Water); Method 625B/N; Concentrations in ug/L

Sampling Site:		MW-50	MW-51
Date Sampled:		14 APR 87	15 APR 87
Date Extracted:		15 APR 87	22 APR 87
Date Analyzed:		14 MAY 87	12 MAY 87
Sticker No., ID:		709, E1	713, E1
Depth Interval (ft):		15	5.5
Compound	Detection Limit (ug/L)		
Acenaphthene	25	BDL	BDL
Acenaphthylene	10	BDL	BDL
Anthracene	10	BDL	BDL
Benzidine	10	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL
Chrysene	10	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL
1,4-Dichlorobenzene	10	BDL	26
3,3-Dichlorobenzidine	10	BDL	BDL
Diethyl Phthalate	10	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL
Fluoranthene	10	BDL	BDL
Fluorene	10	BDL	BDL
Hexachlorobenzene	10	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL
Hexachloroethane	10	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL
Isophorone	10	BDL	BDL
Naphthalene	10	BDL	BDL
Nitrobenzene	10	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL
Phenanthrene	10	BDL	BDL
Pyrene	10	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL

BDL = Below Detection Limit

TABLE 4-48. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 2 of 2

Base/Neutral Extractables (Water); Method 625B/N; Concentrations in ug/L

Sampling Site:		MW-52	MW-53
Date Sampled:		15 APR 87	15 APR 87
Date Extracted:		22 APR 87	22 APR 87
Date Analyzed:		12 MAY 87	12 MAY 87
Sticker No., ID:		719, EI	723, EI
Depth Interval (ft):		5	5
Compound	Detection Limit (ug/L)		
Acenaphthene	25	BDL	BDL
Acenaphthylene	10	BDL	BDL
Anthracene	10	BDL	BDL
Benzidine	10	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL
Chrysene	10	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL
Diethyl Phthalate	10	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL
Fluoranthene	10	BDL	BDL
Fluorene	10	BDL	BDL
Hexachlorobenzene	10	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL
Hexachloroethane	10	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL
Isophorone	10	BDL	BDL
Naphthalene	10	BDL	BDL
Nitrobenzene	10	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL
Phenanthrene	10	BDL	BDL
Pyrene	10	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL

BDL = Below Detection Limit

TABLE 4-49. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 1 of 1

Halogenated Volatile Organics (Water); Method 601; Concentrations in ug/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):		MW-50 7 JAN 87 16 JAN 87 108, A2 16	MW-51 5 MAR 87 12 MAR 87 69, A1 8	MW-52 5 MAR 87 12 MAR 87 73, A2 7
Compound	Detection Limit (ug/L)			
Bromodichloromethane	1.0	BDL	BDL	BDL
Bromoform	1.0	BDL	BDL	BDL
Bromomethane	1.0	BDL	BDL	BDL
Carbon Tetrachloride	1.0	BDL	BDL	BDL
Chlorobenzene	1.0	BDL	15.0	8.0
Chloroethane	1.0	BDL	BDL	BDL
2-Chloroethylvinyl Ether	1.0	BDL	BDL	BDL
Chloroform	1.0	BDL	BDL	BDL
Chloromethane	1.0	BDL	BDL	BDL
Dibromochloromethane	1.0	BDL	BDL	BDL
1,2-Dichlorobenzene	1.0	BDL	BDL	BDL
1,3-Dichlorobenzene	1.0	BDL	BDL	BDL
1,4-Dichlorobenzene	1.0	BDL	7.0	13.0
Dichlorodifluoromethane	1.0	BDL	BDL	BDL
1,1-Dichloroethane	1.0	BDL	BDL	BDL
1,2-Dichloroethane	1.0	BDL	BDL	BDL
1,1-Dichloroethene	1.0	BDL	BDL	BDL
trans-1,2-Dichloroethene	1.0	BDL	BDL	BDL
1,2-Dichloropropene	1.0	BDL	BDL	BDL
cis-1,3-Dichloropropene	1.0	BDL	BDL	BDL
trans-1,3-Dichloropropene	1.0	BDL	BDL	BDL
Methylene Chloride	1.0	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	1.0	BDL	BDL	BDL
1,1,1-Trichloroethane	1.0	BDL	BDL	BDL
1,1,2-Trichloroethane	1.0	BDL	BDL	BDL
Tetrachloroethene	1.0	BDL	BDL	BDL
Trichlorofluoromethane	1.0	BDL	BDL	BDL
Vinyl Chloride	1.0	BDL	BDL	BDL
Trichloroethene	1.0	BDL	BDL	BDL

BDL = Below Detection Limit

TABLE 4-50. RESULTS OF WATER ANALYSES; LANDFILL NO. 3; p. 1 of 1

PCB's and Pesticides (Water); Method 625P; Concentrations in ug/L

Sampling Point:		MW-50	MW-51	MW-52	MW-53
Date Sampled:		14 APR 87	15 APR 87	15 APR 87	15 APR 87
Date Extracted:		15 APR 87	22 APR 87	22 APR 87	22 APR 87
Date Analyzed:		14 MAY 87	12 MAY 87	12 MAY 87	12 MAY 87
Sticker No., ID:		709, EI	713, EI	719, EI	723, EI
Depth Interval (ft):		15	5.5	5	5
Compound	Detection Limit (ug/L)				
Aldrin	10	BDL	BDL	BDL	BDL
Alpha - BHC	10	BDL	BDL	BDL	BDL
Beta - BHC	10	BDL	BDL	BDL	BDL
Delta - BHC	10	BDL	BDL	BDL	BDL
Gamma - BHC	10	BDL	BDL	BDL	BDL
Chlordane	10	BDL	BDL	BDL	BDL
4,4'-DDD	10	BDL	BDL	BDL	BDL
4,4'-DDE	10	BDL	BDL	BDL	BDL
4,4'-DDT	10	BDL	BDL	BDL	BDL
Dieldrin	10	BDL	BDL	BDL	BDL
Endosulfan I	10	BDL	BDL	BDL	BDL
Endosulfan II	10	BDL	BDL	BDL	BDL
Endosulfan Sulfate	10	BDL	BDL	BDL	BDL
Endrin	10	BDL	BDL	BDL	BDL
Endrin Aldehyde	10	BDL	BDL	BDL	BDL
Heptachlor	10	BDL	BDL	BDL	BDL
Heptachlor Epoxide	10	BDL	BDL	BDL	BDL
Toxaphene	10	BDL	BDL	BDL	BDL
PCB 1016	10	BDL	BDL	BDL	BDL
PCB 1221	10	BDL	BDL	BDL	BDL
PCB 1232	10	BDL	BDL	BDL	BDL
PCB 1242	10	BDL	BDL	BDL	BDL
PCB 1248	10	BDL	BDL	BDL	BDL
PCB 1254	10	BDL	BDL	BDL	BDL
PCB 1260	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

4.6 SITE 5 - DPDO WASTE STORAGE AREA

A description and history of the site was provided in Subsection 1.5.5.

4.6.1 Hydrogeology

The topography of the DPDO Waste Storage Area immediately adjacent to the fenced area is flat and clear of vegetation. Within 25 to 30 feet on the northern, western and southern boundaries of the site, however, the land surface becomes heavily wooded and slopes steeply to Stoney Creek on the north and to drainage ditches on the southwest.

Previous soil borings at this site focused on a relatively small area near the former DPDO Waste Storage Area. To widen the focus of the Stage 2 Survey, three new soil borings were installed 100 to 200 feet southwest and northwest of the site (Figure 4-10). In general, soil borings indicate that beneath about two to three feet of sandy to clayey soil, sediments consist of medium to coarse clayey sand with some fine gravel to about ten feet. All borings were terminated in silty, clayey sands approximately 13 to 17 feet below ground surface. Since only one soil boring was converted to a monitoring well (i.e., MW-54), a groundwater flow direction cannot be directly determined at the site. Topographical information and experience at other Base sites, however, makes it reasonable to assume the prevailing groundwater flow at the DPDO area is probably to drainage ditches and Stoney Creek to the west and northwest, respectively. This assumed direction of groundwater flow is indicated in Figure 4-11, and ground-water elevation data for well MW-54 are provided in Table 4-51.

4.6.2 Water Quality

The results of all inorganic and organic testing at Site 5 are provided in Appendix S and T, respectively.

4.6.2.1 Field Measurements--On-site measurements of specific conductance at MW-54 appear slightly elevated relative to the nearest back-ground well, MW-50. Initial specific conductance measurements at MW-54 ranged between 200 to 400 $\mu\text{mhos/cm}$, compared to 30 to 40 $\mu\text{mhos/cm}$ at MW-50 (Appendix G). The measurement of specific conductance in well MW-54 at the time of the April 1987 sampling (52 $\mu\text{mhos/cm}$) was lower than during the well development activities but still

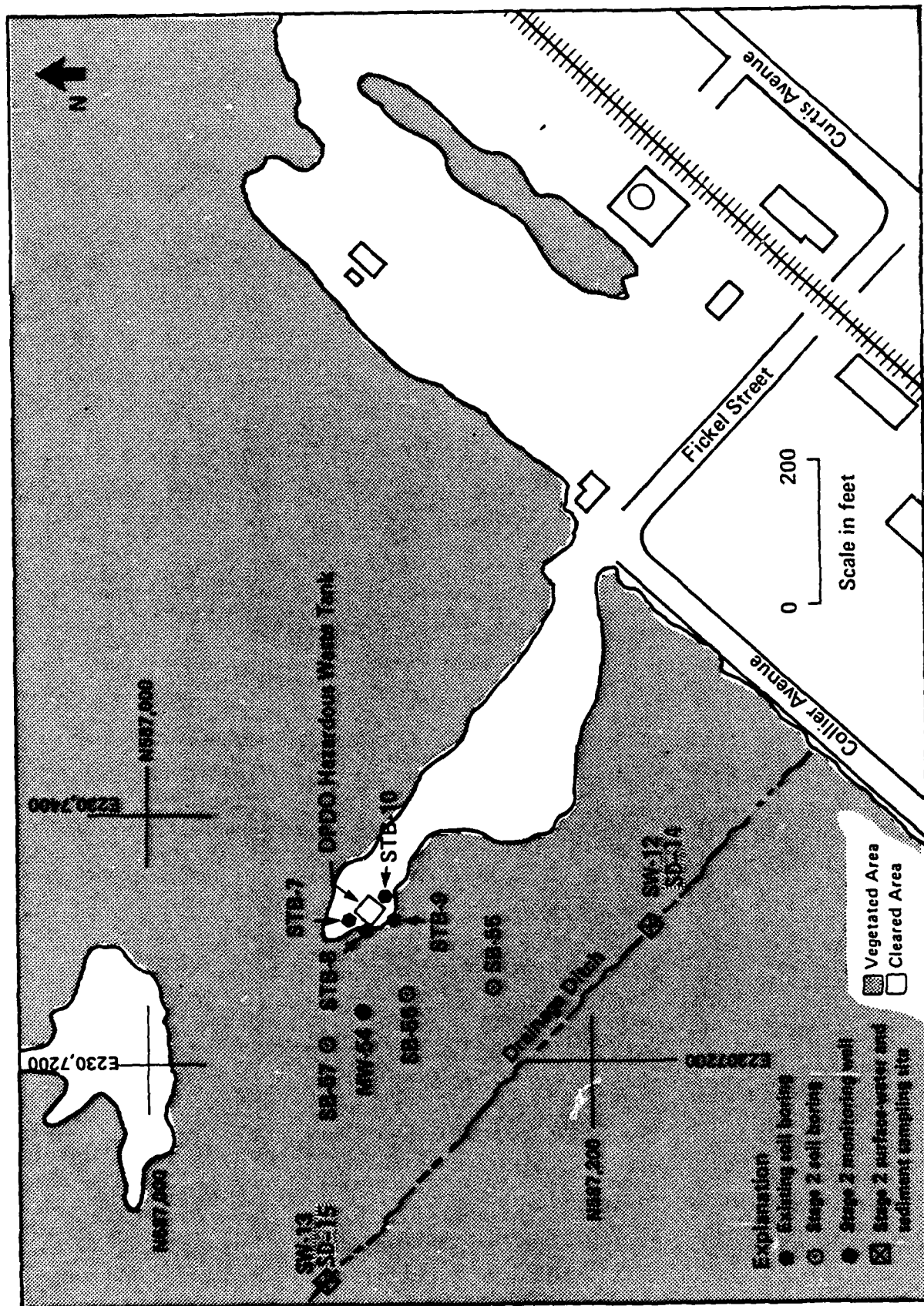


FIGURE 4-10. LOCATION OF SAMPLING POINTS AT SITE 5 (DPDO WASTE STORAGE AREA)

SEYMOUR JOHNSON AFB, NC

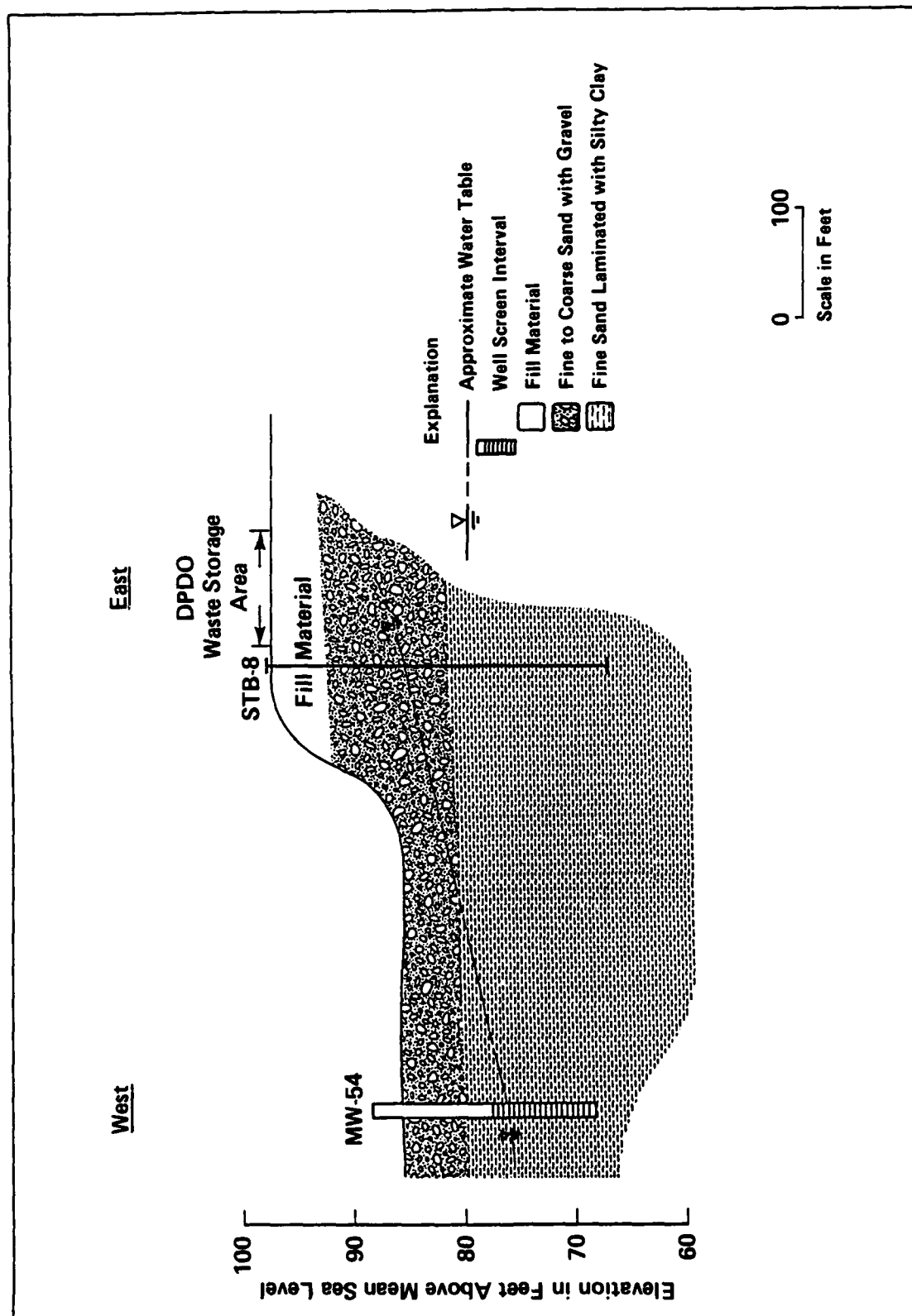


FIGURE 4-11. HYDROGEOLOGIC CROSS SECTION OF SITE 5 (DPDO WASTE STORAGE AREA)
SEYMOUR JOHNSON AFB, NC

TABLE 4-5]. Groundwater Elevations, Site 5 (DPDO Waste Storage Area)

Monitoring Well Number	Well Casing Elev.	GROUND WATER LEVELS							
		10 NOV 86		22 DEC 86		21 JAN 87		3 FEB 87	
		1) Depth	2) Elev.	Depth	Elev.	Depth	Elev.	Depth	Elev.
MW-54	88.51	---	---	12.31	76.20	10.95	77.56	9.18	79.33

1) Depth Below Top of Well Casing

2) Elevation Relative to M.S.L. (ft)

above background conditions in well MW-50 (15 μ mhos/cm) for the same time period. Measurements of pH and temperature were within normal ranges (Appendix G). No floating organic phases were observed in MW-54.

4.6.2.2 Inorganic Results--Monitoring well MW-54 and surface waters SW-12 and SW-13 were analyzed for common anions, thirteen priority pollutant metals, total dissolved solids, total cyanide, and alkalinity. The results of valid inorganic water analyses are provided in Tables 4-52 through 4-59. A summary of selected priority pollutants is provided in Table 4-60. Gross water-quality indicators such as chloride (4.35 mg/L) and bromide (0.17 mg/L) are considered low at MW-54 relative to wells downgradient of the Bases's landfills (Table 4-53). Surface-water stations SW-12 and SW-13 also had low concentrations of chloride (2.32 and 6.73 mg/L, respectively); and bromide (below detection limit and 0.10 mg/L, respectively).

Concentrations of the priority pollutant metal cadmium exceeded relevant standards at one surface water sampling site (SW-13) downslope of the DPDO Waste Storage Area (Table 4-60). It is noted, however, that the cadmium value at MW-13 is not significantly different from that measured in SW-12 (0.008 mg/L; Table 4-59). Location SW-12 is upslope of the DPDO Waste Storage Area and the cadmium values measured could be related to storm water runoff from the Collier Avenue area via the drainage ditch. Groundwater from MW-54 exceed relevant standards for lead and silver (Table 4-60).

4.6.2.3 Organic Results--Monitoring well MW-54 and surface waters SW-12 and SW-13 were analyzed for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, non-halogenated volatile organics, and extractable priority pollutants. The results of valid organic water analyses are provided in Table 4-61 through 4-72. A summary of the positive findings are provided in Table 4-73. Positive results were obtained for halogenated volatile organics in groundwater obtained from well MW-54 and from the surface water sample SW-13 (Table 4-73). Trans-1,2-dichloroethene was detected at 12.0 μ g/L and trichloroethene was detected at 79.0 μ g/L in well MW-54. Trichloroethene was also detected in the surface water sample SW-13 but at a low concentration (3.0 μ g/L) near the method detection limit. The trichloroethene concentration detected in the groundwater sample from MW-54 is above the RMCLs

TABLE 4-52. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1
 Alkalinity (Water); Method A403; Concentration in mg/L CaCO₃

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):		MW-54 2 MAR 87 9 MAR 87 545, KI 15
Compound	Detection Limit (mg/L)	
Alkalinity	10	BDL

BDL = Below Detection Limit

TABLE 4-53. RESULTS OF WATER ANALYSES; OPDO STORAGE AREA: p. 1 of 1

Anions (Water); Method 429A; Concentrations in mg/L

Sampling Point:		MW-54	MW-54
Date Sampled:		23 JAN 87	22 APR 87
Date Analyzed:		2 FEB 87	23 APR 87
Sticker No., ID:		462, J	730, K
Depth Interval (ft):		14	9
Compound	Detection Limit (mg/L)		
Fluoride	0.01	0.033	
Chloride	0.01	4.352	
Nitrate	0.03		2.245
Phosphate	0.60		BDL
Bromide	0.05	0.169	
Nitrite	0.05		BDL
Sulfate	0.05	14.066	

BDL = Below Detection Limits

TABLE 4-54. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Total Cyanide (Water); Method 335.2; Concentration mg/L

Sampling Point:
Date Sampled:
Date Analyzed:
Sticker No., ID:
Depth Interval (ft):

MW-54
22 APR 87
24 APR 87
731

<u>Compound</u>	<u>Detection Limit (mg/L)</u>
Cyanide	0.02

BDL

BDL = Below Detection Limit

TABLE 4-55. RESULTS OF WATER ANALYSES;DPDO STORAGE AREA; p. 1 of 1

Thirteen Priority Pollutant Metals (Water); Concentrations in mg/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):			MW-54 23 JAN 87 8 FEB 87 464, L 14	MW-60 21 JAN 87 8 FEB 87 447, L (Blank)	MW-62 23 JAN 87 8 FEB 87 472, L (Blank)
Compound	Detection Limit (mg/L)	Methods			
Arsenic	0.002	E206.2	BDL	BDL	BDL
Antimony	0.009	E204.2	BDL	BDL	BDL
Beryllium	0.0012	E200.7	BDL	BDL	BDL
Cadmium	0.006	E200.7	0.008	BDL	BDL
Chromium	0.008	E200.7	BDL	BDL	BDL
Copper	0.014	E200.7	BDL	BDL	BDL
Lead	0.005	E200.7	0.100	BDL	BDL
Mercury	0.0002	E245.1	BDL	BDL	BDL
Nickel	0.004	E200.7	BDL	BDL	BDL
Selenium	0.004	E270.2	BDL	BDL	BDL
Silver	0.007	E200.7	0.116	BDL	BDL
Thallium	0.002	E200.7	BDL	BDL	BDL
Zinc	0.003	E200.7	BDL	BDL	BDL

BDL = Below Detection Limit

TABLE 4-56. RESULTS OF WATER ANALYSES; DPOO STORAGE AREA; p. 1 of 1

Anions (Surface Water); Method 429A; Concentrations in mg/L

Sampling Point:		SW-12	SW-12	SW-13	SW-13
Date Sampled:		28 JAN 87	22 APR 87	28 JAN 87	22 APR 87
Date Analyzed:		2 FEB 87	23 APR 87	3 FEB 87	23 APR 87
Sticker No., ID:		514, J	745, K	504, J	749, K
Compound	Detection Limit (mg/L)				
Fluoride	0.01	0.048		0.093	
Chloride	0.01	2.319		6.726	
Nitrate	0.03		BDL		BDL
Phosphate	0.60		BDL		BDL
Bromide	0.05	BDL		0.102	
Nitrite	0.05		BDL		BDL
Sulfate	0.05	16.231		57.118	

BDL = Below Detection Limits

TABLE 4-57. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Total Cyanide (Surface Water); Method 335.2; Concentrations in mg/L

Sampling Point:		SW-12	SW-13
Date Sampled:		22 APR 87	22 APR 87
Date Analyzed:		23 APR 87	23 APR 87
Sticker No., ID:		746, R	750, N
<u>Compound</u>	<u>Detection Limit (mg/L)</u>		
Cyanide	0.02	BDL	BDL

BDL = Below Detection Limit

TABLE 4-58. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA, p. 1 of 1
 Alkalinity (Surface Water); Method A403; Concentration in mg/L CaCO_3

		Sampling Point:		SW-12	SW-13
		Date Sampled:		2 MAR 87	2 MAR 87
		Date Analyzed:		9 MAR 87	9 MAR 87
		Sticker No., ID:		564, A9	563, A9
Compound	Detection Limit (mg/L)				
Alkalinity	10			BDL	BDL

BDL = Below Detection Limit

TABLE 4-59. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Thirteen Priority Pollutant Metals (Surface Water); Concentrations in mg/L

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID:			SW-12 28 JAN 87 8 FEB 87 516, L	SW-13 28 JAN 87 8 FEB 87 506, L
Compound	Detection Limit (mg/L)	Methods		
Arsenic	0.002	E206.2	BDL	BDL
Antimony	0.009	E204.2	BDL	BDL
Beryllium	0.0012	E200.7	BDL	BDL
Cadmium	0.006	E200.7	0.008	0.012
Chromium	0.008	E200.7	BDL	BDL
Copper	0.014	E200.7	BDL	BDL
Lead	0.005	E200.7	BDL	BDL
Mercury	0.0002	E245.1	BDL	BDL
Nickel	0.004	E200.7	BDL	BDL
Selenium	0.004	E270.2	BDL	BDL
Silver	0.007	E200.7	BDL	BDL
Thallium	0.002	E200.7	BDL	BDL
Zinc	0.003	E200.7	0.153	0.025

BDL = Below Detection Limit

TABLE 4-60. SUMMARY OF SELECTED INORGANIC WATER ANALYSES;
SITE 5 (DPDO WASTE STORAGE AREA)

SURFACE AND GROUNDWATER RESULTS IN SAME UNITS AS DETECTION LIMITS

SELECTED PRIORITY POLLUTANTS			SW-12 28 JAN 87	SW-13 28 JAN 87	MW-54 23 JAN 87
	(Detection Limits)	(Relevant 1) Standards)			
Cadmium	(0.006 mg/L)	(0.010 mg/L)	0.008	0.012	0.008
Lead	(0.053 mg/L)	(0.05 mg/L)	BDL	BDL	0.100
Silver	(0.007 mg/L)	(0.05 mg/L)	BDL	BDL	0.116

BDL - Below Detection Limit

1) - Maximum Contaminant Levels Reported in 40CFR141.11,
Inorganic Chemicals, Revised July 1, 1985, p. 523.

TABLE 4-61. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Acid Extractables (Water); Method 625 A; Concentrations in ug/L

Sampling Point:		MW-54
Date Sampled:		22 APR 87
Date Extracted:		28 APR 87
Date Analyzed:		30 MAY 87
Sticker No., ID:		727, GI
Depth Interval (ft):		9
Compound	Detection Limits (ug/L)	
4-Chloro-3-Methylphenol	25	BDL
2-Chlorophenol	25	BDL
2,4-Dichlorophenol	25	BDL
2,4-Dimethylphenol	25	BDL
2,4-Dinitrophenol	250	BDL
2-Methyl-4,6-Dinitrophenol	250	BDL
2-Nitrophenol	25	BDL
4-Nitrophenol	25	BDL
Pentachlorophenol	25	BDL
Phenol	25	BDL
2,4,6-Trichlorophenol	25	BDL

BDL = Below Detection Limits

TABLE 4-62. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Aromatic Volatile Organics (Water); Method 602; Concentrations in ug/L

Sampling Point:		MW-54
Date Sampled:		2 MAR 87
Date Analyzed:		3 MAR 87
Sticker No., ID:		77, A1
Depth Interval (ft):		15
Compound	Detection Limit (ug/L)	
Benzene	1.0	BDL
Chlorobenzene	1.0	BDL
1,2-Dichlorobenzene	1.0	BDL
1,3-Dichlorobenzene	1.0	BDL
1,4-Dichlorobenzene	1.0	BDL
Ethylbenzene	1.0	BDL
Toluene	1.0	BDL

BDL = Below Detection Limit

TABLE 4-63. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1
Base/Neutral Extractables (Water); Method 625B/N; Concentrations in ug/L

Sampling Site:		MW-54
Date Sampled:		22 APR 87
Date Extracted:		28 APR 87
Date Analyzed:		30 MAY 87
Sticker No., ID:		727, G1
Depth Interval (ft):		9
Compound	Detection Limit (ug/L)	
Acenaphthene	25	BDL
Acenaphthylene	10	BDL
Anthracene	10	BDL
Benzidine	10	BDL
Benzo (a) Anthracene	10	BDL
Benzo (a) Pyrene	10	BDL
Benzo (b) Fluoranthene	10	BDL
Benzo (ghi) Perylene	25	BDL
Benzo (k) Fluoranthene	10	BDL
Bis (2-Chloroethoxy) Methane	10	BDL
Bis (2-Chloroethyl) Ether	10	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL
Bis (2-Ethylhexyl) Phthalate	10	43
4-Bromophenyl Phenyl Ether	10	BDL
Benzyl Butyl Phthalate	10	BDL
2-Chloronaphthalene	10	BDL
4-Chlorophenyl Phenyl Ether	10	BDL
Chrysene	10	BDL
Dibenzo (a,h) Anthracene	10	BDL
1,2-Dichlorobenzene	10	BDL
1,3-Dichlorobenzene	10	BDL
1,4-Dichlorobenzene	10	BDL
3,3-Dichlorobenzidine	10	BDL
Diethyl Phthalate	10	BDL
Dimethyl Phthalate	10	BDL
Di-N-Butyl Phthalate	10	BDL
2,4-Dinitrotoluene	10	BDL
2,6-Dinitrotoluene	10	BDL
Di-N-Octylphthalate	10	38
Fluoranthene	10	BDL
Fluorene	10	BDL
Hexachlorobenzene	10	BDL
Hexachlorobutadiene	10	BDL
Hexachlorocyclopentadiene	10	BDL
Hexachloroethane	10	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL
Isophorone	10	BDL
Naphthalene	10	BDL
Nitrobenzene	10	BDL
N-Nitrosodimethylamine	10	BDL
N-Nitroso-Di-N-Propylamine	10	BDL
N-Nitrosodiphenylamine	10	BDL
Phenanthrene	10	BDL
Pyrene	10	BDL
1,2,4-Trichlorobenzene	10	BDL

BDL = Below Detection Limit

TABLE 4-64. RESULTS OF WATER ANALYSES; DPOO STORAGE AREA; p. 1 of 1

Halogenated Volatile Organics (Water); Method 601; Concentrations in ug/L

Sampling Point:		MW-54
Date Sampled:		2 MAR 87
Date Analyzed:		3 MAR 87
Sticker No., ID:		77, A2
Depth Interval (ft):		15
Compound	Detection Limit (ug/L)	
Bromodichloromethane	1.0	BDL
Bromoform	1.0	BDL
Bromomethane	1.0	BDL
Carbon Tetrachloride	1.0	BDL
Chlorobenzene	1.0	BDL
Chloroethane	1.0	BDL
2-Chloroethyl Vinyl Ether	1.0	BDL
Chloroform	1.0	BDL
Chloromethane	1.0	BDL
Dibromochloromethane	1.0	BDL
1,2-Dichlorobenzene	1.0	BDL
1,3-Dichlorobenzene	1.0	BDL
1,4-Dichlorobenzene	1.0	BDL
Dichlorodifluoromethane	1.0	BDL
1,1-Dichloroethane	1.0	6.0*
1,2-Dichloroethane	1.0	BDL
1,1-Dichloroethene	1.0	BDL
trans-1,2-Dichloroethene	1.0	12.0
1,2-Dichloropropene	1.0	BDL
cis-1,3-Dichloropropene	1.0	BDL
trans-1,3-Dichloropropene	1.0	BDL
Methylene Chloride	1.0	BDL
1,1,2,2-Tetrachloroethane	1.0	BDL
1,1,1-Trichloroethane	1.0	25.0*
1,1,2-Trichloroethane	1.0	BDL
Tetrachloroethene	1.0	BDL
Trichlorofluoromethane	1.0	BDL
Vinyl Chloride	1.0	BDL
Trichloroethene	1.0	79.0

BDL = Below Detection Limit

* = Compound Not Confirmed in Second Column Analysis
(See Table T-4. Appendix T)

TABLE 4-65. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1
 Non-Halogenated Volatile Organics (Water); Method SW 8015; Concentration in ug/L

Sampling Point:		MW-54
Date Sampled:		13 JAN 87
Date Analyzed:		23 JAN 87
Sticker No., ID:		301, CI
Depth Interval (ft):		15
Compound	Detection Limit (ug/L)	
Acrylamide	10	BDL
Carbon Disulfide	10	BDL
Diethyl Ether	10	BDL
Methyl Ethyl Ketone	10	BDL
Methyl Isobutyl Ketone	10	BDL
Paraldehyde	10	BDL

BDL = Below Detection Limit

TABLE 4-66. RESULTS OF WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

PCB's and Pesticides (Water); Method 625P; Concentrations in ug/L

Sampling Point:		MW-54
Date Sampled:		22 APR 87
Date Extracted:		28 APR 87
Date Analyzed:		30 MAY 87
Sticker No., ID:		727, GI
Depth Interval (ft):		9
Compound	Detection Limit (ug/L)	
Aldrin	10	BDL
Alpha - BHC	10	BDL
Beta - BHC	10	BDL
Delta - BHC	10	BDL
Gamma - BHC	10	BDL
Chlordane	10	BDL
4,4'-DDD	10	BDL
4,4'-DDE	10	BDL
4,4'-DDT	10	BDL
Dieldrin	10	BDL
Endosulfan I	10	BDL
Endosulfan II	10	BDL
Endosulfan Sulfate	10	BDL
Endrin	10	BDL
Endrin Aldehyde	10	BDL
Heptachlor	10	BDL
Heptachlor Epoxide	10	BDL
Toxaphene	10	BDL
PCB 1016	10	BDL
PCB 1221	10	BDL
PCB 1232	10	BDL
PCB 1242	10	BDL
PCB 1248	10	BDL
PCB 1254	10	BDL
PCB 1260	10	BDL

BDL = Below Detection Limits

TABLE 4-67. RESULTS OF SURFACE WATER ANALYSES; DPDO STORAGE AREA ; p. 1 of 1

Acid Extractables (Surface Water); Method 625 A; Concentrations in ug/L

Sampling Point:		SW-12	SW-13
Date Sampled:		28 JAN 87	28 JAN 87
Date Extracted:		4 FEB 87	4 FEB 87
Date Analyzed:		10 FEB 87	10 FEB 87
Sticker No., ID:		487, G2	501, G2
Compound	Detection Limits (ug/L)		
4-Chloro-3-Methylphenol	25	BDL	BDL
2-Chlorophenol	25	BDL	BDL
2,4-Dichlorophenol	25	BDL	BDL
2,4-Dimethylphenol	25	BDL	BDL
2,4-Dinitrophenol	250	BDL	BDL
2-Methyl-4,6-Dinitrophenol	250	BDL	BDL
2-Nitrophenol	25	BDL	BDL
4-Nitrophenol	25	BDL	BDL
Pentachlorophenol	25	BDL	BDL
Phenol	25	BDL	BDL
2,4,6-Trichlorophenol	25	BDL	BDL

BDL = Below Detection Limits

TABLE 4-68. RESULTS OF SURFACE WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Aromatic Volatile Organics (Surface Water); Method 602; Concentrations in ug/L

		SW-12	SW-13
Sampling Point:		28 JAN 87	28 JAN 87
Date Sampled:		4 FEB 87	4 FEB 87
Date Analyzed:		476, AI	490, AI
Sticker No., ID:			
Compound	Detection Limit (ug/L)		
Benzene	1.0	BDL	BDL
Chlorobenzene	1.0	BDL	BDL
1,2-Dichlorobenzene	1.0	BDL	BDL
1,3-Dichlorobenzene	1.0	BDL	BDL
1,4-Dichlorobenzene	1.0	BDL	BDL
Ethylbenzene	1.0	BDL	BDL
Toluene	1.0	BDL	BDL
Xylene 1)	1.0	BDL	BDL

BDL = Below Detection Limit

1) = Quantitated as Ethylbenzene

TABLE 4-69. RESULTS OF SURFACE WATER ANALYSES; DPDO STORAGE AREA: p. 1 of 1

Base/Neutral Extractables (Surface Water); Method 625B/N; Concentrations in ug/L

		Sampling Site:	SW-12	SW-13
		Date Sampled:	28 JAN 87	28 JAN 87
		Date Extracted:	4 FEB 87	4 FEB 87
		Date Analyzed:	10 FEB 87	10 FEB 87
		Sticker No., ID:	486, GI	500, GI
Compound	Detection Limit (ug/L)			
Acenaphthene	25		BDL	BDL
Acenaphthylene	10		BDL	BDL
Anthracene	10		BDL	BDL
Benzidine	10		BDL	BDL
Benzo (a) Anthracene	10		BDL	BDL
Benzo (a) Pyrene	10		BDL	BDL
Benzo (b) Fluoranthene	10		BDL	BDL
Benzo (ghi) Perylene	25		BDL	BDL
Benzo (k) Fluoranthene	10		BDL	BDL
Bis (2-Chloroethoxy) Methane	10		BDL	BDL
Bis (2-Chloroethyl) Ether	10		BDL	BDL
Bis (2-Chloroisopropyl) Ether	10		BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10		BDL	BDL
4-Bromophenyl Phenyl Ether	10		BDL	BDL
Benzyl Butyl Phthalate	10		BDL	BDL
2-Chloronaphthalene	10		BDL	BDL
4-Chlorophenyl Phenyl Ether	10		BDL	BDL
Chrysene	10		BDL	BDL
Dibenzo (a,h) Anthracene	10		BDL	BDL
1,2-Dichlorobenzene	10		BDL	BDL
1,3-Dichlorobenzene	10		BDL	BDL
1,4-Dichlorobenzene	10		BDL	BDL
3,3-Dichlorobenzidine	10		BDL	BDL
Diethyl Phthalate	10		BDL	BDL
Dimethyl Phthalate	10		BDL	BDL
Di-N-Butyl Phthalate	10		BDL	BDL
2,4-Dinitrotoluene	10		BDL	BDL
2,6-Dinitrotoluene	10		BDL	BDL
Di-N-Octylphthalate	10		BDL	BDL
Fluoranthene	10		BDL	BDL
Fluorene	10		BDL	BDL
Hexachlorobenzene	10		BDL	BDL
Hexachlorobutadiene	10		BDL	BDL
Hexachlorocyclopentadiene	10		BDL	BDL
Hexachloroethane	10		BDL	BDL
Indeno (1,2,3-cd) Pyrene	25		BDL	BDL
Isophorone	10		BDL	BDL
Naphthalene	10		BDL	BDL
Nitrobenzene	10		BDL	BDL
N-Nitrosodimethylamine	10		BDL	BDL
N-Nitroso-Di-N-Propylamine	10		BDL	BDL
N-Nitrosodiphenylamine	10		BDL	BDL
Phenanthrene	10		BDL	BDL
Pyrene	10		BDL	BDL
1,2,4-Trichlorobenzene	10		BDL	BDL

BDL = Below Detection Limit

TABLE 4-70. RESULTS OF SURFACE WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Halogenated Volatile Organics (Surface Water); Method 601; Concentrations in ug/L

		Sampling Point:	
		SW-12	
		SW-13	
		28 JAN 87	
		2 MAR 87	
		4 FEB 87	
		3 MAR 87	
		477, A2	
		547, A2	
Compound	Detection Limit (ug/L)		
Bromodichloromethane	1.0	BDL	BDL
Bromoform	1.0	BDL	BDL
Bromomethane	1.0	BDL	BDL
Carbon Tetrachloride	1.0	BDL	BDL
Chlorobenzene	1.0	BDL	BDL
Chloroethane	1.0	BDL	BDL
2-Chlorethyl vinyl Ether	1.0	BDL	BDL
Chloroform	1.0	BDL	BDL
Chloromethane	1.0	BDL	BDL
Dibromochloromethane	1.0	BDL	BDL
1,2-Dichlorobenzene	1.0	BDL	BDL
1,3-Dichlorobenzene	1.0	BDL	BDL
1,4-Dichlorobenzene	1.0	BDL	BDL
Dichlorodifluoromethane	1.0	BDL	BDL
1,1-Dichloroethane	1.0	BDL	BDL
1,2-Dichloroethane	1.0	BDL	BDL
1,1-Dichloroethene	1.0	BDL	BDL
trans-1,2-Dichloroethene	1.0	BDL	BDL
1,2-Dichloropropene	1.0	BDL	BDL
cis-1,3-Dichloropropene	1.0	BDL	BDL
trans-1,3-Dichloropropene	1.0	BDL	BDL
Methylene Chloride	1.0	BDL	BDL
1,1,2,2-Tetrachloroethane	1.0	BDL	BDL
1,1,1-Trichloroethane	1.0	BDL	BDL
1,1,2-Trichloroethane	1.0	BDL	BDL
Tetrachloroethene	1.0	BDL	BDL
Trichlorofluoromethane	1.0	BDL	BDL
Vinyl Chloride	1.0	BDL	BDL
Trichloroethene	1.0	BDL	3.0

BDL = Below Detection Limit

TABLE 4-71. RESULTS OF SURFACE WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Non-Halogenated Volatile Organics (Surface Water); Method SW 8015; Concentration in ug/L

		Sampling Point: SW-12		SW-13	
		Date Sampled: 28 JAN 87		28 JAN 87	
		Date Analyzed: 3 FEB 87		3 FEB 87	
		Sticker No., ID: 480, CI		494, CI	
Compound	Detection Limit (ug/L)				
Acrylamide	10	BDL		BDL	
Carbon Disulfide	10	BDL		BDL	
Diethyl Ether	10	BDL		BDL	
Methyl Ethyl Ketone	10	BDL		BDL	
Methyl Isobutyl Ketone	10	BDL		BDL	
Paraldehyde	10	BDL		BDL	

BDL = Below Detection Limit

TABLE 4-72. RESULTS OF SURFACE WATER ANALYSES; DPDO STORAGE AREA; p. 1 of 1

PCB's and Pesticides (Surface Water); Method 625P; Concentrations in ug/L

		SW-12	SW-13
Sampling Point:		28 JAN 87	28 JAN 87
Date Sampled:		4 FEB 87	4 FEB 87
Date Extracted:		10 FEB 87	10 FEB 87
Date Analyzed:		486, GI	500, GI
Sticker No., ID:			
Compound	Detection Limit (ug/L)		
Aldrin	10	BDL	BDL
Alpha - BHC	10	BDL	BDL
Beta - BHC	10	BDL	BDL
Delta - BHC	10	BDL	BDL
Gamma - BHC	10	BDL	BDL
Chlordane	10	BDL	BDL
4,4'-DDD	10	BDL	BDL
4,4'-DDE	10	BDL	BDL
4,4'-DDT	10	BDL	BDL
Dieldrin	10	BDL	BDL
Endosulfan I	10	BDL	BDL
Endosulfan II	10	BDL	BDL
Endosulfan Sulfate	10	BDL	BDL
Endrin	10	BDL	BDL
Endrin Aldehyde	10	BDL	BDL
Heptachlor	10	BDL	BDL
Heptachlor Epoxide	10	BDL	BDL
Toxaphene	10	BDL	BDL
PCB 1016	10	BDL	BDL
PCB 1221	10	BDL	BDL
PCB 1232	10	BDL	BDL
PCB 1242	10	BDL	BDL
PCB 1248	10	BDL	BDL
PCB 1254	10	BDL	BDL
PCB 1260	10	BDL	BDL

BDL = Below Detection Limits

TABLE 4-73. RESULTS OF POSITIVE ORGANIC ANALYSES (WATER); SITE 5 (DPDO WASTE STORAGE AREA)

Results of Groundwater and Surface Water Analyses; Concentrations in ug/L

Sampling Point:		MW-54	SW-13	Recommended Maximum Contaminant Levels (RMCLs)
Date Sampled:		2 MAR 87	2 MAR 87	
Sticker No., ID:		77, A2	547, A2	
Detection Limit (ug/L)				
HALOGENATED VOLATILE ORGANICS (Method 601)				
Trans-1,2-Dichloroethene	1.0	12.0	BDL	70 ug/L ¹⁾
Trichloroethene	1.0	79.0	3.0	5 ug/L ²⁾

BDL = Below Detection Limit

1) Proposed RMCLs for Trans-1,2-Dichloroethylene Reported in the Federal Register, Vol. 50, No. 219, Wednesday, November 13, 1985, p. 46891.

2) Final RMCLs for Trichloroethylene Reported in the Federal Register, Vol. 52, No. 130, Wednesday, July 8, 1987, p. 25691.

Note: The results reported as positive on this table are those for which second-column confirmation by gas chromatography has been performed on samples.

for this compound (Table 4-73). The groundwater sample obtained from well MW-54 did not have a detection of acid extractables (Table 4-61), aromatic volatile organics (Table 4-62), non-halogenated volatile organics (Table 4-65), or PCB's and pesticides (Table 4-66). The phthalates detected in the groundwater sample (Table 4-63) are thought to be a result of laboratory-induced contamination as explained further in Section 4.8.

4.6.3 Soil Sampling Results

4.6.3.1 Field Measurements--Subsurface soils at SB-55, SB-56, and SB-57 were originally sampled at approximately five-foot intervals to a depth of about 15 feet below grade. During the original drilling of the three soil borings, on organic vapor analyzer (OVA) scan was made of each soil sample. The OVA scan of soil samples from Site 5 were below or near detection limits except for those measured in boring SB-57. OVA readings of 8 to 15 ppm were measured from soil samples obtained at a depth of 2 to 6 feet at the time of boring in SB-57 (Appendix E).

4.6.3.2 Inorganic Results--The results of valid inorganic soil analyses are provided in Table 4-74 through 4-77. Cyanide was not detected in any of the subsurface soils or sediment analyses (Tables 4-74, and 4-75, respectively). Soils were also analyzed for thirteen priority pollutant metals (Tables 4-76 and 4-77). As there is not a background boring at Site 5, the priority pollutant metals measured in the three DPDO borings are compared to background conditions at boring SB-60 (Coal Pile Storage Area) for those common methods analyzed by the two analytical methods (priority pollutant metals and total metals screen). The ranges of those common metals from both sites are summarized below:

		Ranges of Values DPDO Soils 1)	Ranges of Values in SB-60
Antimony	(mg/Kg)	BDL - 337	BDL
Beryllium	(mg/Kg)	BDL - 0.28	0.26 - 0.52
Cadmium	(mg/Kg)	BDL - 2.67	BDL - 4.40
Chromium	(mg/Kg)	BDL - 28.8	5.50 - 31.50
Copper	(mg/Kg)	BDL - 6.21	BDL - 3.3
Lead	(mg/Kg)	BDL - 82.90	4.60 - 15.70
Nickel	(mg/Kg)	BDL - 5.22	BDL - 8.8
Silver	(mg/Kg)	BDL - 3.28	BDL
Thallium	(mg/Kg)	BDL	BDL
Zinc	(mg/Kg)	BDL - 36.40	2.80 - 9.70

1) = Includes Soil Borings SB-55, SB-56, and SB-57

TABLE 4-74. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 1 of 2

Total Cyanide (Soils); Method 335.2; Concentrations in mg/Kg

Sampling Point:	SB-55	SB-55	SB-55	SB-56	SB-56
Date Sampled:	13 APR 87	13 APR 87	13 APR 87	14 APR 87	14 APR 87
Date Analyzed:	14 APR 87	14 APR 87	14 APR 87	15 APR 87	15 APR 87
Sticker No., ID:	569, D	755, D	753, D	571, D	756, D
Depth Interval (ft):	0-2	3-5	9-11	0-2	3-5
Detection Compound Limit (mg/Kg)					
Cyanide 0.5	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

TABLE 4-74. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 2 of 2

Total Cyanide (Soils); Method 335.2; Concentrations in mg/Kg

Sampling Point:	SB-56	SB-57	SB-57
Date Sampled:	23 APR 87	13 APR 87	22 APR 87
Date Analyzed:	24 APR 87	14 APR 87	23 APR 87
Sticker No., ID:	757, D	573, D	607, D
Depth Interval (ft):	8-10	0-2	13-15
Detection Limit (mg/Kg)			
Cyanide	0.5	BDL	BDL

BDL = Below Detection Limit

1) = Depth Interval Not Originally Required for Sampling; Below Water Table.

TABLE 4-75. RESULTS OF SEDIMENT ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Total Cyanide (Sediment); Method 335.2; Concentrations in mg/Kg

Sampling Point:
Date Sampled:
Date Analyzed:
Sticker No., ID:

SD-14	SD-15
22 APR 87	22 APR 87
23 APR 87	23 APR 87
763, C	764, C
BDL	BDL

Compound Detection
 Limit (mg/Kg)

Cyanide 0.5

BDL = Below Detection Limit

TABLE 4-76. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 1 of 3

Thirteen Priority Pollutant Metals (Soil); Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Analyzed			SB-55 13 NOV 86 12 DEC 86			
Sticker No., ID: Depth Interval (ft):			54, D 1-3	58, D 3-5	62, D 9-11	66, D 11-13
Species	Detection Limits (mg/Kg)	Methods				
Iron 1)	4.50	SW6010	12,800	9,350	2,170	15,700
Aluminum 1)	4.00	SW6010	31,100	19,000	2,600	1,970
Antimony	0.90	SW7041	20	337	12.60	16.40
Lead	3.50	SW6010	7.81	BDL	BDL	BDL
Nickel	1.00	SW6010	5.22	BDL	BDL	BDL
Copper	0.90	SW6010	2.80	BDL	BDL	BDL
Zinc	0.30	SW6010	3.91	6.83	13.50	18.10
Beryllium	0.12	SW6010	0.280	0.251	0.240	0.208
Silver	0.60	SW6010	BDL	3.28	3.00	2.96
Cadmium	0.34	SW6010	BDL	BDL	BDL	2.67
Chromium	0.80	SW6010	21.50	28.80	4.10	15.50
Thallium	0.20	SW7841	BDL	BDL	BDL	BDL
Arsenic	0.13	SW7060	3.373	2.554	BDL	2.130
Selenium	0.22	SW7740	0.488	BDL	BDL	0.231

BDL = Below Detection Limits

1) = Not priority pollutant metals

* = Invalid Data

TABLE 4-76. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 2 of 3

Thirteen Priority Pollutant Metals (Soil); Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Analyzed:			SB-56 12 NOV 86 12 DEC 86				
Sticker No., ID: Depth Interval (ft):			22, D 0-2	26, D 3-5	30, D 8-10	30, D 8-10	34, D 13-15
Species	Detection Limits (mg/Kg)	Methods					
Iron 2)	4.50	SW6010	2,480	7,240	10,400	10,600	15,100
Aluminum 2)	4.00	SW6010	4,970	22,000	7,060	7,090	2,150
Antimony	0.90	SW7041	BDL	BDL	BDL	8.22	8.51
Lead	3.50	SW6010	82.90	7.34	BDL	BDL	6.29
Nickel	1.00	SW6010	BDL	3.16	BDL	BDL	BDL
Copper	0.90	SW6010	6.21	BDL	BDL	BDL	3.96
Zinc	0.30	SW6010	36.40	4.22	BDL	BDL	BDL
Beryllium	0.12	SW6010	0.165	0.241	0.250	BDL	0.164
Silver	0.60	SW6010	BDL	BDL	BDL	BDL	BDL
Cadmium	0.34	SW6010	0.37	BDL	BDL	BDL	BDL
Chromium	0.80	SW6010	12.10	11.60	BDL	BDL	BDL
Thallium	0.20	SW7841	BDL	BDL	BDL	BDL	BDL
Arsenic	0.13	SW7060	0.804	2.296	2.043	BDL	2.958
Selenium	0.22	SW7740	0.226	BDL	0.347	1.749	0.594

BDL = Below Detection Limits

1) = In-House RTI Duplicate of SB-56, 30, D, 8-10 ft.

2) = Not priority pollutant metals

* = Invalid Data

TABLE 4-76. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 3 of 3

Thirteen Priority Pollutant Metals (Soil); Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Analyzed:			SB-57 13 NOV 86 12 DEC 86 1)				
Sticker No., ID: Depth Interval (ft):			38, D 2-4	42, D 4-6	68, D 13-15	46, D 9-11	50, D 11-13
Species	Detection Limits (mg/Kg)	Methods					
Iron 2)	4.50	SW6010	1,340	5,800	6,110	3,060	1,170
Aluminum 2)	4.00	SW6010	1,930	12,500	16,000	17,400	4,760
Antimony	0.90	SW7041	10.40	9.58	20.10	7.71	50.30
Lead	3.50	SW6010	BDL	BDL	BDL	BDL	BDL
Nickel	1.00	SW6010	BDL	BDL	BDL	BDL	BDL
Copper	0.90	SW6010	BDL	BDL	BDL	BDL	BDL
Zinc	0.30	SW6010	BDL	27.60	6.24	7.71	11.40
Beryllium	0.12	SW6010	BDL	0.230	0.297	0.158	0.130
Silver	0.60	SW6010	BDL	BDL	---	BDL	2.79
Cadmium	0.34	SW6010	BDL	BDL	0.60	BDL	0.60
Chromium	0.80	SW6010	BDL	5.49	13.60	12.80	5.29
Thallium	0.20	SW7841	BDL	BDL	BDL	BDL	BDL
Arsenic	0.13	SW7060	0.080	1.102	1.567	0.914	BDL
Selenium	0.22	SW7740	BDL	BDL	0.296	BDL	BDL

BDL = Below Detection Limits

1) = Blind Duplicate of SB-57, 42, D; 4-6 ft.

2) = Not priority pollutant metals

* = Invalid Data

TABLE 4-77. RESULTS OF SEDIMENT ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Thirteen Priority Pollutant Metals (Sediment); Concentrations in mg/Kg

Sampling Point:		SD-14	SD-15
Date Sampled:		23 JAN 87	23 JAN 87
Date Analyzed:		9 FEB 87	9 FEB 87
Sticker No., ID:		360, C	362, C
Compound	Detection Limit (mg/Kg)		
Arsenic	0.13	1.40	0.81
Antimony	0.90	BDL	BDL
Beryllium	0.12	0.299	0.299
Cadmium	0.34	12.8	BDL
Chromium	0.80	8.87	6.68
Copper	0.90	43.3	6.08
Lead	3.50	150.0	28.3
Mercury	0.10	0.211	0.124
Nickel	1.00	13.4	9.07
Selenium	0.22	0.58	0.70
Silver	0.60	16.2	BDL
Thallium	0.20	BDL	BDL
Zinc	0.30	285.0	14.8

BDL = Below Detection Limit

The subsurface soils at the DPDO Storage Area are generally within or near the range of values at SB-60 with the notable exceptions of antimony (337 mg/Kg) in SB-55 at a depth of 3 to 5 feet; lead (82.9 mg/Kg) in SB-56 at a depth of 0 to 2 feet; and zinc (36.4 mg/Kg) in SB-56 at a depth of 0 to 2 feet (Table 4-76). These soil results may not be an indication of soil contamination from the DPDO Storage Area, however, as noted by high concentrations of lead (150 mg/Kg) and zinc (285 mg/Kg) in the sediment sample (SD-14) obtained upslope of the site (Table 4-77).

4.6.3.3 Organic Results--Soil samples were also collected in April 1987 at similar intervals to those originally sampled, but above the water table. These soil samples were analyzed for petroleum hydrocarbons, aromatic volatile organics, halogenated volatile organics, non-halogenated volatile organics, and extractable priority pollutants. A summary of the positive organic analyses (petroleum hydrocarbons) is provided in Table 4-78. Petroleum hydrocarbons were detected at moderate levels (i.e., about 10 to 20 times the detection limit) within 2 feet of the surface at SB-56 and SB-57 (Table 4-78). Two sediment sites, SD-14 and SD-15, were chosen to coincide with surface-water sites SW-12 and SW-13, respectively (Figure 4-10). Petroleum hydrocarbons were detected (38 mg/Kg) downslope of the DPDO Waste Storage Area at sampling point SD-15 (Table 4-78). The results of other valid organic soil analyses performed at the DPDO Storage Area are provided in Table 4-79 through 4-90. The phthalates reported in the DPDO borings (Table 4-82) are considered to be the results of field or laboratory-induced contamination of the samples as further described in Section 4.8. With the exception of the petroleum hydrocarbons previously discussed, no other organics were detected (or confirmed by the second column confirmation) in the DPDO soils.

4.6.3.4 Stage 1 Results--The Stage 1 results of soil analyses at the DPDO site are provided in Table 4-91. Based on these results there was some indication of shallow (less than 3 feet) soil contamination in the immediate vicinity of the DPDO Storage Area as indicated by the presence of oil and grease in soil test borings STB-7, STB-8, and STB-9 (Table 4-91). Lead (676 mg/Kg) and chromium (71 mg/Kg) were notably high in the shallow soils at STB-8, but thought to be related to a yellow substance (possibly paint) observed in the fill soils.

TABLE 4-78. RESULTS OF POSITIVE ORGANIC ANALYSES (SOIL); SITE 5 (DPDO WASTE STORAGE AREA)

Results of Soil and Sediment Analyses; Concentrations in mg/Kg

Sampling Point:		SB-56	SB-57	SD-15
Date Sampled:		12 NOV 87	13 NOV 86	23 JAN 87
Sticker No., ID:		20, B	35, B	385, A
Depth Interval (ft):		0-2	0-2	---
Detection Limit (mg/Kg)				
PETROLEUM HYDROCARBONS (Method E418.1)	25	310	560	38

NOTE: No Environmental or Regulatory Criteria are Known for Petroleum Hydrocarbons in Soil

TABLE 4-79. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 1 of 3

Acid Extractables (Soil); Method SW3550/SW8270; Concentrations in mg/Kg

Sampling Point:		SB-55	SB-55	SB-55	SB-55
Date Sampled:		13 APR 87	13 APR 87	13 APR 87	13 NOV 86
Date Extracted:		24 APR 87	24 APR 87	24 APR 87	25 NOV 86
Date Analyzed:		11 MAY 87	11 MAY 87	11 MAY 87	8 JAN 87
Sticker No., ID:		568, B	752, B	754, B	64, B
Depth Interval (ft):		0-2	3-5	9-11	11-13
Compound	Detection Limits (mg/Kg)				
4-Chloro-3-Methylphenol	1.0	BDL	BDL	BDL	BDL
2-Chlorophenol	1.0	BDL	BDL	BDL	BDL
2,4-Dichlorophenol	1.0	BDL	BDL	BDL	BDL
2,4-Dimethylphenol	1.0	BDL	BDL	BDL	BDL
2,4-Dinitrophenol	10.0	BDL	BDL	BDL	BDL
2-Methyl-4,6-Dinitrophenol	10.0	BDL	BDL	BDL	BDL
2-Nitrophenol	1.0	BDL	BDL	BDL	BDL
4-Nitrophenol	1.0	BDL	BDL	BDL	BDL
Pentachlorophenol	1.0	BDL	BDL	BDL	BDL
Phenol	1.0	BDL	BDL	BDL	BDL
2,4,6-Trichlorophenol	1.0	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-79. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 2 of 3

Acid Extractables (Soil); Method SW3550/SW8270; Concentrations in mg/Kg

Sampling Point:		SB-56	SB-56	SB-56	SB-56	SB-56
Date Sampled:		13 APR 87	12 NOV 86	12 NOV 86	12 NOV 86	12 NOV 86
Date Extracted:		24 APR 87	24 NOV 86	24 NOV 86	24 NOV 86	24 NOV 86
Date Analyzed:		11 MAY 87	23 DEC 86	23 DEC 86	23 DEC 86	23 DEC 86
Sticker No., ID:		570, B	24, B	28, B	32, B	67, B
Depth Interval (ft):		0-2	3-5	8-10	13-15	15-18
Compound	Detection Limits (mg/Kg)					
4-Chloro-3-Methylphenol	1.0	BDL	BDL	BDL	BDL	BDL
2-Chlorophenol	1.0	BDL	BDL	BDL	BDL	BDL
2,4-Dichlorophenol	1.0	BDL	BDL	BDL	BDL	BDL
2,4-Dimethylphenol	1.0	BDL	BDL	BDL	BDL	BDL
2,4-Dinitrophenol	10.0	BDL	BDL	BDL	BDL	BDL
2-Methyl-4,6-Dinitrophenol	10.0	BDL	BDL	BDL	BDL	BDL
2-Nitrophenol	1.0	BDL	BDL	BDL	BDL	BDL
4-Nitrophenol	1.0	BDL	BDL	BDL	BDL	BDL
Pentachlorophenol	1.0	BDL	BDL	BDL	BDL	BDL
Phenol	1.0	BDL	BDL	BDL	BDL	BDL
2,4,6-Trichlorophenol	1.0	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-79. RESULTS OF SOIL ANALYSES; OPDO STORAGE AREA; p. 3 of 3

Acid Extractables (Soil); Method SW3550/JW8270; Concentrations in mg/Kg

		1)
Sampling Point:		SB-57
Date Sampled:		13 NOV 86
Date Extracted:		24 NOV 86
Date Analyzed:		23 DEC 86
Sticker No., ID:		35, 8
Depth Interval (ft):		0-2
Compound	Detection Limits (mg/Kg)	
4-Chloro-3-Methylphenol	1.0	BDL
2-Chlorophenol	1.0	BDL
2,4-Dichlorophenol	1.0	BDL
2,4-Dimethylphenol	1.0	BDL
2,4-Dinitrophenol	10.0	BDL
2-Methyl-4,6-Dinitrophenol	10.0	BDL
2-Nitrophenol	1.0	BDL
4-Nitrophenol	1.0	BDL
Pentachlorophenol	1.0	BDL
Phenol	1.0	BDL
2,4,6-Trichlorophenol	1.0	BDL

BDL = Below Detection Limits

1) = Detection Limit 10 Times That Indicated on This Page

2) = Detection Limit 20 Times That Indicated on This Page

TABLE 4-80. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 1 of 2

Aromatic Volatile Organics (Soil); Method 602; Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Analyzed: Sticker No., ID: Depth Interval (ft):		SB-55 13 NOV 86 20 NOV 86 52, B 1-3	SB-55 13 APR 87 16 APR 87 752, B 3-5	SB-55 13 APR 87 16 APR 87 754, B 9-11	SB-55 13 NOV 86 20 NOV 86 64, B 11-13	SB-56 12 NOV 1986 19, 20 NOV 1986 20, B 24, B 28, B 32, B 67, B 0-2 3-5 8-10 13-15 15-18				
Compound	Detection Limits (mg/Kg)									
Benzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Ethylbenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Toluene	0.001	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Xylene ¹⁾	0.001	BDL	---	---	BDL	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limits
 1) = Analyzed by Method 8020

TABLE 4-80. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 2 of 2

Aromatic Volatile Organics (Soil); Method 602; Concentrations in mg/Kg

Sampling Point:		SB-57		SB-57			
Date Sampled:		13 APR 87		13 NOV 86			
Date Analyzed:		16 APR 87		20 NOV 86			
Sticker No., ID:		572, B		36, B	40, B	44, B	44, B
Depth Interval (ft):		0-2		2-4	4-6	9-11	11-13
Compound	Detection Limits (mg/Kg)						
Benzene	0.001	BDL	---	BDL	BDL	BDL	BDL
Chlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL
Ethylbenzene	0.001	BDL	BDL	BDL	BDL	BDL	BDL
Toluene	0.001	BDL	BDL	BDL	BDL	BDL	BDL
Xylene ¹⁾	0.001	BDL	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

1) = Analyzed by Method 8020

TABLE 4-81. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 1 of 3

Halogenated Volatile Organics (Soil); Method 601; Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Analyzed:		SB-55 13 NOV 86 20 NOV 86			
Sticker No., ID: Depth Interval (ft):		52, B 1-3	56, B 3-5	60, B 9-11	64, B 11-13
Compound	Detection Limits (mg/Kg)				
Benzyl Chloride	0.001	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy)Methane	0.001	BDL	BDL	BDL	BDL
Bis (2-chloroisopropyl)Ether	0.001	BDL	BDL	BDL	BDL
Bromobenzene	0.001	BDL	BDL	BDL	BDL
Bromodichloromethane	0.001	BDL	BDL	BDL	BDL
Bromoform	0.001	BDL	BDL	BDL	BDL
Bromomethane	0.001	BDL	BDL	BDL	BDL
Carbon Tetrachloride	0.001	BDL	BDL	BDL	BDL
Chloroacetaldehyde	0.001	BDL	BDL	BDL	BDL
Chloral	0.001	BDL	BDL	BDL	BDL
Chlorobenzene	0.001	BDL	BDL	BDL	BDL
Chloroethane	0.001	BDL	BDL	BDL	BDL
Chloroform	0.001	BDL	BDL	BDL	BDL
1-Chlorohexane	0.001	BDL	BDL	BDL	BDL
2-Chloroethyl Vinyl Ether	0.001	BDL	BDL	BDL	BDL
Chloromethane	0.001	BDL	BDL	BDL	BDL
Chloromethyl Methyl Ether	0.001	BDL	BDL	BDL	BDL
Chlorotoluene	0.001	BDL	BDL	BDL	BDL
Dibromochloromethane	0.001	BDL	BDL	BDL	BDL
Dibromomethane	0.001	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL
Dichlorodifluoromethane	0.001	BDL	BDL	BDL	BDL
1,1-Dichloroethane	0.001	BDL	BDL	BDL	BDL
1,2-Dichloroethane	0.001	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	0.001	BDL	BDL	BDL	BDL
Trans-1,2-Dichloroethylene	0.001	BDL	BDL	BDL	BDL
Dichloromethane	0.001	BDL	BDL	BDL	BDL
1,2-Dichloropropane	0.001	BDL	BDL	BDL	BDL
1,3-Dichloropropylene	0.001	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	0.001	BDL	BDL	BDL	BDL
1,1,1,2-Tetrachloroethane	0.001	BDL	BDL	BDL	BDL
Tetrachloroethylene	0.001	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	0.001	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	0.001	BDL	BDL	BDL	BDL
Trichloroethylene	0.001	BDL	BDL	BDL	BDL
Trichlorofluoromethane	0.001	BDL	BDL	BDL	BDL
Trichloropropane	0.001	BDL	BDL	BDL	BDL
Vinyl Chloride	0.001	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-81. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 2 of 3

Halogenated Volatile Organics (Soil); Method 601; Concentrations in mg/Kg

		SB-56				
Sampling Point:		13 NOV 86				
Date Sampled:		19 NOV 86				
Date Analyzed:						
Sticker No., ID:		20, B	24, B	28, B	32, B	67, B
Depth Interval (ft):		0-2	3-5	8-10	13-15	15-18
Compound	Detection Limits (mg/Kg)					
Benzyl Chloride	0.001	BDL	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy)Methane	0.001	BDL	BDL	BDL	BDL	BDL
Bis (2-chloroisopropyl)Ether	0.001	BDL	BDL	BDL	BDL	BDL
Bromobenzene	0.001	BDL	BDL	BDL	BDL	BDL
Bromodichloromethane	0.001	BDL	BDL	BDL	BDL	BDL
Bromoform	0.001	BDL	BDL	BDL	BDL	BDL
Bromomethane	0.001	BDL	BDL	BDL	BDL	BDL
Carbon Tetrachloride	0.001	BDL	BDL	BDL	BDL	BDL
Chloroacetaldehyde	0.001	BDL	BDL	BDL	BDL	BDL
Chloral	0.001	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL
Chloroethane	0.001	BDL	BDL	BDL	BDL	BDL
Chloroform	0.001	BDL	BDL	BDL	BDL	BDL
1-Chlorohexane	0.001	BDL	BDL	BDL	BDL	BDL
2-Chloroethyl Vinyl Ether	0.001	BDL	BDL	BDL	BDL	BDL
Chloromethane	0.001	BDL	BDL	BDL	BDL	BDL
Chloromethyl Methyl Ether	0.001	BDL	BDL	BDL	BDL	BDL
Chlorotoluene	0.001	BDL	BDL	BDL	BDL	BDL
Dibromochloromethane	0.001	BDL	BDL	BDL	BDL	BDL
Dibromomethane	0.001	BDL	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL
Dichlorodifluoromethane	0.001	BDL	BDL	BDL	BDL	BDL
1,1-Dichloroethane	0.001	BDL	BDL	BDL	BDL	BDL
1,2-Dichloroethane	0.001	BDL	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	0.001	BDL	BDL	BDL	BDL	BDL
Trans-1,2-Dichloroethylene	0.001	BDL	BDL	BDL	BDL	BDL
Dichloromethane	0.001	BDL	BDL	BDL	BDL	BDL
1,2-Dichloropropane	0.001	BDL	BDL	BDL	BDL	BDL
1,3-Dichloropropylene	0.001	BDL	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	0.001	BDL	BDL	BDL	BDL	BDL
1,1,1,2-Tetrachloroethane	0.001	BDL	BDL	BDL	BDL	BDL
Tetrachloroethylene	0.001	BDL	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	0.001	BDL	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	0.001	BDL	BDL	BDL	BDL	BDL
Trichloroethylene	0.001	BDL	BDL	BDL	BDL	BDL
Trichlorofluoromethane	0.001	BDL	BDL	BDL	BDL	BDL
Trichloropropane	0.001	BDL	BDL	BDL	BDL	BDL
Vinyl Chloride	0.001	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-81. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 3 of 3

Halogenated Volatile Organics (Soil); Method 601; Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Analyzed:		SB-57 13 NOV 86 20 NOV 86				
Sticker No., ID: Depth Interval (ft):		35, B 0-2	36, B 2-4	40, B 4-6	44, B 9-11	48, B 11-13
Compound	Detection Limits (mg/Kg)					
Benzyl Chloride	0.001	BDL	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy)Methane	0.001	BDL	BDL	BDL	BDL	BDL
Bis (2-chloroisopropyl)Ether	0.001	BDL	BDL	BDL	BDL	BDL
Bromobenzene	0.001	BDL	BDL	BDL	BDL	BDL
Bromodichloromethane	0.001	BDL	BDL	BDL	BDL	BDL
Bromoform	0.001	BDL	BDL	BDL	BDL	BDL
Bromomethane	0.001	BDL	BDL	BDL	BDL	BDL
Carbon Tetrachloride	0.001	BDL	BDL	BDL	BDL	BDL
Chloroacetaldehyde	0.001	BDL	BDL	BDL	BDL	BDL
Chloral	0.001	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL
Chloroethane	0.001	BDL	BDL	BDL	BDL	BDL
Chloroform	0.001	BDL	BDL	BDL	BDL	BDL
1-Chlorohexane	0.001	BDL	BDL	BDL	BDL	BDL
2-Chloroethyl Vinyl Ether	0.001	BDL	BDL	BDL	BDL	BDL
Chloromethane	0.001	BDL	BDL	BDL	BDL	BDL
Chloromethyl Methyl Ether	0.001	BDL	BDL	BDL	BDL	BDL
Chlorotoluene	0.001	BDL	BDL	BDL	BDL	BDL
Dibromochloromethane	0.001	BDL	BDL	BDL	BDL	BDL
Dibromomethane	0.001	BDL	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	0.001	BDL	BDL	BDL	BDL	BDL
Dichlorodifluoromethane	0.001	BDL	BDL	BDL	BDL	BDL
1,1-Dichloroethane	0.001	BDL	BDL	BDL	BDL	BDL
1,2-Dichloroethane	0.001	BDL	BDL	BDL	BDL	BDL
1,1-Dichloroethylene	0.001	BDL	BDL	BDL	BDL	BDL
Trans-1,2-Dichloroethylene	0.001	BDL	BDL	BDL	BDL	BDL
Dichloromethane	0.001	BDL	BDL	BDL	BDL	BDL
1,2-Dichloropropane	0.001	BDL	BDL	BDL	BDL	BDL
1,3-Dichloropropylene	0.001	BDL	BDL	BDL	BDL	BDL
1,1,2,2-Tetrachloroethane	0.001	BDL	BDL	BDL	BDL	BDL
1,1,1,2-Tetrachloroethane	0.001	BDL	BDL	BDL	BDL	BDL
Tetrachloroethylene	0.001	BDL	BDL	BDL	BDL	BDL
1,1,1-Trichloroethane	0.001	BDL	BDL	BDL	BDL	BDL
1,1,2-Trichloroethane	0.001	BDL	BDL	BDL	BDL	BDL
Trichloroethylene	0.001	BDL	BDL	BDL	BDL	BDL
Trichlorofluoromethane	0.001	BDL	BDL	BDL	BDL	BDL
Trichloropropane	0.001	BDL	BDL	BDL	BDL	BDL
Vinyl Chloride	0.001	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-82. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 1 of 3

Base/Neutral Extractables (Soil); Method SW3550/625; Concentrations in mg/Kg

Sampling Point:		SB-55	SB-55	SB-55
Date Sampled:		13 APR 87	13 APR 87	13 APR 87
Date Extracted:		24 APR 87	24 APR 87	24 APR 87
Date Analyzed:		11 MAY 87	11 MAY 87	11 MAY 87
Sticker No, ID:		568, B	752, B	754, B
Depth Interval (ft):		0-2	3-5	9-11
Compound	Detection Limits (mg/Kg)			
Acenaphthene	1.0	BDL	BDL	BDL
Acenaphthylene	0.4	BDL	BDL	BDL
Anthracene	0.4	BDL	BDL	BDL
Benidine	0.4	BDL	BDL	BDL
Benzo (a) Anthracene	0.4	BDL	BDL	BDL
Benzo (a) Pyrene	0.4	BDL	BDL	BDL
Benzo (b) Fluoranthene	0.4	BDL	BDL	BDL
Benzo (ghi) Perylene	1.0	BDL	BDL	BDL
Benzo (k) Fluoranthene	0.4	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	0.4	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	0.4	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	0.4	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	0.4	3.0	5.3	0.94
4-Bromophenyl Phenyl Ether	0.4	BDL	BDL	BDL
Benzyl Butyl Phthalate	0.4	BDL	BDL	BDL
2-Chloronaphthalene	0.4	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	0.4	BDL	BDL	BDL
Chrysene	0.4	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	0.4	BDL	BDL	BDL
1,2-Dichlorobenzene	0.4	BDL	BDL	BDL
1,3-Dichlorobenzene	0.4	BDL	BDL	BDL
1,4-Dichlorobenzene	0.4	BDL	BDL	BDL
3,3-Dichlorobenzidine	0.4	BDL	BDL	BDL
Diethyl Phthalate	0.4	BDL	BDL	BDL
Dimethyl Phthalate	0.4	BDL	BDL	BDL
Di-N-Butyl Phthalate	0.4	BDL	BDL	BDL
2,4-Dinitrotoluene	0.4	BDL	BDL	BDL
2,6-Dinitrotoluene	0.4	BDL	BDL	BDL
Di-N-Octylphthalate	0.4	BDL	BDL	BDL
Fluoranthene	0.4	BDL	BDL	BDL
Fluorene	0.4	BDL	BDL	BDL
Hexachlorobenzene	0.4	BDL	BDL	BDL
Hexachlorobutadiene	0.4	BDL	BDL	BDL
Hexachlorocyclopentadiene	0.4	BDL	BDL	BDL
Hexachloroethane	0.4	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	1.0	BDL	BDL	BDL
Isophorone	0.4	BDL	BDL	BDL
Naphthalene	0.4	BDL	BDL	BDL
Nitrobenzene	0.4	BDL	BDL	BDL
N-Nitrosodimethylamine	0.4	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	0.4	BDL	BDL	BDL
N-Nitrosodiphenylamine	0.4	BDL	BDL	BDL
Phenanthrene	0.4	BDL	BDL	BDL
Pyrene	0.4	BDL	BDL	BDL
1,2,4-Trichlorobenzene	0.4	BDL	BDL	BDL

BDL = Below Detection Limit

TABLE 4-82. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 2 of 3

Base/Neutral Extractables (Soil); Method SW3550/625; Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Extracted: Date Analyzed:		SB-56 13 APR 87 24 APR 87 11 MAY 87		SB-56 12 NOV 86 24 NOV 86 23 DEC 86				
Sticker No., ID: Depth Interval (ft):		570, B 0-2		24, B 3-5	28, B 8-10	32, B 13-15	67, B 15-18	
Compound	Detection Limits (mg/Kg)							
Acenaphthene	1.0	BDL	BDL	BDL	BDL	BDL	BDL	
Acenaphthylene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Anthracene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Benzidine	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Benzo (a) Anthracene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Benzo (a) Pyrene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Benzo (b) Fluoranthene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Benzo (ghi) Perylene	1.0	BDL	BDL	BDL	BDL	BDL	BDL	
Benzo (k) Fluoranthene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Bis (2-Chloroethoxy) Methane	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Bis (2-Chloroethyl) Ether	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Bis (2-Chloroisopropyl) Ether	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Bis (2-Ethylhexyl) Phthalate	0.4	3.2	0.89	4.1	BDL	BDL	BDL	
4-Bromophenyl Phenyl Ether	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Benzyl Butyl Phthalate	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
2-Chloronaphthalene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
4-Chlorophenyl Phenyl Ether	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Chrysene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Dibenzo (a,h) Anthracene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
1,2-Dichlorobenzene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
1,3-Dichlorobenzene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
1,4-Dichlorobenzene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
3,3-Dichlorobenzidine	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Diethyl Phthalate	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Dimethyl Phthalate	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Di-N-Butyl Phthalate	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
2,4-Dinitrotoluene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
2,6-Dinitrotoluene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Di-N-Octylphthalate	0.4	BDL	BDL	BDL	BDL	BDL	0.69	
Fluoranthene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Fluorene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Hexachlorobenzene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Hexachlorobutadiene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Hexachlorocyclopentadiene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Hexachloroethane	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Indeno (1,2,3-cd) Pyrene	1.0	BDL	BDL	BDL	BDL	BDL	BDL	
Isophorone	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Naphthalene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Nitrobenzene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
N-Nitrosodimethylamine	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
N-Nitroso-Di-N-Propylamine	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
N-Nitrosodiphenylamine	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Phenanthrene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
Pyrene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	
1,2,4-Trichlorobenzene	0.4	BDL	BDL	BDL	BDL	BDL	BDL	

BDL = Below Detection Limits

TABLE 4-82. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 3 of 3

Base/Neutral Extractables (Soil); Method SW3550/625; Concentrations in mg/Kg

		1)
Sampling Point:		SB-57
Date Sampled:		13 NOV 86
Date Extracted:		24 NOV 86
Date Analyzed:		23 DEC 86
Sticker No., ID:		35, B
Depth Interval (ft):		0-2
Compound	Detection Limits (mg/Kg)	
Acenaphthene	1.0	BDL
Acenaphthylene	0.4	BDL
Anthracene	0.4	BDL
Benzidine	0.4	BDL
Benzo (a) Anthracene	0.4	BDL
Benzo (a) Pyrene	0.4	BDL
Benzo (b) Fluoranthene	0.4	BDL
Benzo (ghi) Perylene	1.0	BDL
Benzo (k) Fluoranthene	0.4	BDL
Bis (2-Chloroethoxy) Methane	0.4	BDL
Bis (2-Chloroethyl) Ether	0.4	BDL
Bis (2-Chloroisopropyl) Ether	0.4	BDL
Bis (2-Ethylhexyl) Phthalate	0.4	24.0
4-Bromophenyl Phenyl Ether	0.4	BDL
Benzyl Butyl Phthalate	0.4	BDL
2-Chloronaphthalene	0.4	BDL
4-Chlorophenyl Phenyl Ether	0.4	BDL
Chrysene	0.4	BDL
Dibenzo (a,h) Anthracene	0.4	BDL
1,2-Dichlorobenzene	0.4	BDL
1,3-Dichlorobenzene	0.4	BDL
1,4-Dichlorobenzene	0.4	BDL
3,3-Dichlorobenzidine	0.4	BDL
Diethyl Phthalate	0.4	BDL
Dimethyl Phthalate	0.4	BDL
Di-N-Butyl Phthalate	0.4	7.4
2,4-Dinitrotoluene	0.4	BDL
2,6-Dinitrotoluene	0.4	BDL
Di-N-Octylphthalate	0.4	BDL
Fluoranthene	0.4	BDL
Fluorene	0.4	BDL
Hexachlorobenzene	0.4	BDL
Hexachlorobutadiene	0.4	BDL
Hexachlorocyclopentadiene	0.4	BDL
Hexachloroethane	0.4	BDL
Indeno (1,2,3-cd) Pyrene	1.0	BDL
Isophorone	0.4	BDL
Naphthalene	0.4	BDL
Nitrobenzene	0.4	BDL
N-Nitrosodimethylamine	0.4	BDL
N-Nitroso-Di-N-Propylamine	0.4	BDL
N-Nitrosodiphenylamine	0.4	BDL
Phenanthrene	0.4	BDL
Pyrene	0.4	BDL
1,2,4-Trichlorobenzene	0.4	BDL

BDL = Below Detection Limits

1) = Detection Limit is 10 Times That Indicated on This Page

2) = Detection Limit is 20 Times that Indicated on This Page

TABLE 4-83. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 1 of 3

PCB/Pesticides (Soil); Method 625P; Concentrations in mg/Kg

Sampling Point:		SB-55	SB-55	SB-55
Date Sampled:		13 APR 87	13 APR 87	13 APR 87
Date Extracted:		24 APR 87	24 APR 87	24 APR 87
Date Analyzed:		11 MAY 87	11 MAY 87	11 MAY 87
Sticker No., ID:		568, B	752, B	754, B
Depth Interval (ft):		0-2	3-5	9-11
Compound	Detection Limits (mg/Kg)			
Aldrin	0.40	BDL	BDL	BDL
Alpha-BHC	0.40	BDL	BDL	BDL
Beta-BHC	0.40	BDL	BDL	BDL
Delta-BHC	0.40	BDL	BDL	BDL
Gamma-BHC	0.40	BDL	BDL	BDL
Chlordane	0.40	BDL	BDL	BDL
4,4'-DDD	0.40	BDL	BDL	BDL
4,4'-DDE	0.40	BDL	BDL	BDL
4,4'-DDT	0.40	BDL	BDL	BDL
Dieldrin	0.40	BDL	BDL	BDL
Endosulfan I	0.40	BDL	BDL	BDL
Endosulfan II	0.40	BDL	BDL	BDL
Endosulfan Sulfate	0.40	BDL	BDL	BDL
Endrin	0.40	BDL	BDL	BDL
Endrin Aldehyde	0.40	BDL	BDL	BDL
Heptachlor	0.40	BDL	BDL	BDL
Heptachlor Epoxide	0.40	BDL	BDL	BDL
Toxaphene	0.40	BDL	BDL	BDL
PCB 1016	0.40	BDL	BDL	BDL
PCB 1221	0.40	BDL	BDL	BDL
PCB 1232	0.40	BDL	BDL	BDL
PCB 1242	0.40	BDL	BDL	BDL
PCB 1248	0.40	BDL	BDL	BDL
PCB 1254	0.40	BDL	BDL	BDL
PCB 1260	0.40	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-83. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 2 of 3

PCB/Pesticides (Soil); Method 625P; Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Extracted: Date Analyzed: Sticker No., ID: Depth Interval (ft):		SB-56 13 APR 87 24 APR 87 11 MAY 87 570, B 0-2	SB-56 12 NOV 86 24 NOV 86 23 DEC 86 24, B 3-5	SB-56 12 NOV 86 24 NOV 86 23 DEC 86 28, B 8-10	SB-56 12 NOV 86 24 NOV 86 23 DEC 86 32, B 13-15	SB-56 12 NOV 86 24 NOV 86 23 DEC 86 67, B 15-18
Compound	Detection Limits (mg/Kg)					
Aldrin	4.0	BDL	BDL	BDL	BDL	BDL
Alpha-BHC	4.0	BDL	BDL	BDL	BDL	BDL
Beta-BHC	4.0	BDL	BDL	BDL	BDL	BDL
Delta-BHC	4.0	BDL	BDL	BDL	BDL	BDL
Gamma-BHC	4.0	BDL	BDL	BDL	BDL	BDL
Chlordane	4.0	BDL	BDL	BDL	BDL	BDL
4,4'-DDD	4.0	BDL	BDL	BDL	BDL	BDL
4,4'-DDE	4.0	BDL	BDL	BDL	BDL	BDL
4,4'-DDT	4.0	BDL	BDL	BDL	BDL	BDL
Dieldrin	4.0	BDL	BDL	BDL	BDL	BDL
Endosulfan I	4.0	BDL	BDL	BDL	BDL	BDL
Endosulfan II	4.0	BDL	BDL	BDL	BDL	BDL
Endosulfan Sulfate	4.0	BDL	BDL	BDL	BDL	BDL
Endrin	4.0	BDL	BDL	BDL	BDL	BDL
Endrin Aldehyde	4.0	BDL	BDL	BDL	BDL	BDL
Heptachlor	4.0	BDL	BDL	BDL	BDL	BDL
Heptachlor Epoxide	4.0	BDL	BDL	BDL	BDL	BDL
Toxaphene	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1016	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1221	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1232	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1242	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1248	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1254	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1260	4.0	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-83. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 3 of 3

PCB/Pesticides (Soil); Method 625P; Concentrations in mg/Kg

Sampling Point:		SB-57	SB-57	SB-57	SB-57	SB-57
Date Sampled:		13 NOV 86	13 NOV 86	13 NOV 86	13 NOV 86	13 NOV 86
Date Extracted:		24 NOV 86	24 NOV 86	24 NOV 86	24 NOV 86	24 NOV 86
Date Analyzed:		23 DEC 86	12 JAN 87	5 JAN 87	5 JAN 87	5 JAN 87
Sticker No., ID:		35, B	36, B	40, B	44, B	48, B
Depth Interval (ft):		0-2	2-4	4-6	9-11	11-13
Compound	Detection Limits (mg/Kg)					
Aldrin	4.0	BDL	BDL	BDL	BDL	BDL
Alpha-BHC	4.0	BDL	BDL	BDL	BDL	BDL
Beta-BHC	4.0	BDL	BDL	BDL	BDL	BDL
Delta-BHC	4.0	BDL	BDL	BDL	BDL	BDL
Gamma-BHC	4.0	BDL	BDL	BDL	BDL	BDL
Chlordane	4.0	BDL	BDL	BDL	BDL	BDL
4,4'-DDD	4.0	BDL	BDL	BDL	BDL	BDL
4,4'-DDE	4.0	BDL	BDL	BDL	BDL	BDL
4,4'-DDT	4.0	BDL	BDL	BDL	BDL	BDL
Dieldrin	4.0	BDL	BDL	BDL	BDL	BDL
Endosulfan I	4.0	BDL	BDL	BDL	BDL	BDL
Endosulfan II	4.0	BDL	BDL	BDL	BDL	BDL
Endosulfan Sulfate	4.0	BDL	BDL	BDL	BDL	BDL
Endrin	4.0	BDL	BDL	BDL	BDL	BDL
Endrin Aldehyde	4.0	BDL	BDL	BDL	BDL	BDL
Heptachlor	4.0	BDL	BDL	BDL	BDL	BDL
Heptachlor Epoxide	4.0	BDL	BDL	BDL	BDL	BDL
Toxaphene	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1016	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1221	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1232	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1242	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1248	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1254	4.0	BDL	BDL	BDL	BDL	BDL
PCB 1260	4.0	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limits

TABLE 4-84. RESULTS OF SOIL ANALYSES; DPDO STORAGE AREA; p. 1 of 1
 Petroleum Hydrocarbon (Sol1); Method 625P; Concentrations in mg/Kg

Sampling Point: Date Sampled: Date Analyzed:		SB-55 13 NOV 86 1 JAN 87		SB-56 12 NOV 86 1 JAN 87		SB-57 13 NOV 86 1 JAN 87	
Sticker No., ID: Depth Interval (ft):		52, B 56, B 60, B 64, B 1-3 3-5 9-11 11-13		20, B 24, B 28, B 32, B 36, B 40, B 44, B 48, B 0-2 3-5 8-10 13-15 15-18		35, B 36, B 40, B 44, B 48, B 0-2 2-4 4-6 9-11 11-13	
Species		BDL BDL BDL BDL		BDL BDL BDL BDL		BDL BDL BDL BDL	
Hydrocarbons		BDL BDL BDL BDL		BDL BDL BDL BDL		BDL BDL BDL BDL	
Detection Limits (mg/Kg)		310		560		BDL	

BDL = Below Detection Limits

TABLE 4-85. RESULTS OF SEDIMENT ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Acid Extractables (Sediment); Method 625 A; Concentrations In mg/Kg

		Sampling Point:	SD-14	SD-15
		Date Sampled:	23 JAN 87	23 JAN 87
		Date Extracted:	4 FEB 87	4 FEB 87
		Date Analyzed:	23 FEB 87	23 FEB 87
		Sticker No., ID:	379, A	385, A
Compound	Detection Limits (mg/Kg)			
4-Chloro-3-Methylphenol	1.25	BDL	BDL	
2-Chlorophenol	1.25	BDL	BDL	
2,4-Dichlorophenol	1.25	BDL	BDL	
2,4-Dimethylphenol	1.25	BDL	BDL	
2,4-Dinitrophenol	12.50	BDL	BDL	
2-Methyl-4,6-Dinitrophenol	12.50	BDL	BDL	
2-Nitrophenol	1.25	BDL	BDL	
4-Nitrophenol	1.25	BDL	BDL	
Pentachlorophenol	1.50	BDL	BDL	
Phenol	1.25	BDL	BDL	
2,4,6-Trichlorophenol	1.25	BDL	BDL	

BDL = Below Detection Limits

TABLE 4-86. RESULTS OF SEDIMENT ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Aromatic Volatile Organics (Sediment); Method 602; Concentrations in mg/Kg

		Sampling Point:		SD-14	SD-15
		D :		28 JAN 87	28 JAN 87
		Date Analyzed:		4 FEB 87	4 FEB 87
		Sticker No., ID:		379, A	385, A
Compound	Detection Limit (mg/Kg)				
Benzene	0.001	BDL		BDL	BDL
Chlorobenzene	0.001	BDL		BDL	BDL
1,2-Dichlorobenzene	0.001	BDL		BDL	BDL
1,3-Dichlorobenzene	0.001	BDL		BDL	BDL
1,4-Dichlorobenzene	0.001	BDL		BDL	BDL
Ethylbenzene	0.001	BDL		BDL	BDL
Toluene	0.001	BDL		BDL	BDL
Xylene 1)	0.001	BDL		BDL	BDL

BDL = Below Detection Limit

1) = Quantitated as Ethylbenzene

TABLE 4-87. RESULTS OF SEDIMENT ANALYSES;DPDO STORAGE AREA; p. 1 of 1

Base/Neutral Extractables (Sediment); Method 625B/N; Concentrations in ug/Kg

		Sampling Site:	SD-14	SD-15
		Date Sampled:	23 JAN 87	23 JAN 87
		Date Extracted:	4 FEB 87	4 FEB 87
		Date Analyzed:	23 FEB 87	23 FEB 87
		Sticker No., ID:	379, A	385, A
Compound	Detection Limit (ug/Kg)			
Acenaphthene	1250		BDL	BDL
Acenaphthylene	500		BDL	BDL
Anthracene	500		BDL	BDL
Benzidine	500		BDL	BDL
Benzo (a) Anthracene	500		BDL	BDL
Benzo (a) Pyrene	500		BDL	BDL
Benzo (b) Fluoranthene	500		BDL	BDL
Benzo (ghi) Perylene	1250		BDL	BDL
Benzo (k) Fluoranthene	500		BDL	BDL
Bis (2-Chloroethoxy) Methane	500		BDL	BDL
Bis (2-Chloroethyl) Ether	500		BDL	BDL
Bis (2-Chloroisopropyl) Ether	500		BDL	BDL
Bis (2-Ethylhexyl) Phthalate	500		BDL	BDL
4-Bromophenyl Phenyl Ether	500		BDL	BDL
Benzyl Butyl Phthalate	500		BDL	BDL
2-Chloronaphthalene	500		BDL	BDL
4-Chlorophenyl Phenyl Ether	500		BDL	BDL
Chrysene	500		BDL	BDL
Dibenzo (a,h) Anthracene	500		BDL	BDL
1,2-Dichlorobenzene	500		BDL	BDL
1,3-Dichlorobenzene	500		BDL	BDL
1,4-Dichlorobenzene	500		BDL	BDL
3,3-Dichlorobenzidine	500		BDL	BDL
Diethyl Phthalate	500		BDL	BDL
Dimethyl Phthalate	500		BDL	BDL
Di-N-Butyl Phthalate	500		BDL	BDL
2,4-Dinitrotoluene	500		BDL	BDL
2,6-Dinitrotoluene	500		BDL	BDL
Di-N-Octylphthalate	500		BDL	BDL
Fluoranthene	500		BDL	BDL
Fluorene	500		BDL	BDL
Hexachlorobenzene	500		BDL	BDL
Hexachlorobutadiene	500		BDL	BDL
Hexachlorocyclopentadiene	500		BDL	BDL
Hexachloroethane	500		BDL	BDL
Indeno (1,2,3-cd) Pyrene	1250		BDL	BDL
Isophorone	500		BDL	BDL
Naphthalene	500		BDL	BDL
Nitrobenzene	500		BDL	BDL
N-Nitrosodimethylamine	500		BDL	BDL
N-Nitroso-Di-N-Propylamine	500		BDL	BDL
N-Nitrosodiphenylamine	500		BDL	BDL
Phenanthrene	500		BDL	BDL
Pyrene	500		BDL	BDL
1,2,4-Trichlorobenzene	500		BDL	BDL

BDL = Below Detection Limit

TABLE 4-88. RESULTS OF SEDIMENT ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Non-Halogenated Volatile Organics (Sediment); Method 8015; Concentration in mg/Kg

		Sampling Point:	
		Date Sampled:	
		Date Analyzed:	
		Sticker No., ID:	
		SD-14	SD-15
		23 JAN 87	23 JAN 87
		3 FEB 87	3 FEB 87
		379, A	385, A
Compound	Detection Limit (mg/Kg)		
Acrylamide	0.010	BDL	BDL
Carbon Disulfide	0.010	BDL	BDL
Diethyl Ether	0.010	BDL	BDL
Methyl Ethyl Ketone	0.010	BDL	BDL
Methyl Isobutyl Ketone	0.010	BDL	BDL
Paraldehyde	0.010	BDL	BDL

BDL = Below Detection Limit

TABLE 4-89. RESULTS OF SEDIMENT ANALYSES; DPDO STORAGE AREA; p. 1 of 1

PCB's and Pesticides (Sediment); Method 625P; Concentrations in mg/Kg

Compound	Detection Limit (mg/Kg)	Sampling Point: Date Sampled: Date Extracted: Date Analyzed: Sticker No., ID:	
		SD-14 23 JAN 87 4 FEB 87 23 FEB 87 379, A	SD-15 23 JAN 87 4 FEB 87 23 FEB 87 385, A
Aldrin	0.50	BDL	BDL
Alpha - BHC	0.50	BDL	BDL
Beta - BHC	0.50	BDL	BDL
Delta - BHC	0.50	BDL	BDL
Gamma - BHC	0.50	BDL	BDL
Chlordane	0.50	BDL	BDL
4,4'-DDD	0.50	BDL	BDL
4,4'-DDE	0.50	BDL	BDL
4,4'-DDT	0.50	BDL	BDL
Dieldrin	0.50	BDL	BDL
Endosulfan I	0.50	BDL	BDL
Endosulfan II	0.50	BDL	BDL
Endosulfan Sulfate	0.50	BDL	BDL
Endrin	0.50	BDL	BDL
Endrin Aldehyde	0.50	BDL	BDL
Heptachlor	0.50	BDL	BDL
Heptachlor Epoxide	0.50	BDL	BDL
Toxaphene	0.50	BDL	BDL
PCB 1016	0.50	BDL	BDL
PCB 1221	0.50	BDL	BDL
PCB 1232	0.50	BDL	BDL
PCB 1242	0.50	BDL	BDL
PCB 1248	0.50	BDL	BDL
PCB 1254	0.50	BDL	BDL
PCB 1260	0.50	BDL	BDL

BDL = Below Detection Limits

TABLE 4-90. RESULTS OF SEDIMENT ANALYSES; DPDO STORAGE AREA; p. 1 of 1

Petroleum Hydrocarbons (Sediment); Method 625 P; Concentrations in mg/Kg

Sampling Point:		SD-14	SD-15
Date Sampled:		23 JAN 87	23 JAN 87
Date Extracted:		6 FEB 87	6 FEB 87
Date Analyzed		6 FEB 87	6 FEB 87
Sticker No.:		379, A	385, A
Compound	Detection Limit (mg/Kg)		
Hydrocarbons	25	BDL	38

TABLE 4-91. RESULTS OF STAGE 1 CHEMICAL ANALYSIS (SOILS);
SITE 5 (DPDO)

Soil test boring number	Sample depth (ft)	Date drilled (1984)	Oil and grease (mg/Kg)	Lead (mg/Kg)	Chromium (mg/Kg)	Pesticides (mg/Kg)
STB-7	3	1-17	63.9	2.3	3.0	BDL
	9		BDL	3.0	7.5	BDL
	15		BDL	2.5	9.7	BDL
	21		BDL	3.3	7.3	BDL
	27		BDL	BDL	4.6	BDL
STB-8	3	1-17	243.3	676.0	71.0	BDL
	9		BDL	BDL	2.5	BDL
	15		BDL	6.8	3.1	BDL
	21		BDL	0.8	8.2	BDL
	27		BDL	3.5	7.4	BDL
STB-9	3	1-17	9,074.0	0.6	6.8	BDL
	9		BDL	2.6	2.9	BDL
	15		BDL	2.4	10.2	BDL
	21		BDL	1.1	7.8	BDL
	27		BDL	9.5	3.0	BDL
STB-10	3	1-17	BDL	0.9	3.1	BDL
	9		BDL	0.9	4.2	BDL
	15		BDL	1.6	6.4	BDL
	21		BDL	1.8	6.7	BDL
	27		BDL	2.3	5.9	BDL

BDL = Below detection limits

4.6.4 Conclusions

The results of laboratory and on-site analyses confirm that groundwater, surface water, and shallow soil contamination exists downgradient of the DPDO Waste Storage Area. The Stage 2 field measurements (conductivity and OVA readings) support the conclusions of shallow soil and groundwater contamination resulting from the DPDO Storage Area. The most contaminated sample in terms of volatile organics was water from well MW-54 which exceeds the RMCLs for trichloroethene. Since this compound was also detected in a surface water sample approximately 400 feet downslope of the DPDO Waste Storage Area, there is some indication that the organic contamination may extend into the shallow groundwater, surface water, and surficial soils in the Stoney Creek flood plain, west of the site.

4.7 SITE 6 - COAL PILE STORAGE AREA

A description and history of the site was provided in Subsection 1.5.6. Three soil borings (SB-58, SB-59, and a background boring SB-60) were drilled at the site (Figure 4-12). Lithologic descriptions of the subsurface conditions encountered in these three borings are provided in Appendix E. A geologic cross section through Site 6 is provided in Figure 4-13. The organic vapor analyzer (OVA) scan of soil samples from Site 6 were all below detection limits at the time of boring (Appendix E).

4.7.1 Soil Sampling Results

Soils at Site 6 were only analyzed for field measurements (OVA scans) and total metal screens. The analytical results are provided herein and in Appendix U.

4.7.1.1 Inorganic Results--Subsurface soils at SB-58, SB-59, and SB-60 were sampled at approximately 2.5, 5, and 10 foot depths for total metal screens (Table 4-92). Soil borings SB-58 and SB-59 were located within the former Coal Pile Storage Area, whereas background soil boring SB-60 was located approximately 600 feet southeast of the former Coal Pile Storage Area (Figure 4-12), presumably in an area uncontaminated by coal storage. Mean values for each parameter were calculated (Table 4-93) in order to compare coal pile soils against background soils at SB-60 with the exception of iron and aluminum, the metals in the soils beneath the Coal Pile Storage Area are generally within or near the range of background conditions.

4.7.2 Conclusions

Although minor differences exist in the distribution and concentration of metals in the Site 6 borings, the analytical results from the background boring SB-60 do not appear to differ significantly from those of SB-58 and SB-59. In fact, mean metal concentrations in background boring SB-60 appear to be slightly higher than in SB-58 and SB-59, e.g., iron, aluminum, cadmium, chromium, silicon, potassium, sodium, and lead. Consequently, it appears the soils to a depth of 10 feet at the former coal pile area are not contaminated by metals above background levels.

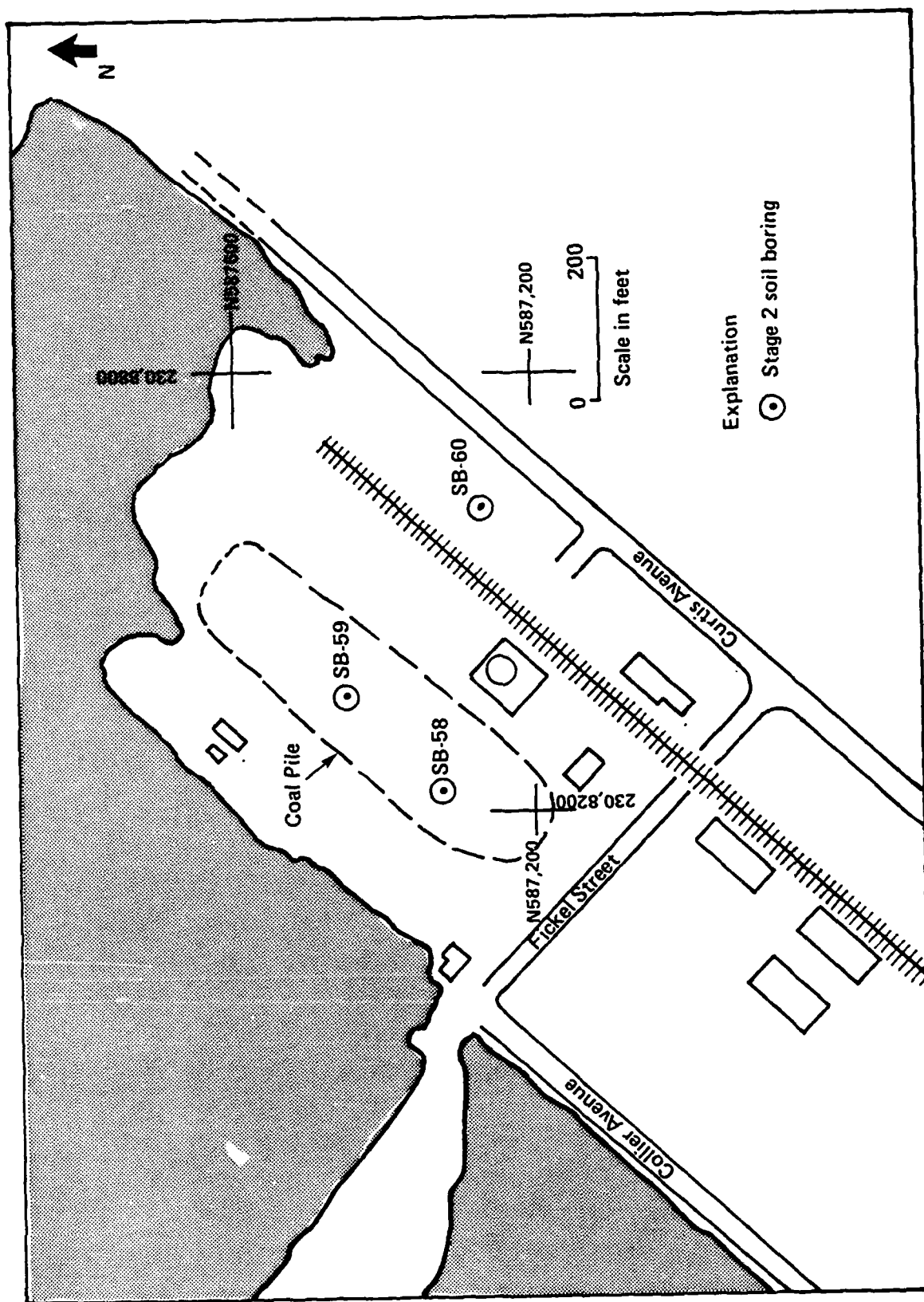


FIGURE 4-12. LOCATION OF SOIL BORINGS AT SITE 6 (COAL PILE STORAGE AREA)
SEYMOUR JOHNSON AFB, NC

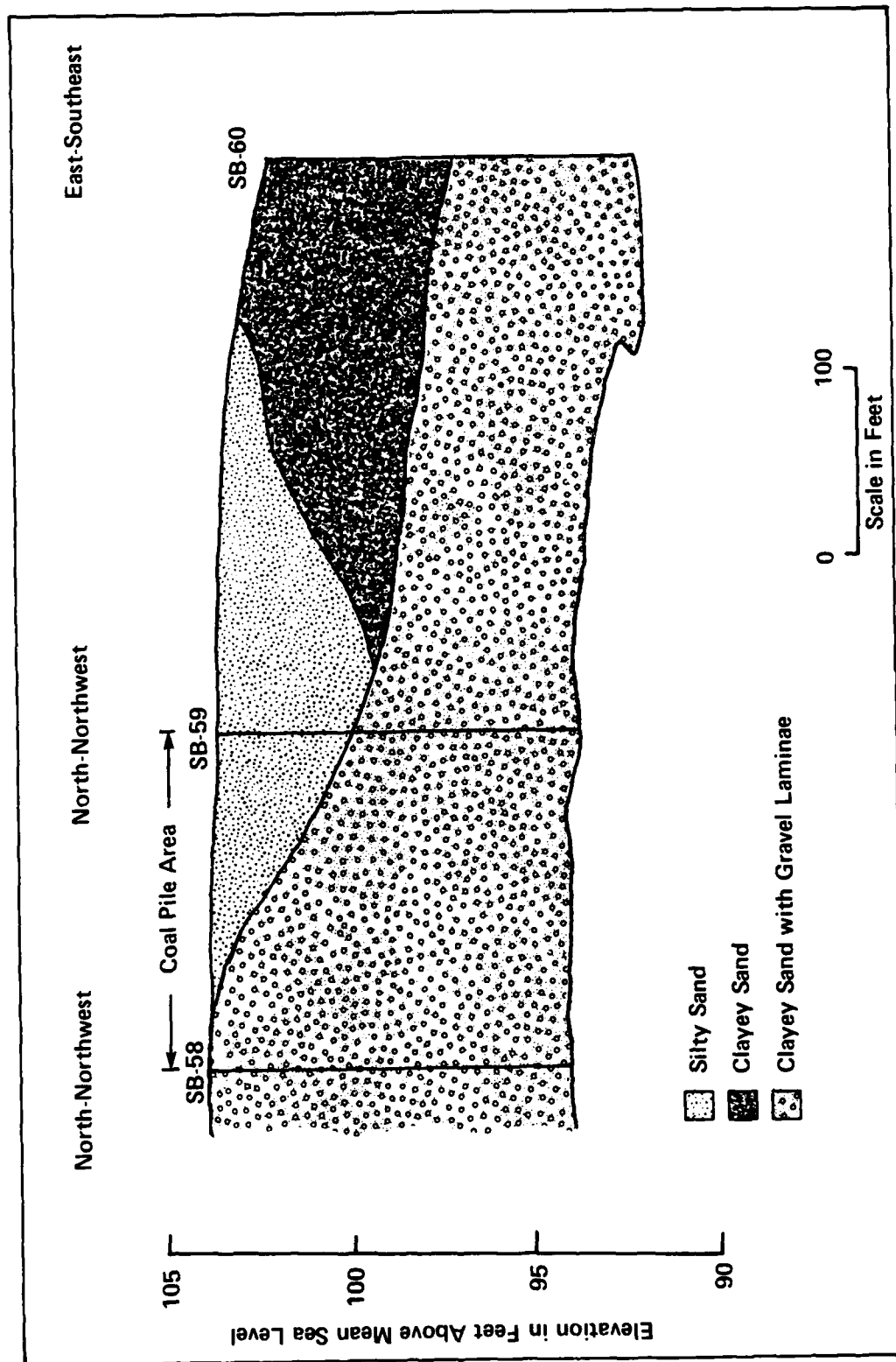


FIGURE 4-13. GEOLOGIC CROSS SECTION OF SITE 6 (COAL PILE STORAGE AREA)

SEYMOUR JOHNSON AFB, NC

TABLE 4-93. MEAN VALUES FOR TOTAL METAL SCREEN IN SOIL;
COAL PILE STORAGE AREA

Species	Mean Background Value (mg/Kg)	SB-58 Value (mg/Kg)	SB-59 Value (mg/Kg)
Iron	7020	9,153.34	14,596.67
Manganese	28.83	18.37	16.67
Vanadium	20.90	73.70	35.37
Aluminum	18,736.67	23,296.67	28,700
Nickel	6.37	4.83	6.2
Cobalt	1.17	1.20	1.67
Barium	19.67	19.03	25.93
Beryllium	0.33	0.32	0.37
Silver	BDL	BDL	BDL
Copper	2.10	1.77	2.47
Cadmium	BDL	BDL	1.71
Chromium	12.37	15.34	20.87
Magnesium	438.33	453.34	592.67
Molybdenum	BDL	BDL	BDL
Lead	8	BDL	9.43
Zinc	6	6.63	6.03
Antimony	BDL	BDL	BDL
Boron	3.6	2.80	BDL
Calcium	166.13	100.80	300.13
Silicon	1,550.67	1,793	2,120
Sodium	63	50	37.34
Thallium	BDL	BDL	BDL
Potassium	358.67	352.34	493.67

4.8 FIELD QUALITY ASSURANCE PROCEDURES AND QUALITY CONTROL DATA

This section provides a summary of the field sampling quality assurance (QA) procedures and a summary of the field quality control (QC) data. Laboratory QA/QC data and related information are provided in Appendix J.

4.8.1 Field Program Quality Assurance

A key element of the field program was to establish routine quality control procedures to minimize the impact of sampling error on measurement data. For many of the parameters sampled, such as volatile organic compounds, extreme care was required during sampling to minimize loss of volatiles and prevent sample contamination. In many cases, analytical errors may account for a negligibly small portion of the total measurement error.

The Seymour Johnson AFB field program was carefully planned and executed in accordance with the Technical Operations Plan (Appendix D). The sampling team followed specified procedures throughout the field program to ensure consistency and minimize sampling error. A detailed description of the field program is provided in Section 3. During the field program, the following general steps were taken to assure sample reliability and to avoid problems associated with cross contamination:

Drilling/Soil Sampling:

- Drilling and well installation proceeded from sites where little to no contamination was known to exist, to sites suspected of being contaminated.
- Drilling was performed without the use of drilling fluids and auger flights were thoroughly cleaned between each site.
- All soil sampling tools were thoroughly cleaned between each sampling interval.
- All soil sample containers were thoroughly precleaned in the laboratory prior to sample collection.
- Blind duplicates of the soil sample were submitted as quality control samples.
- All soil samples were stored at 4°C until analysis.
- Strict sample custody was maintained for all soil samples and all field observations were recorded in detailed logbooks.

Well Installation/Water Sampling:

- All monitoring wells were extensively developed after installation and all well development tools were thoroughly cleaned between each well.
- Sample collection efforts were split for organic and inorganic parameters to maintain consistency in detailed sampling and preservation procedures.
- Groundwater and surface water sampling proceeded from those sites known to have little or no known contamination to those sites with known or suspected contamination. Sampling within a site similarly proceeded from assumed least contaminated areas to most contaminated areas.
- Monitoring wells were purged of standing water and stabilized in terms of gross water-quality indicators prior to sampling.
- Teflon bailers and related sampling materials (pH and conductivity-meter probes, collection containers, mixing flasks, blue ice containers, and coolers) were thoroughly decontaminated between each use for collection of groundwater samples. Groundwater samples were consistently collected from the middle of the water column within the monitoring well.
- All water sample containers were thoroughly precleaned in the laboratory prior to sample collection.
- All water sample preservatives were American Chemical Society certified reagent grade chemicals.
- Instruments used for field measurements (pH, temperature, conductivity, and organic vapor analyzer) were calibrated at least once daily, and recalibrated as necessary.
- Ten percent of the water samples were split in the field and submitted as blind duplicate quality control samples to compare with the overall precision of the analytical measurement system.
- A large percentage of the organic samples were split in the field and submitted as duplicate quality control samples that were also used to compare with the precision of the analytical measurement system.
- Field blanks were submitted to the laboratory for each analytical parameter and consisted of ultra-pure reagent-grade water. Field blanks were indistinguishable (blind) from other field samples.
- All water samples were stored at 4°C until analysis.
- Strict sample custody was maintained for all water samples and all field observations were recorded in detailed logbooks.

4.8.2 Field QC Data

The results of field QC data are summarized by analytical parameter in Tables 4-94 through 4-106. The field QC data specifically include:

- Blind field duplicates: Duplicate samples that were labeled such that they were indistinguishable from other field samples. The blind duplicates were typically labeled with a non-existent sampling point (e.g., MW-04, MW-07, MW-09)
- Field Duplicates: Duplicate samples of field samples (particularly samples for water analysis of organics) that were analyzed along with primary samples. The field duplicates maintained the same sampling point identification number as the primary sample, but usually had a different sample sticker number (i.e., the field duplicates were not truly "blind" samples). The analysis of field duplicates, as defined herein, was not required in the Statement of Work but the results are provided as supportive QC data.
- Field Blanks: Ultra-pure reagent-grade water samples that were indistinguishable from other field samples. The field blanks were typically labeled with a non-existent sampling point (e.g., MW-56, MW-58, MW-60). The teflon bailers and related sampling equipment was cleaned using procedures outlined in Section 3.0. The reagent grade water was then poured directly into the teflon bailer (while at RTI's mobile laboratory) and then decaunted directly into the sample container for analysis.

Analysis of the field QC data allows the precision of the entire measurement system, including sampling error, to be estimated by comparing the results of duplicate analyses. Where duplicate values are available, the relative percent difference (RPD) of the values was determined as follows:

$$RPD = x_1 - x_2 / ((x_1 + x_2) / 2) \cdot 100\%$$

where x_1 and x_2 are paired duplicate values. The following subsections discuss the results of the field QC data by parameter within the general categories of inorganic and organic analyses.

4.8.2.1 Inorganics Field QC Data--The results of inorganic field QC data are presented in Tables 4-94 through 4-99. The results of one blind field duplicate for alkalinity (below detection limits) correspond favorably to the results the actual field sample (Table 4-94). The results of three blind field duplicates and three field blanks for anions are provided in Table 4-95. The average field

TABLE 4-94. SUMMARY OF FIELD QC DATA FOR ALKALINITY (WATER); p. 1 of 1

		1)	
SAMPLING POINT:		MW-54	MW-61
STICKER NO., ID:		545,K1	567,K1
APPENDIX TABLE, PAGE:		S-1,1	S-1,1
COMPOUND	DETECTION LIMIT (mg/L)		
Alkalinity	10	BDL	BDL

BDL = Below Detection Limits

1) = Blind Field Duplicate of 545,K1

TABLE 4-95. SUMMARY OF FIELD QC DATA FOR ANIONS; p. 1 of 2

SAMPLING POINT: STICKER NO., ID:			APPENDIX TABLE, PAGE:			DETECTION LIMIT (ug/mL)			
COMPOUND	1)	2)	3)	1)	2)	3)	1)	2)	3)
	MW-14 417, J	MW-09 531, J/ 663, K	MW-52 524, J/ 722, 0	MW-09 531, J/ 663, K	MW-64 769, L	MW-08 530, K			
	M-1,1	M-1,1	Q-1,2	M-1,1	Q-1,1	Q-1,2			
		RPD							

TABLE 4-95. SUMMARY OF FIELD QC DATA FOR ANIONS; p. 2 of 2

COMPOUND	DETECTION LIMIT (ug/mL)	SAMPLING POINT:		
		1)	1)	1)
		MW-65	MW-65	MW-60
		766,K	765,K	446,J
		M-1,4	M-1,4	0-1,1
Fluoride	0.01			0.035
Chloride	0.01			0.166
Nitrate	0.03	BDL	BDL	BDL
Phosphate	0.60	BDL	BDL	BDL
Bromide	0.05			BDL
Nitrite	0.05	BDL	BDL	BDL
Sulfate	0.05			0.250

BDL = Below Detection Limit

RPD = Relative Percent Difference

1) = Field Blank

TABLE 4-96. SUMMARY OF FIELD QC DATA FOR TOTAL CYANIDE (WATER); p. 1 of 1

		1)		2)
SAMPLING POINT:		SW-12	SW-20	MW-62
STICKER NO., ID:		746,R	751,0	473,N
APPENDIX TABLE, PAGE:		S-11,1	S-11,1	S-3,1
COMPOUND	DETECTION LIMIT (ug/L)			
<u>Total Cyanide</u>	<u>0.02</u>	BDL	BDL	BDL

BDL = Below Detection Limits

1) = Blind Field Duplicate of 746,R

2) = Field Blank

TABLE 4-97. SUMMARY OF FIELD QC DATA FOR PRIORITY POLLUTANTS (WATER); P. 1 of 1

APPENDIX TABLE, PAGE:									
STICKER NO., ID:									
SAMPLING POINT:									
COMPOUND	DETECTION LIMIT (ug/mL)								
	1)	2)	3)	4)	4)	4)	4)	4)	4)
	MW-11	MW-01	MW-46	MW-56	MW-52	MW-08	MW-60	MW-60	MW-62
	326,J	427,K	352,L	432,M	526,L	532,M	455,0	447,L	472,L
	K-1,1	K-1,1	M-2,1	M-2,1	Q-2,1	Q-2,1	K-1,1	S-4,1	S-4,1
					</				

BDL = Below Detection Limit

RPD = Relative Percent Difference

* = Detection Limit 0.002ug/mL for these samples

1) = Blind Field Duplicate of 326,J

2) = Blind Field Duplicate of 352,L

3) = Blind Field Duplicate of 526,L

4) = Field Blank

TABLE 4-98. SUMMARY OF FIELD QC DATA FOR TOTAL DISSOLVED SOLIDS (WATER); p. 1 of 1

COMPOUND	SAMPLING POINT:			STICKER NO., ID:			APPENDIX TABLE, PAGE:			DETECTION LIMIT (mg/L)		
	1)	2)	3)	1)	2)	3)	1)	2)	3)	1)	2)	3)
Total Dissolved Solids	MW-12	MW-56	MW-60	MW-12	MW-56	MW-60	MW-12	MW-56	MW-60	MW-12	MW-56	MW-60
	0335,N	0423,N	0448,N	0335,N	0423,N	0448,N	0335,N	0423,N	0448,N	0335,N	0423,N	0448,N
	0-3,1	0-3,1	0-3,1	0-3,1	0-3,1	0-3,1	0-3,1	0-3,1	0-3,1	0-3,1	0-3,1	0-3,1
	91	65	33.3%	722	673	7.0%						

RPD = Relative Percent Difference

1) = Blind Field Duplicate of 335,N

2) = Blind Field Duplicate of 528,N

3) = Field Blank

TABLE 4-99. SUMMARY OF FIELD QC DATA FOR TOTAL METAL SCREEN (SOIL); P. 1 of 1

SPECIES	DETECTION		LIMIT (ug/g)		1)	
	LIMIT (ug/g)		LIMIT (ug/g)		LIMIT (ug/g)	
Iron	4.5		1190	1230	3.3%	
Manganese	1.5		3	3.8	23.5%	
Vandium	0.6		5.3	4.67	12.6%	
Aluminum	---		10200	10200	0.0%	
Nickel	3.0		2.7	BDL		
Cobalt	0.8		1	1.08	7.7%	
Barium	1.0		18.6	2.21	167.3%	
Beryllium	0.12		0.26	0.229	12.7%	
Silver	2.8		BDL	4.91		
Copper	2.8		BDL	BDL		
Cadmium	0.34		BDL	BDL		
Chromium	2.1		5.5	4.68	16.1%	
Magnesium	12.0		114	104	9.2%	
Molybdenum	0.9		BDL	BDL		
Lead	6.3		15.7	10.6	38.8%	
Zinc	0.6		2.8	0.8	111.1%	
Antimony	6.0		BDL	19.9		
Boron	2.4		BDL	210		
Calcium	2.4		BDL	29.9		
Silicon	7.0		1480	538	93.4%	
Sodium	12.0		10	36.8	114.6%	
Thallium	0.2		BDL	BDL		
Potassium	0.5		124	121	2.4%	

BDL = Below Detection Limit
 RPD = Relative Percent Difference
 1) = Blind Field Duplicate of 5,A

duplicate RPD was 9.9 percent. The field blank is noted to have trace levels of fluoride, chloride, and sulfate (Table 4-95). The results of one blind field duplicate for total cyanide (below detection limits) corresponds to the results of the actual field sample (Table 4-96). The results of three blind field duplicates and three field blanks for priority pollutants are provided in Table 4-97. The duplicate analyses correspond favorably (typically below detection limits). In the one case where two paired duplicate values were obtained (for zinc in well MW-52) the RPD was 9.1 percent. All blanks were free of priority pollutants (Table 4-97). The results of two blind field duplicates and one field blank for total dissolved solids are presented in Table 4-98. The average field duplicate RPD was 20.2 percent. The field blank contained a total dissolved solids concentration of 13 mg/L (Table 4-98).

The results of one blind field duplicate for a total metal screen of soils is provided in Table 4-99. The field duplicate RPD for the individual metal species compare favorably, particularly considering the variability typically associated with soil analyses. The greatest imprecision was noted in the analysis of barium, zinc, and sodium. The average field duplicate RPD for the metal screen analysis (43 percent) is considered good, however, for soil analyses (Table 4-99).

In summary, the field QC data for inorganic parameters compare favorably with the actual sample data and indicate that the field sampling methods and laboratory precision have provided reliable measurements. More rigorous laboratory QA/QC data for the inorganic parameters are provided in Appendix J and substantiate the reliability of the measurements noted herein.

4.8.2.2 Organics Field QC Data--The results for organic field QC data are presented in Table 4-100 through 4-106. The results of four blind field duplicates, 17 field duplicates, and a field blank for acid extractables are summarized in Table 4-100. All results agree favorably in that no acid extractables were detected in any of the paired samples or in the field blank (Table 4-100).

The results of two blind field duplicates and a field blank for aromatic volatile organics are summarized in Table 4-101. The results agree favorably in that most paired values were below detection limits and in the one positive detection (benzene in well MW-46 at Site 2) the field duplicate RPD was 6.5 percent (Table 4-101). No aromatic volatile organics were detected in the field blank.

TABLE 4-100. SUMMARY OF FIELD QC DATA FOR ACID EXTRACTABLES (WATER); P. 2 of 5

COMPOUND	DETECTION LIMIT (ug/L)		1)		2)		3)		4)	
	LIMIT (ug/L)		MW-44		MW-45		MW-46		MW-47	
4-Chloro-3-Methylphenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Chlorophenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4-Dichlorophenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4-Dimethylphenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4-Dinitrophenol	250		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Methyl-4,6-Dinitrophenol	250		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Nitrophenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4-Nitrophenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pentachlorophenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4,6-Trichlorophenol	25		BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit
 1) = Field Duplicate of 684,E1
 2) = Field Duplicate of 688,E1
 3) = Field Duplicate of 692,E1
 4) = Field Duplicate of 696,E1

TABLE 4-100. SUMMARY OF FIELD QC DATA FOR ACID EXTRACTABLES (WATER); P. 3 of 5

COMPOUND	DETECTION LIMIT (ug/L)				
	SAAMPLING POINT: STICKER NO., ID: APPENDIX TABLE, PAGE:				
	1)	2)	3)	4)	5)
	MW-48 700,E1 N-1,5	MW-49 707,E4 N-1,5	MW-57 735,E1 N-1,6	MW-57 771,E2 N-1,6	SW-10 730,E1 N-15,1
4-Chloro-3-Methylphenol	BDL	BDL	BDL	BDL	BDL
2-Chlorophenol	BDL	BDL	BDL	BDL	BDL
2,4-Dichlorophenol	BDL	BDL	BDL	BDL	BDL
2,4-Dimethylphenol	BDL	BDL	BDL	BDL	BDL
2,4-Dinitrophenol	BDL	BDL	BDL	BDL	BDL
2-Methyl-4,6-Dinitrophenol	BDL	BDL	BDL	BDL	BDL
4-Nitrophenol	BDL	BDL	BDL	BDL	BDL
4-Nitrophenol	BDL	BDL	BDL	BDL	BDL
Pentachlorophenol	BDL	BDL	BDL	BDL	BDL
Phenol	BDL	BDL	BDL	BDL	BDL
2,4,6-Trichlorophenol	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

- 1) = Field Duplicate of 700,E1
 2) = Field Duplicate of 707,E3
 3) = Blind Field Duplicate of 700,E3
 4) = Blind Field Duplicate of 707,E4
 5) = Field Duplicate of 730,E1

TABLE 4-100. SUMMARY OF FIELD QC DATA FOR ACID EXTRACTABLES (WATER); P. 4 of 5

COMPOUND	DETECTION LIMIT (ug/L)		1)		2)		3)		4)	
	SAMPLING POINT: STICKER NO., ID: APPENDIX TABLE, PAGE:		SW-11	SW-11	MW-12	MW-12	MW-50	MW-50	MW-51	MW-51
4-Chloro-3-Methylphenol	25		740,E1	741,E1	664,E1	665,E2	709,E1	710,E2	713,E1	714,E2
2-Chlorophenol	25		N-16,1	N-16,1	P-1,1	P-1,1	R-1,1	R-1,1	R-1,1	R-1,1
2,4-Dichlorophenol	25									
2,4-Dimethylphenol	25									
2,4-Dinitrophenol	250									
2-Methyl-4,6-Dinitrophenol	250									
2-Nitrophenol	25									
4-Nitrophenol	25									
Pentachlorophenol	25									
Phenol	25									
2,4,6-Trichlorophenol	25									

BDL = Below Detection Limit

1) = Field Duplicate of 740,E1

2) = Field Duplicate of 664,E1

3) = Field Duplicate of 709,E1

4) = Field Duplicate of 713,E1

TABLE 4-100. SUMMARY OF FIELD QC DATA FOR ACID EXTRACTABLES (WATER); p. 5 of 5

SAMPLING POINT:					DETECTION				
STICKER NO., ID:					LIMIT (ug/L)				
APPENDIX TABLE, PAGE:									
	1)		2)		3)		4)		
	MW-52	MW-53	MW-54	MW-56					
	719,E1	723,E1	727,G1	263,E2					
	R-1,2	R-1,2	T-1,1	T-1,1					
4-Chloro-3-Methylphenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Chlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4-Dichlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4-Dimethylphenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4-Dinitrophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Methyl-4,6-Dinitrophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2-Nitrophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4-Nitrophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Pentachlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Phenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2,4,6-Trichlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 719,E1

2) = Field Duplicate of 723,E1

3) = Field Duplicate of 727,G1

4) = Field Blank

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 1 of 9

COMPOUND	DETECTION LIMIT (ug/L)	1)		2)	
		MW-13 668,E1 N-4,1	MW-13 669,E2 N-4,1	MW-14 668,E1 N-4,2	MW-14 673,E2 N-4,2
Acenaphthene	25	BDL	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	25	BDL	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL	BDL
Di-N-Octylphthalate	10	11	BDL	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 668,E1

2) = Field Duplicate of 668,E1

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 2 of 9

COMPOUND	DETECTION LIMIT (ug/L)	SAMPLING POINT: STICKER NO., ID: APPENDIX TABLE, PAGE:			
		MW-43 680,E3 N-4,3	1) MW-43 681,E4 N-4,3	2) MW-04 661,E2 N-4,4	3) MW-04 660,E1 N-4,4
Acenaphthene	25	BDL	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL	BDL	18
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 680,E3

2) = Blind Field Duplicate of 680,E3

3) = Blind Field Duplicate of 681,E4

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 3 of 9

COMPOUND	DETECTION LIMIT (ug/L)	1)		2)	
		MW-44 684,E1 N-4,5	MW-44 685,E2 N-4,5	MW-45 688,E1 N-4,5	MW-45 689,E2 N-4,5
Acenaphthene	25	BDL	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 684,E1

2) = Field Duplicate of 688,E1

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 4 of 9

COMPOUND	DETECTION LIMIT (ug/L)	1)		2)	
		MW-46 692,E1 N-4,7	MW-46 693,E2 N-4,7	MW-47 696,E1 N-4,8	MW-47 697,E2 N-4,8
Acenaphthene	25	BDL	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	21	BDL	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 692,E1

2) = Field Duplicate of 696,E1

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 5 of 9

		1)		2)	
SAMPLING POINT:		MW-48	MW-48	MW-49	MW-49
STICKER NO., ID:		700,E1	701,E2	706,E3	707,E4
APPENDIX TABLE, PAGE:		N-4,9	N-4,9	N-4,10	N-4,10
COMPOUND	DETECTION LIMIT (ug/L)				
Acenaphthene	25	BDL	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL	BDL	14
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL	BDL	18
Fluoranthene	10	BDL	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 700,E1

2) = Field Duplicate of 706,E3

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 6 of 9

		1)		2)	
SAMPLING POINT:		SW-10	SW-10	SW-11	SW-11
STICKER NO., ID:		736,E1	737,E2	740,E1	741,E2
APPENDIX TABLE, PAGE:		N-18,1	N-18,1	N-18,1	N-18,1
COMPOUND	DETECTION LIMIT (ug/L)				
Acenaphthene	25	BDL	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 736,E1

2) = Field Duplicate of 740,E1

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 7 of 9

COMPOUND	DETECTION LIMIT (ug/L)	1)			2)	
		MW-12 664,E1 P-3,1	MW-12 685,E2 P-3,1	RPD	MW-50 789,E1 R-3,1	MW-50 718,E2 R-3,1
Acenaphthene	25	BDL	BDL		BDL	BDL
Acenaphthylene	10	BDL	BDL		BDL	BDL
Anthracene	10	BDL	BDL		BDL	BDL
Benzidine	10	BDL	BDL		BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL		BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL		BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL		BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL		BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL		BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL		BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL		BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL		BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	34	35	2.9%	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL		BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL		BDL	BDL
2-Chloronaphthalene	10	BDL	BDL		BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL		BDL	BDL
Chrysene	10	BDL	BDL		BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL		BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL		BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL		BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL		BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL		BDL	BDL
Diethyl Phthalate	10	BDL	BDL		BDL	BDL
Dimethyl Phthalate	10	BDL	BDL		BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL		BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL		BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL		BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL		BDL	BDL
Fluoranthene	10	BDL	BDL		BDL	BDL
Fluorene	10	BDL	BDL		BDL	BDL
Hexachlorobenzene	10	BDL	BDL		BDL	BDL
Hexachlorobutadiene	10	BDL	BDL		BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL		BDL	BDL
Hexachloroethane	10	BDL	BDL		BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL		BDL	BDL
Isophorone	10	BDL	BDL		BDL	BDL
Naphthalene	10	BDL	BDL		BDL	BDL
Nitrobenzene	10	BDL	BDL		BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL		BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL		BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL		BDL	BDL
Phenanthrene	10	BDL	BDL		BDL	BDL
Pyrene	10	BDL	BDL		BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL		BDL	BDL

BDL = Below Detection Limit
RPD = Relative Percent Difference

1) = Field Duplicate of 664,E1
2) = Field Duplicate of 789,E1

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 8 of 9

		1)		2)	
SAMPLING POINT:		MW-52	MW-52	MW-53	MW-53
STICKER NO., ID:		719,E1	720,E2	723,E1	724,E2
APPENDIX TABLE, PAGE:		R-3,3	R-3,3	R-3,4	R-3,4
COMPOUND	DETECTION LIMIT (ug/L)				
Acenaphthene	25	BDL	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	BDL	BDL	BDL	48
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL	BDL
Di-N-Octylphthalate	10	BDL	BDL	BDL	38
Fluoranthene	10	BDL	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 719,E1

2) = Field Duplicate of 723,E1

TABLE 4-102. SUMMARY OF FIELD QC DATA FOR BASE/NEUTRAL EXTRACTABLES (WATER); p. 9 of 9

COMPOUND	DETECTION LIMIT (ug/L)	1)		2)
		MW-54 727,G1 T-3,1	MW-54 728,G2 T-3,1	MW-56 262,E1 T-3,1
Acenaphthene	25	BDL	BDL	BDL
Acenaphthylene	10	BDL	BDL	BDL
Anthracene	10	BDL	BDL	BDL
Benzidine	10	BDL	BDL	BDL
Benzo (a) Anthracene	10	BDL	BDL	BDL
Benzo (a) Pyrene	10	BDL	BDL	BDL
Benzo (b) Fluoranthene	10	BDL	BDL	BDL
Benzo (ghi) Perylene	25	BDL	BDL	BDL
Benzo (k) Fluoranthene	10	BDL	BDL	BDL
Bis (2-Chloroethoxy) Methane	10	BDL	BDL	BDL
Bis (2-Chloroethyl) Ether	10	BDL	BDL	BDL
Bis (2-Chloroisopropyl) Ether	10	BDL	BDL	BDL
Bis (2-Ethylhexyl) Phthalate	10	43	BDL	BDL
4-Bromophenyl Phenyl Ether	10	BDL	BDL	BDL
Benzyl Butyl Phthalate	10	BDL	BDL	BDL
2-Chloronaphthalene	10	BDL	BDL	BDL
4-Chlorophenyl Phenyl Ether	10	BDL	BDL	BDL
Chrysene	10	BDL	BDL	BDL
Dibenzo (a,h) Anthracene	10	BDL	BDL	BDL
1,2-Dichlorobenzene	10	BDL	BDL	BDL
1,3-Dichlorobenzene	10	BDL	BDL	BDL
1,4-Dichlorobenzene	10	BDL	BDL	BDL
3,3-Dichlorobenzidine	10	BDL	BDL	BDL
Diethyl Phthalate	10	BDL	BDL	BDL
Dimethyl Phthalate	10	BDL	BDL	BDL
Di-N-Butyl Phthalate	10	BDL	BDL	BDL
2,4-Dinitrotoluene	10	BDL	BDL	BDL
2,6-Dinitrotoluene	10	BDL	BDL	BDL
Di-N-Octylphthalate	10	38	BDL	BDL
Fluoranthene	10	BDL	BDL	BDL
Fluorene	10	BDL	BDL	BDL
Hexachlorobenzene	10	BDL	BDL	BDL
Hexachlorobutadiene	10	BDL	BDL	BDL
Hexachlorocyclopentadiene	10	BDL	BDL	BDL
Hexachloroethane	10	BDL	BDL	BDL
Indeno (1,2,3-cd) Pyrene	25	BDL	BDL	BDL
Isophorone	10	BDL	BDL	BDL
Naphthalene	10	BDL	BDL	BDL
Nitrobenzene	10	BDL	BDL	BDL
N-Nitrosodimethylamine	10	BDL	BDL	BDL
N-Nitroso-Di-N-Propylamine	10	BDL	BDL	BDL
N-Nitrosodiphenylamine	10	BDL	BDL	BDL
Phenanthrene	10	BDL	BDL	BDL
Pyrene	10	BDL	BDL	BDL
1,2,4-Trichlorobenzene	10	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 727,G1

2) = Field Blank

TABLE 4-103. SUMMARY OF FIELD QC DATA FOR HALOGENATED VOLATILE ORGANICS (WATER); P. 1 of 1

SAMPLING POINT: STICKER NO., ID: APPENDIX TABLE, PAGE:						1)		2)		3)	
COMPOUND		DETECTION LIMIT (ug/L)		MW-46	MW-55	MW-14	MW-57	MW-56			
				166,A2	266,A2	230,A2	314,A1	253,A2			
				N-5,4	N-5,4	N-6,1	N-6,1	T-4,1			
					RPD						
Bromodichloromethane	1.0	BDL	BDL			BDL	BDL	BDL			
Bromoform	1.0	BDL	BDL			BDL	BDL	BDL			
Bromomethane	1.0	BDL	BDL			BDL	BDL	BDL			
Carbon Tetrachloride	1.0	BDL	BDL			BDL	BDL	BDL			
Chlorobenzene	1.0	BDL	BDL			BDL	BDL	BDL			
Chloroethane	1.0	BDL	BDL			BDL	BDL	BDL			
2-Chlorethylvinyl Ether	1.0	BDL	BDL			BDL	BDL	BDL			
Chloroform	1.0	BDL	BDL			BDL	BDL	3.8			
Chloromethane	1.0	BDL	BDL			BDL	BDL	BDL			
Dibromochloromethane	1.0	BDL	BDL			BDL	BDL	BDL			
1,2-Dichlorobenzene	1.0	BDL	BDL			BDL	BDL	BDL			
1,3-Dichlorobenzene	1.0	BDL	BDL			BDL	BDL	BDL			
1,4-Dichlorobenzene	1.0	BDL	BDL			BDL	BDL	BDL			
Dichlorodifluoromethane	1.0	BDL	BDL			BDL	BDL	BDL			
1,1-Dichloroethane	1.0	BDL	BDL			BDL	BDL	BDL			
1,2-Dichloroethane	1.0	BDL	BDL			BDL	BDL	BDL			
1,1-Dichloroethene	1.0	BDL	BDL			BDL	BDL	BDL			
trans-1,2-Dichloroethene	1.0	1.2	3.2		96.9%	BDL	BDL	BDL			
1,2-Dichloropropene	1.0	BDL	BDL			BDL	BDL	BDL			
cis-1,3-Dichloropropene	1.0	BDL	BDL			BDL	BDL	BDL			
trans-1,3-Dichloropropene	1.0	BDL	BDL			BDL	BDL	BDL			
Methylene Chloride	1.0	BDL	BDL			BDL	BDL	BDL			
1,1,2,2-Tetrachloroethane	1.0	BDL	BDL			BDL	BDL	BDL			
1,1,1-Trichloroethane	1.0	BDL	BDL			BDL	BDL	BDL			
1,1,2-Trichloroethane	1.0	BDL	BDL			BDL	BDL	BDL			
Tetrachloroethene	1.0	BDL	BDL			BDL	BDL	BDL			
Trichlorofluoromethane	1.0	BDL	BDL			BDL	BDL	BDL			
Vinyl Chloride	1.0	BDL	BDL			BDL	BDL	BDL			
Trichloroethene	1.0	BDL	1.4			BDL	BDL	BDL			

BDL = Below Detection Limit

RPD = Relative Percent Difference

1) = Blind Field Duplicate of 166,A2

2) = Blind Field Duplicate of 230,A2

3) = Field Blank

TABLE 4-104. SUMMARY OF FIELD QC DATA FOR NON-HALOGENATED VOLATILE ORGANICS (WATER); p. 1 of 1

COMPOUND	DETECTION LIMIT (ug/L)			SAMPLING POINT: STICKER NO., ID: APPENDIX TABLE, PAGE:		
	1)	2)	3)	1)	2)	3)
Acrylamide	BDL	BDL	BDL	SW-12	MW-58	MW-58
Carbon Disulfide	BDL	BDL	BDL	480,C1	537,D2	312,C1
Diethyl Ether	BDL	BDL	BDL	T-26,1	T-26,1	T-5,1
Methyl Ethyl Ketone	BDL	BDL	BDL			
Methyl Isobutyl Ketone	BDL	BDL	BDL			
Paraldehyde	BDL	BDL	BDL			

BDL = Below Detection Limit

1) = Blind Field Duplicate of 480,C1

2) = Blind Field Duplicate of 494,C1

3) = Field Blank

TABLE 4-105. SUMMARY OF FIELD QC DATA FOR PCB'S AND PESTICIDES (WATER); P. 1 of 5

COMPOUND	SAMPLING POINT:				
	STICKER NO., ID:	1)	2)	3)	4)
	APPENDIX TABLE, PAGE:	MW-13 668,E1 N-6,1	MW-14 672,E1 N-6,1	MW-43 680,E3 N-6,2	MW-54 661,E2 N-6,2
	DETECTION LIMIT (ug/L)				
Aldrin	10	BDL	BDL	BDL	BDL
Alpha - BHC	10	BDL	BDL	BDL	BDL
Beta - BHC	10	BDL	BDL	BDL	BDL
Delta - BHC	10	BDL	BDL	BDL	BDL
Gamma - BHC	10	BDL	BDL	BDL	BDL
Chlordane	10	BDL	BDL	BDL	BDL
4,4'-DDD	10	BDL	BDL	BDL	BDL
4,4'-DDE	10	BDL	BDL	BDL	BDL
4,4'-DDT	10	BDL	BDL	BDL	BDL
Dieldrin	10	BDL	BDL	BDL	BDL
Endosulfan I	10	BDL	BDL	BDL	BDL
Endosulfan II	10	BDL	BDL	BDL	BDL
Endosulfan Sulfate	10	BDL	BDL	BDL	BDL
Endrin	10	BDL	BDL	BDL	BDL
Endrin Aldehyde	10	BDL	BDL	BDL	BDL
Heptachlor	10	BDL	BDL	BDL	BDL
Heptachlor Epoxide	10	BDL	BDL	BDL	BDL
Toxaphene	10	BDL	BDL	BDL	BDL
PCB 1016	10	BDL	BDL	BDL	BDL
PCB 1221	10	BDL	BDL	BDL	BDL
PCB 1232	10	BDL	BDL	BDL	BDL
PCB 1242	10	BDL	BDL	BDL	BDL
PCB 1248	10	BDL	BDL	BDL	BDL
PCB 1254	10	BDL	BDL	BDL	BDL
PCB 1260	10	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 668,E1

2) = Field Duplicate of 672,E1

3) = Field Duplicate of 680,E3

4) = Blind Field Duplicate of 680,E3

5) = Blind Field Duplicate of 681,E4

TABLE 4-105. SUMMARY OF FIELD QC DATA FOR PCB'S AND PESTICIDES (WATER); p. 3 of 5

COMPOUND	SAMPLING POINT:				
	STICKER NO., ID:	APPENDIX TABLE, PAGE:	1)	2)	3)
DETECTION LIMIT (ug/L)					
	MW-48	MW-48	MW-49	MW-49	MW-57
5)	700,E1	701,E2	706,E3	707,E4	736,E1
	N-6,5	N-6,5	N-6,5	N-6,5	N-6,6
Aldrin	BDL	BDL	BDL	BDL	BDL
Alpha - BHC	BDL	BDL	BDL	BDL	BDL
Beta - BHC	BDL	BDL	BDL	BDL	BDL
Delta - BHC	BDL	BDL	BDL	BDL	BDL
Gamma - BHC	BDL	BDL	BDL	BDL	BDL
Chlordane	BDL	BDL	BDL	BDL	BDL
4,4'-DDD	BDL	BDL	BDL	BDL	BDL
4,4'-DDE	BDL	BDL	BDL	BDL	BDL
4,4'-DDT	BDL	BDL	BDL	BDL	BDL
Dieldrin	BDL	BDL	BDL	BDL	BDL
Endosulfan I	BDL	BDL	BDL	BDL	BDL
Endosulfan II	BDL	BDL	BDL	BDL	BDL
Endosulfan Sulfate	BDL	BDL	BDL	BDL	BDL
Endrin	BDL	BDL	BDL	BDL	BDL
Endrin Aldehyde	BDL	BDL	BDL	BDL	BDL
Heptachlor	BDL	BDL	BDL	BDL	BDL
Heptachlor Epoxide	BDL	BDL	BDL	BDL	BDL
Toxaphene	BDL	BDL	BDL	BDL	BDL
PCB 1016	BDL	BDL	BDL	BDL	BDL
PCB 1221	BDL	BDL	BDL	BDL	BDL
PCB 1232	BDL	BDL	BDL	BDL	BDL
PCB 1242	BDL	BDL	BDL	BDL	BDL
PCB 1248	BDL	BDL	BDL	BDL	BDL
PCB 1254	BDL	BDL	BDL	BDL	BDL
PCB 1260	BDL	BDL	BDL	BDL	BDL

BDL = Below Detection Limit

1) = Field Duplicate of 700,E1

2) = Field Duplicate of 706,E3

3) = Blind Field Duplicate of 706,E3

4) = Blind Field Duplicate of 707,E4

5) = Field Duplicate of 736,E1

TABLE 4-106. SUMMARY OF FIELD QC DATA FOR PETROLEUM HYDROCARBONS (WATER); p. 1 of 1

		1)		2)		3)	
SAMPLING POINT:		MW-44	MW-02	SW-10	MW-57	MW-58	
STICKER NO., ID:		149,C	321,C	179,C	316,C	256,C	
APPENDIX TABLE, PAGE:		N-7,2	N-7,2	N-21,1	N-21,1	T-7,1	
COMPOUND	DETECTION LIMIT (mg/L)						
Hydrocarbons	2.0	BDL	BDL	BDL	BDL	BDL	

BDL = Below Detection Limits

1) = Blind Field Duplicate of 149,C

2) = Blind Field Duplicate of 179,C

3) = Field Blank

The results of two blind field duplicates, 16 field duplicates, and a field blank for base/neutral extractables are summarized in Table 4-102. The results compare favorably in that most compounds for the paired samples are below detection limits. Phthalates (Bis (2-Ethylhexyl) Phthalate and Di-N-Octylphthalate) occur randomly in the paired data at or near detection limits ($10\mu\text{g/L}$). Except in one case (well MW-12 at Site 3) the phthalates were not substantiated by field duplicate analysis. Phthalates (plasticizers) are ubiquitous in small concentrations in many laboratories and based on the field QC results it is thought that the phthalates encountered in these water samples are a result of laboratory-induced contamination. It is further noted that in the case of well MW-12 (Site 3) that no other organic or inorganic contamination was measured. It is also noted (Table 4-102) that in the analysis of groundwater from well MW-43 (the background well at Site 2) that in 4 duplicate analyses, phthalate was only reported in one blind field duplicate (MW-04), suggesting laboratory-induced contamination.

The results of two blind field duplicates and a field blank for halogenated volatile organics are summarized in Table 4-103. The results compare favorably in that most of the compounds for the paired samples are below detection limits. In the one case of a positive detection in the blind field duplicates (1,2-Dichloroethane in well MW-46 at Site 2) the compound was detected in the blind field duplicate with a RPD of 90.9 percent (Table 4-103). With the exception of trace levels of chloroform ($3.8\mu\text{g/L}$) no halogenated volatile organics were detected in the field blank. Trace levels of chloroform are not uncommon in many sources of drinking water.

The results of two blind field duplicates and a field blank for non-halogenated volatile organics are summarized in Table 4-104. The results compare favorably in that all the compounds analyzed for in the paired samples and the field blank are below detection limits (Table 4-104).

The results of four blind field duplicates, 17 field duplicates, and a field blank for PCB's and pesticides are summarized in Table 4-105. The results compare favorably in that all the compounds analyzed for are below detection limits (Table 4-105).

The results of two blind field duplicates and a field blank for petroleum hydrocarbons are summarized in Table 4-106. The results compare favorably in that no petroleum hydrocarbons were detected in the paired samples or in the field blank.

In summary, the field QC data for organic parameters compare favorably with the actual sample data and indicate that the field sampling methods and laboratory precision have provided reliable measurements. More rigorous laboratory QA/QC data for the inorganic parameters (the use of second-column confirmations, laboratory duplicates, surrogates, and blanks) are provided in Appendix J and further substantiate the reliability of the measurements noted herein.

4.9 SIGNIFICANCE OF FINDINGS

The significance of the findings are summarized in the following subsections on the basis of hydrogeology, analytical results, and site environmental categorization.

4.9.1 Hydrogeology

The significant hydrogeological findings are:

- A surficial aquifer was encountered at all sites where monitoring wells were installed in the Stage 1 and Stage 2 Surveys on the Base. The significant findings of the surficial aquifer are that:
 - The water table occurs at a very shallow depth and is, therefore, susceptible to contamination by Base activities. For wells upgradient of the Stoney Creek flood plain, depth to water below ground surface, on the average, is about 12 feet; for wells within the flood plain (i.e. MW-44 through MW-49, and MW-51 through MW-53) depth to water is less than one foot below ground surface.
 - The surficial aquifer is primarily composed of silty sand but is expected to have a significant spatial variation in aquifer properties.
 - Groundwater flow components are primarily horizontal, with some downward flow likely for wells upgradient of Stoney Creek. For wells within the flood plain, some upward flow is apparent on the basis of hydraulic and water-quality conditions.
 - The surficial aquifer is not used on the Base and potential users off the Base should be effectively separated from the Base's shallow groundwater discharges because of the location of surrounding streams and drainage ditches.
- A clayey stratum exists beneath the surficial aquifer and is thought to represent the upper section of the Black Creek formation. The significant findings of the clayey stratum are that:
 - It has been identified on a regular basis beneath the surficial aquifer at all sites.
 - In the one soil boring where its lithologic distribution and properties have been studied, the upper section of the Black Creek formation is continuous to a depth of about 40 to 45 feet below ground surface. At approximately 40 to 45 feet, the sand laminations dissipate leaving a highly dense gray clay which continues to at least 75 feet below ground surface.

- It appears to serve as an effective base to the surficial aquifer with a predominantly clayey texture.
- It is estimated to be several orders of magnitude less permeable than the sands within the overlying surficial aquifer.
- Its clayey composition and intense stratification should physically retard the downward movement of water.
- Its montmorillonitic clayey composition should offer sorption capacity to certain contaminants.
- The Black Creek formation and underlying Cape Fear formation form a principal aquifer system. The significance of this aquifer system is that:
 - It is a source of water for the Base.
 - It is also used on a regional basis as a significant supply of groundwater.
 - It is hydraulically connected to the Neuse River near the Base's water supply wells.
 - Most of the recharge is interpreted to be from off-Base sources.
 - It is partially confined (and largely protected) by the thick clays of the Black Creek formation.

4.9.2 Analytical Results

The significant analytical findings are evaluated below with regard to the extent and severity of contaminant at each site.

4.9.2.1 Site 1 - Fire Training Area No. 3--At Site 1, chlorobenzene was detected in only one well downgradient of the Fire Training Area No. 3 (Table 4-3). The concentration detected is lower than the RMCLs for chlorobenzene. The extent of organics in the groundwater appears to be limited to the surficial aquifer in a relatively small area in the vicinity of well MW-41. The severity of the contamination is considered slight.

4.9.2.2 Site 2 - Landfill No. 4--At Site 2, benzene; 1,1-dichloroethane; trans-1,2-dichloroethene; or trichloroethene were detected in some downgradient wells (Table 4-15). The concentrations detected are all below the RMCLs except for benzene concentrations (7.0 $\mu\text{g/L}$) directly in the landfill as measured in well

MW-13 (Table 4-15). Concentrations of priority pollutants exceeded relevant standards or criterion for lead, nickel, or silver in some downgradient wells (Table 4-9). The extent of organics in the groundwater at Landfill No. 4 appears to be limited and approximately limited to the width of the landfill and approximately 200 feet downgradient of the landfill to the surficial aquifer in the flood plain of Stoney Creek.

4.9.2.3 Site 3 - Landfill No. 1--Site 3 (Landfill No. 1) appears to pose no environmental contamination problems based solely on the results of analyses from MW-12 .

4.9.2.4. Site 4 - Landfill No. 3--At Site 4, benzene; chlorobenzene; 1,4-dichlorobenzene; or toluene were detected in some wells downgradient of the landfill (Table 4-45). The concentrations detected are lower than RMCLs. The extent of organics in the groundwater appears to be limited to the surficial aquifer and is primarily in an area surrounding downgradient wells MW-51 and MW-52 in the flood plain adjacent to Stoney Creek.

4.9.2.5 Site 5 - DPDO Waste Storage Area--At Site 5, trans-1,2-dichloroethene and trichloroethene were detected in the only well (MW-54) downgradient of the site (Table 4-73). The concentration of trichloroethene in the groundwater (79 $\mu\text{g/L}$) exceeds the RMCLs for this compound. Trichloroethene was also detected in one surface water sample downslope of the DPDO Waste Storage Area near the method detection limits (Table 4-73). Petroleum hydrocarbons were detected in two shallow soil samples (SB-56 and SB-57) and in one sediment sample (SD-15) downslope of the DPDO Waste Storage Area (Table 4-78).

Cadmium was detected at a concentration above relevant standards (0.012 mg/L) at one surface water sampling point (SW-13) downslope of the DPDO Waste Storage Area (Table 4-60). Concentrations of lead and silver exceeded relevant standards in groundwater sampled from well MW-54 (Table 4-60).

The contamination detected downslope of the DPDO Waste Storage Area appears to have extended into the shallow groundwater, surface water, and soils in the Stoney Creek flood plain west of the site.

4.9.2.6 Site 6 - Coal Pile Storage Area--Soils to a depth of approximately 10 feet do not appear to be contaminated above background levels.

SECTION 5

ALTERNATIVE MEASURES

This section of the report provides available options for monitoring and further evaluation of the site conditions. Specific recommendations for the individual sites are provided in Section 6. Groundwater contamination has been identified at certain sites on the Base. Although some indication of the spatial dimension of the contamination is known, the precise physical limits and temporal variability of this contamination should be addressed by supplemental data before effective future actions can be implemented. For certain sites, the amount of supplemental data could be considered cost-effective when compared to the expense of remediation, particularly if the resultant remediation is not best suited for the contaminants encountered or subsurface conditions.

Based on site hydrogeology and analytical results of environmental sampling, sites can be categorized in terms of possible remedial action alternatives and/or long-term monitoring. Category 1 sites consist of sites where no further action (including remedial action) is required. Data for these sites are considered sufficient to rule out significant public health or environmental hazards. Category 2 sites are those requiring additional Phase II effort to determine the direction, magnitude, rate of movement and extent of detected contaminants. Category 3 sites consist of sites where remedial action alternatives, including long-term monitoring, may be considered appropriate.

Based on data gathered in the field program, Landfill No. 1 and the former Coal Pile Storage Area appear to warrant a Category 1 status. The remainder of the sites at the Base appear to warrant a Category 2 status for additional Phase II efforts. Even though contaminant levels at most sampling sites are generally near detection limits or below relevant standards or criterion, well defined limits on the extent of contamination (spatially or temporally) generally do not exist. Additional environmental sampling at carefully placed new monitoring installations would greatly aid in establishing contamination limits at all Category 2 sites. In addition, the precise direction and rate of groundwater flow beneath the sites should be considered. Prediction of contaminant migration can be optimized once the direction of groundwater flow is clarified (e.g., through relatively inexpensive standpipe piezometers). Although some consideration should be given to future remediation efforts at all the Category 2 sites, no site, at present, warrants unqualified status as a Category 3 site.

Alternative measures for consideration at the sites could include any of the following:

- Resample existing wells or surface water to confirm previous results and address temporal variability.
- Install hand-augered standpipe piezometers for water-table measurements as well as gross water-quality indicators (pH, specific conductance, TDS, etc.). These piezometers would be particularly useful (and cost-effective) in areas where the water table is shallow such as in the flood plain of Stoney Creek. The piezometers could then be used to site optimal locations for permanent monitoring wells, if warranted.
- Assist in the siting of supplemental monitoring wells using surface geophysical techniques to delineate the lateral extent of highly conductive groundwater downgradient of the landfills. It is expected that there is a sufficient contrast between contaminated and relatively non-contaminated water (in terms of conductivity and TDS) to make the use of electromagnetic surveying a valid reconnaissance tool.
- Install supplemental monitoring wells, if warranted on the basis of supplemental data, to further quantify the chemistry of the groundwater.
- Refine the list of analytical parameters in future cost-effective monitoring to focus on key indicator parameters for specific sites (e.g., the chemically conservative inorganic constituent chloride may be useful for long-term monitoring objectives at the landfills).

SECTION 6

RECOMMENDATIONS

The sites studied as a part of this Phase II, Stage 2 Survey were previously categorized with respect to the significance of analytical findings (Section 5). The following recommendations are now made in light of that categorization scheme. A summary of the recommendations involving supplemental evaluation is provided in Table 6-1.

6.1 CATEGORY 1 - Sites Where No Further Action is Required

6.1.1 Site 3-Landfill No. 1

No further sampling or monitoring of Landfill No. 1 is recommended. If the well is not to be used further for semi-routine monitoring of indicator parameters, then well MW-12 should be properly abandoned following NCNRCD specifications (Appendix H).

6.1.2 Site 6-Coal Pile Storage Area

Although minor differences exist in the distribution and concentration of metals between borings SB-58 and SB-59 and the background boring SB-60, the borings in the Coal Pile Storage Area do not seem to differ significantly from background. Consequently, it appears that the soils to a depth of 10 feet at the site are not contaminated by metals above background levels. The soil test borings were properly sealed (by grouting back to the land surface) as a part of the Stage 2 Survey, so no further action is recommended at the site.

6.2 CATEGORY 2 - Sites Where Additional Stage 3 Effort Is Required

6.2.1 Site 1-Fire Training Area No. 3

Groundwater contamination at Site 1 does not appear to be at high concentrations or widespread. In addition, the site is remote from a groundwater discharge area (Stoney Creek). Some slight contamination of groundwater

TABLE 6-1. SUMMARY OF RECOMMENDATIONS FOR BASE SITES

SITE NUMBER/NAME	RECOMMENDATIONS	RATIONALE
1 (Fire Training Area No. 3)	Collect samples from existing wells and reanalyze groundwater for aromatic volatile organic compounds to verify data. If warranted, consider installation of shallow water-level piezometers and additional downgradient monitoring wells.	Chlorobenzene detected in one well downgradient of site.
2 (Landfill No. 4)	Collect samples from existing wells and reanalyze for organics, base/neutral extractables, halogenated volatile organics, and selected inorganic parameters to verify data. Also consider collecting water samples from springs and Stoney Creek. If warranted, consider installation of shallow water-level piezometers and additional downgradient monitoring wells. Consider use of geophysical surveying.	Organics detected in four wells downgradient of site. Some metals detected in downgradient wells exceed relevant standards or criterion.
3 (Landfill No. 1)	No Further Action (Category 1)	No groundwater contamination indicated by data.
4 (Landfill No. 3)	Collect samples from existing wells and reanalyze for organics, base/neutral extractables, halogenated volatile organics, and selected inorganic parameters, to verify data. Also consider collecting water samples from springs and Stoney Creek. If warranted, consider installation of shallow water-level piezometers and additional downgradient monitoring wells. Consider use of geophysical surveying	Organics detected in two wells downgradient of site.
5 (DPDO Waste Storage Area)	Collect samples from existing well and surface water and analyze water samples for aromatic volatile organics, petroleum hydrocarbons, and selected inorganic parameters to verify data. Collect additional surficial soil samples and analyze for gross soil contamination. If warranted, consider installation of shallow water level piezometers, additional downgradient monitoring wells, and an upgradient monitoring well.	Organics detected in one groundwater, surface water, and sediment sample downgradient of site. Some metals detected in groundwater and surface water sample exceed relevant standards or criterion.
6 (Coal Pile)	No Further Action (Category 1)	No soils contamination indicated by data.

does appear to exist in the vicinity of well MW-41, as previously described in Section 4, and it is, therefore, recommended that some supplemental data be obtained. First, additional groundwater samples should be collected from existing wells and analyzed for aromatic volatile organic compounds to verify the data. Second, some consideration should be given to obtaining soil and water samples directly in the Fire Training area to define the magnitude of contamination at the source area. These data could then be related directly to the contamination downgradient of the site.

Third, consideration should then be given, if warranted by the supplemental analytical data, to the installation of two new wells downgradient of MW-41 (but outside Landfill No. 1) to ascertain the downgradient extent of contamination. Locating these new monitoring wells could be greatly facilitated by the pre-installation of four to ten hand-augered temporary standpipe piezometers to accurately map groundwater-flow directions.

6.2.2 Site 2-Landfill No. 4

The principal recommendation is to routinely resample the current network of monitoring wells for gross-water quality indicators (e.g., specific conductance, TDS, or TOC) and, on occasion, inorganic and organic compounds documented in this field program. Springs downgradient of the landfill should also be monitored and consideration should be given to sampling Stoney Creek upstream and downstream of Site 2. The surface water quality data should be compared with the groundwater quality data to evaluate the water quality relationship between Stoney Creek and the shallow aquifer downgradient of Site 2, i.e., to confirm or refute the presence of chloride and bromide in groundwater.

If warranted as a result of supplemental water quality data from existing wells, springs, and Stoney Creek, consideration should be given to installing at least one to two new monitoring wells southwest of MW-46 and at least one monitoring well north of MW-45 and MW-47. These wells should also be analyzed for aromatic volatile organics, base/neutral extractables, halogenated volatile organics, and selected inorganic parameters. Consideration should also be given in the use of surface geophysical techniques (i.e., electromagnetic surveying) as a reconnaissance tool downgradient of Site 2.

This technique is expected to be useful in the delineation between highly conductive, potentially contaminated shallow groundwater and groundwater with a lower conductivity. As such geophysical techniques may also be useful in siting future monitoring wells, if any.

As a consequence of the uncertainty in detailed groundwater flow direction at this site, a second recommendation is to further evaluate water-table contours within and downgradient of the landfill. This may be accomplished through the installation of 15 to 20 hand-augered temporary standpipe piezometers which may be used for water-table measurements as well as gross water-quality indicators. Consideration should also be given to evaluating the flow relationship (as well as water quality relationship) between Stoney Creek and the shallow aquifer in the floodplain.

6.2.3 Site 4-Landfill No. 3

Routine sampling of existing wells MW-51 and MW-52 and springs down-gradient of the landfill is recommended and groundwater should be analyzed to confirm previous results. Subsequent water quality analyses should include samples for aromatic volatile organics, base/neutral extractables, halogenated volatile organics, and selected inorganic parameters. Consideration should also be given to sampling Stoney Creek upstream and downstream of Site 4. The surface water quality data should be compared with the groundwater quality data to evaluate the water quality relationship between Stoney Creek and the shallow aquifer downgradient of Site 4, i.e., to confirm or refute the presence of chloride and bromide in groundwater.

If warranted on the basis of the supplemental data, a limited series of eight to twelve hand-augered piezometers is recommended to quickly and cost-effectively measure water-table elevations and indicate the presence of gross contamination through the field measurement of specific conductance. Consideration should then be given, if warranted, to the installation of at least two monitoring wells southwest of MW-51. Consideration should also be given in the use of surface geophysical techniques (i.e., electromagnetic surveying) as a reconnaissance tool downgradient of Site 2. Electromagnetic surveying is recommended because of the large contrast in background values of TDS (approximately 10 mg/L) with those values in the downgradient wells (on the

order of 500 mg/L). This technique is therefore expected to be useful in the delineation between highly conductive, potentially contaminated shallow groundwater and groundwater with a lower conductivity. As such geophysical techniques may also be useful in siting future monitoring wells, if any.

As with Landfill No. 4, some consideration should be given to evaluating the flow relationship (as well as water quality relationship) between Stoney Creek and the shallow aquifer in the floodplain.

6.2.4 Site 5-DPDO Waste Storage Area

In addition to continued sampling of MW-54 and surface waters for organic and priority pollutant metals, efforts should be undertaken to determine the groundwater flow patterns from the DPDO Waste Storage Area to discharge points in Stoney Creek or nearby drainage ditches. Hand-augered piezometers could prove most useful in this task. Once the flow system is better understood, two or three downgradient monitoring wells should be installed, if warranted on the basis of supplemental analytical data, to help define the extent of groundwater contamination. An upgradient background well should also be installed. Springs discharging into the drainage ditches and Stoney Creek should also be monitored. Subsequent water-quality monitoring should be analyzed for aromatic volatile organics, base/neutral extractables, halogenated volatile organics, petroleum hydrocarbons, and selected inorganic parameters.

The extent of surficial soil contamination could be addressed through soil contamination screening; e.g., a large number of petroleum hydrocarbon soil samples could be collected by hand-auger techniques in suspected source areas and downgradient discharge points. A background soil boring should also be considered.

Consideration should be given to conducting a full remedial investigation/feasibility study (RI/FS) to include an enhanced FS during the next effort at Site 5. Subsequent remedial action (if necessary) could then be based on results of the follow-on RI/FS.