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REPORT OF CURRENT SITUATION AND DRAFT PLAN OF ACTION, NAVAL WEAPONS STATION EARLE, COLTS NECK, NEW JERSEY

December 1988

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EXECUTIVE SUMMARY

The Initial Assessment Study of Naval Weapons Station Earle, Colts Neck, New Jersey, identified 29 sites. Eleven of these sites were investigated during the Confirmation Study. To accomplish this investigation, 29 groundwater monitor wells were installed at 9 sites located on the Main Base area and the waterfront area (Sandy Hook). The unconsolidated deposits were described according to the Unified Soil Classification System. Following installation, each well was developed and sampled for a predetermined assemblage of analytes. Surface waters and sediments were sampled at three of the sites. Soil samples were collected from soil borings at five sites.

The following interpretations were made from the analyses of geological, hydrogeological, and chemical conditions encountered during the Confirmation Study field investigation at Naval Weapons Station Earle (NWS Earle):

- The shallow unconsolidated deposits consist of silty fine to coarse quartzose sand, medium glauconitic sand, and clay lenses. These deposits are divided into three formations: Vincentown, Cohansey, and Kirkwood. The site investigated in the Sandy Hook area was interpreted to be within the Red Bank Sands overlying the Navesink Formation.

- Groundwater occurs under unconfined conditions over most of the station and is generally found within 25 feet of the surface. A localized perched zone does exist at Site 5.

- The principal direction of groundwater flow is toward the east, with northern and southern components. Local variations occur because of surface water influences. At Sites 3 and 11, groundwater flow direction is contrary to that expected.

- With the exception of pH, no New Jersey or Federal drinking water guidelines were exceeded in any groundwater sample. Except for Site 3, the pH of the groundwater samples is within the normal range of pH for formations in Monmouth County. Pentachlorophenol was found in upgradient monitor wells at Site 5 and Site 11. The wells at Site 5 are in close proximity to railroad tracks.

- Spring sample 4-A exceeded the 10^{-6} cancer risk criterion for N-nitrosodiphenylamine. An oily film was observed on the water surface, and petroleum hydrocarbons were present at fairly high concentrations. Specific conductance and total organic carbon concentration both were elevated.

Site 10 contained the only surface water sampled in which any analyte was detected at levels exceeding New Jersey or Federal drinking water guidelines. The organic compound N-nitrosodiphenylamine was detected in a stream sample downgradient of Site 10. N-nitrosodiphenylamine is difficult to distinguish from diphenylamine, which is used as a stabilizer in nitrocellulose explosives.

- The low concentrations of volatile organic compounds in groundwater and surface water pose no adverse impact to the environment or public health.

- At Site 19, the stream sediments contained greater than normal concentrations of methylene chloride, chloroform, 2-butanone, acetone, and toluene, as well as petroleum hydrocarbons, lead, silver, and mercury.

- Soils at Site 19 contained concentrations of petroleum hydrocarbons, acetone, cadmium, lead, and zinc greater than suggested safe levels, based on New Jersey and Federal criteria.

Table ES-1 presents the possible exceedances of each site from current regulatory guidelines.

The proposed plans for the Remedial Investigation/Feasibility Study (RI/FS) are presented. Initial data collection is proposed to substantiate the findings and to clarify the site characterization performed under the Confirmation Study. The RI/FS activities will include confirmation sampling of existing monitor wells and installing additional monitor wells and soil borings to define the extent and concentration of contaminants in each potentially affected medium. These results are proposed to be used in a quantitative baseline risk assessment to assess which sites require remediation.

WESTON

Tabl ES-1

Regulatory Exceedances, NWS Earle, Colts Neck, NJ

SITE NO.	EXCEEDANCE
2	None Identified.
3	pH.
4	Petroleum hydrocarbons -- Concentration of petroleum hydrocarbons at spring noticeable.
5	Methylene chloride -- Highest methylene chloride level appears in field blank at 420 ug/L, which is interpreted to reflect procedural contamination. Pentachlorphenol -- 150 ug/L in well 5-3 and 81 ug/L in well 5-1 exceed NJAC 7:9-6.6 groundwater standards. Both wells are upgradient of the site.
7	Methylene chloride -- Highest methylene chloride level appears in field blank at 11 ug/L, which is interpreted to reflect procedural contamination.
10	Methylene chloride -- 14 ug/L in sample 10-1, 13 ug/L in sample 10-2A. High levels appear in field blank and may reflect procedural contamination. N-nitrosdiphenylamine in surface water exceeds the 10^{-6} cancer risk factor. This compound could not be differentiated from diphenylamine, a compound more likely to be found on the site.
11	Pentachlorophenol -- 120 ug/L in well 11-1 exceeds NJAC 7:9-6.6 groundwater standards. This well is upgradient of the site.

Table ES-1
(continued)

SITE NO.	EXCEEDANCE
19	Methylene chloride -- 14 ug/L in sample 19.1, 13 ug/L in sample 19.2. High levels of methylene chloride appear in field blank and may reflect procedural contamination. Cadmium -- NJDEP ECRA action limit exceeded (31,900 mg/kg in soil sample 19-B). Chromium -- NJDEP ECRA action limit exceeded (639 mg/kg in soil sample 19-B). Lead -- NJDEP ECRA action limit exceeded (1,560 mg/kg in soil sample 19-B). Zinc -- NJDEP ECRA action limit exceeded (776 mg/kg in soil sample 19-B). Petroleum hydrocarbons -- NJDEP action limit exceeded -- 681 mg/kg 19-B (6th hour), 445 mg/kg 19-B (1st hour), 129 mg/kg 19-A (dup).
20	None Identified.
22	None Identified.
26	None Identified.

SECTION 1

INTRODUCTION

This document is the report of the current situation and a description of proposed responses at the 11 sites investigated during the Confirmation Study at Naval Weapons Station Earle (NWS Earle) in Monmouth County, New Jersey.

1.1 NAVY ASSESSMENT AND CONTROL OF INSTALLATION POLLUTANTS PROGRAM

The Navy Assessment and Control of Installation Pollutants (NACIP) program was promulgated by OPNAV NOTE 6420, SER 45/733503 of 11 September 1980 and by Marine Corps Order 6280.1 of 30 January 1981. The objective of the NACIP program was to protect human health and the environment by identifying, assessing, and controlling contamination resulting from past operations involving hazardous materials on Navy lands. The NACIP program, which has been replaced by the Navy's Installation Restoration (IR) program, consisted of four distinct phases:

- Phase I -- Preliminary Assessment (PA), formerly known as the Initial Assessment Study (IAS), identifies any possible contamination sources through records searches, personnel interviews, and site visits. The purpose of the PA is to evaluate the seriousness of the hazardous substance release, or threat of release, and to recommend additional response action at the site. As a result, no action may be taken if available data indicate that there is no threat or potential threat to public health or the environment. Alternatively, the best response action may be an immediate removal of the threat or potential threat. The PA, therefore, establishes the priority for scheduling a site inspection by characterizing a site.

- Phase II -- Site Inspection, previously known as the Confirmation Study, supplements the information gathered in the PA; eliminates from further consideration those releases that pose no threat to public health or the environment; determines the potential need for removal action; collects or develops additional data, as appropriate, to evaluate the release pursuant to the Hazard Ranking System (HRS); collects data, as appropriate, beyond that required to score and list the release pursuant to the HRS to better characterize the release for more effective and rapid initiation of the RIFS.

- Phase III -- Remedial Investigation/Feasibility Study (RI/FS); previously a part of the Corrective Measures, performs extensive on-site investigations including physical and analytical monitoring to quantify the extent of the problem and to develop alternatives for possible corrective measures.

- Phase IV -- Remedial Action Plan, within which corrective projects are evaluated and implemented to control and mitigate confirmed contamination.

1.2 HISTORY OF RESPONSE

The IAS at NWS Earle was conducted through the firm of Fred C. Hart Associates. The final report for the IAS was issued in 1980. The Navy selected Roy F. Weston, Inc. (WESTON) to perform the Confirmation Study investigation in 1985. The field work was performed, and an interim report was presented by WESTON to the Navy in December 1986. The Navy has received comments from the New Jersey Department of Environmental Protection (NJDEP) and the United States Environmental Protection Agency (EPA) subsequent to the interim report submission. A tabulated chronology of these reports and actions is shown in Table 1-1.

1.3 PURPOSE OF THE PROBLEM CONFIRMATION STUDY

The Confirmation Study was designed to be a sequentially phased effort to perform the following:

- Determine the existence, concentration, extent, and rate of migration of previously identified contaminants of potential health and environmental concern.

- Develop economically feasible alternatives to effect compliance with applicable health and environmental standards, where required.

- Prepare site operations plans.

- Prepare government project documentation with supporting cost estimates for project funding approval.

1.4 FACILITY BACKGROUND, LOCATION, SURROUNDINGS, AND GEOLOGY

NWS Earle is located in east-central Monmouth County, New Jersey. The facility is composed of the central Main Base and a narrow road and rail link to the facility's shore operations adjacent to the town of Leonardo on Sandy Hook Bay. The facility has been in existence since 1946.

Table 1-1

Tabulated Chronology of Environmental Actions
NWS Earle, Colts Neck, NJ

11 Sept. 1980	-	NACIP program initiated by OPNAV NOTE 6240 SER 45/733503 and Marine Corps Order 6280.1 of 30 January 1981
3 Aug. 1981	-	NWS Earle designated for an IAS by CNO letter SER 451/397464
July 1982	-	IAS conducted by Fred C. Hart Assoc., Inc.
15 Oct. 1982	-	EPA proposed amendment to 40 CFR Part 300 to include NWS Earle on the National Priorities List (NPL) in the Federal Register (Vol. 49, No. 200)
July 1985	-	Health/Safety (H/S) and Plan of Action and Management (POAM) for Confirmation Study by WESTON
1 Oct. 1985	-	EPA comments on H/S and POAM
Nov. 1985	-	Geophysical field investigation
21 Nov./3 Dec.	-	NJDEP comments on H/S and POAM
Jan.-Mar. 1986	-	Monitor wells drilled
July 1986	-	Groundwater and surface water sampled
19 Dec. 1986	-	Confirmation Study interim report by WESTON
21 Jun. 1988	-	Telecopied letter to EPA from New Jersey Department of Waste Management
28 July 1988	-	Letter to Navy with combined comments of EPA and NJDEP concerning the interim report
30 Sept. 1988	-	WESTON receives authorization to proceed with RI/FS planning

Operations at NWS Earle are primarily focused on the handling, storage, renovation, and transshipment of munitions. Operations generating wastes are typically small in scale and widely dispersed throughout the almost 16 square miles of the Main Base. In addition to ordnance operations, non-ordnance operations, such as Public Works and the homeporting of CONSERVRON TWO, also generate wastes requiring the evaluation of disposal activities. The potential problems identified during the IAS were associated with the disposal of municipal wastes and small amounts of industrial wastes and the production of nitrogen compounds resulting from incomplete combustion during the open burning of ordnance materials.

1.4.1 Geology

Based on observations of samples from pilot borings drilled for monitor well installation, the shallow unconsolidated deposits at NWS Earle may be divided into three distinct lithologies. Generally, those sites located in the central portion of NWS Earle (Sites 4 and 26) contain brownish-yellow and light gray fine to very coarse sand. In the northern portion of the station (Sites 2, 5, and 11), yellowish-brown to olive, silty, fine- to coarse-grained sands and glauconitic medium sands are dominant. Yellowish-brown and gray very fine to fine sands overlie dark gray silt in the southern portion of the station (Sites 3 and 19). Some glauconitic medium to coarse sands were found under the silt. Thin silty clay to clay lenses were found at some sites.

Available literature (Initial Assessment Study; Jablonski, 1968) indicates that the surficial deposits in the vicinity of NWS Earle are the Vincentown Formation, Kirkwood Formation, Hornerstown Sand, and the Cohansey Sand. The waterfront vicinity has the Cretaceous Red Bank Sand and Navesink Formation at the surface. The surficial deposits at the sites investigated in this report are shown in Figure 1-1.

The major topographic feature at the base, the Homing Hills, is made up of the Cohansey Sand. Below the Cohansey Sand, the Kirkwood Formation overlies the Vincentown Formation. The boring log descriptions for Sites 2, 5, and 11 are similar to descriptions of the Vincentown Sand. The lithology of Sites 4 and 26 is similar to that of the Cohansey Sand, and Sites 3 and 19 appear to be located in the Kirkwood Formation. At Site 10, however, pilot borings penetrated surficial deposits that resemble the Kirkwood Formation and glauconitic deposits that resemble the Vincentown Formation at depth. The location of each Main Base area site within the various formations is shown in Figure 1-2. Site 7, located at the waterfront area near Sandy Hook, is situated in primarily brown quartzic sands and black micaceous silt of the Red Bank Sand. There is some uncertainty as to the exact formation that is exposed at Site 7, Lithologically, Site 7 may be underlain by the Navesink Formation.

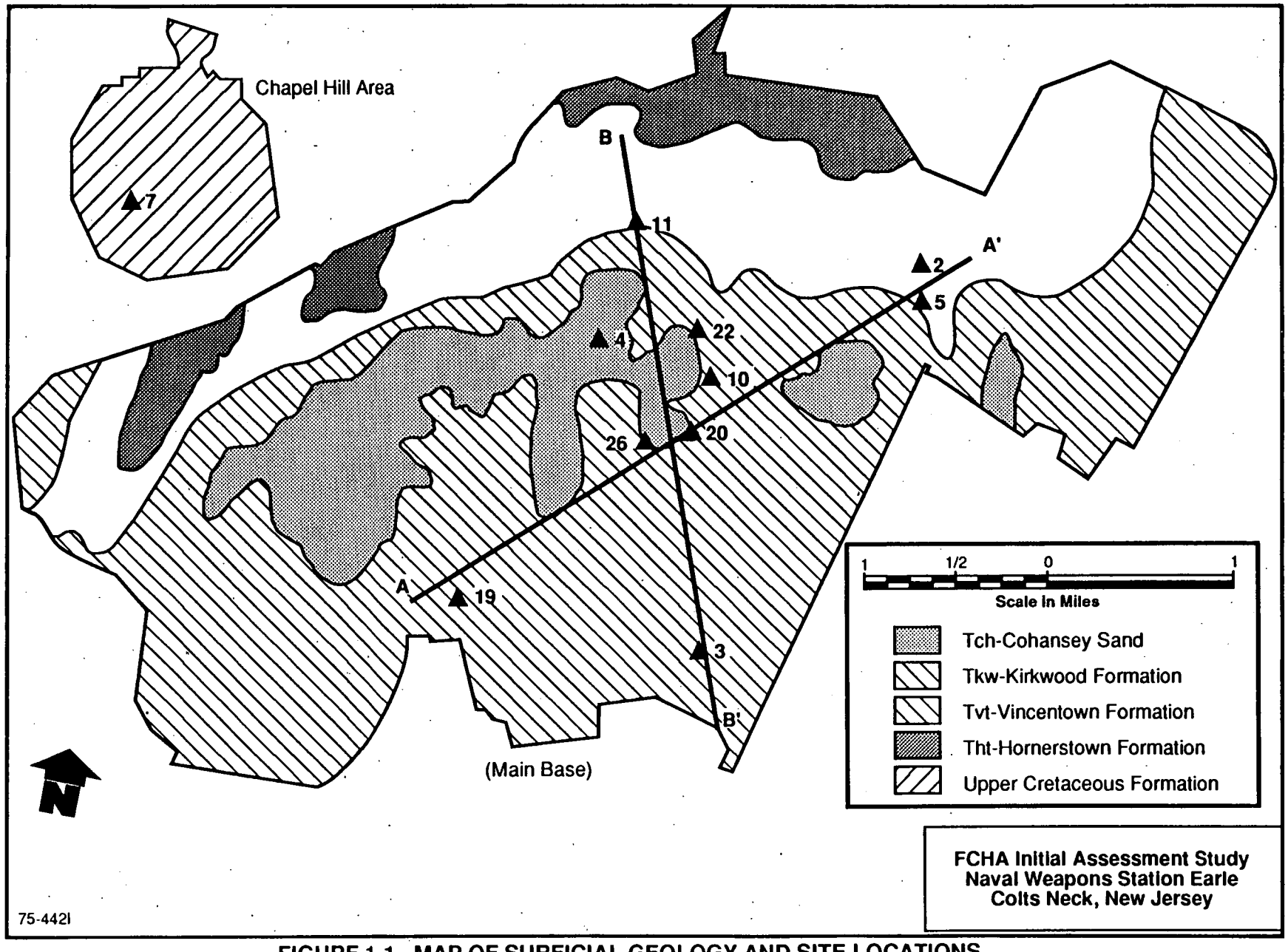


FIGURE 1-1 MAP OF SURFICIAL GEOLOGY AND SITE LOCATIONS

Figur 1-2
Geologic Formati ns at Surfac n Sit

	Cohansey Sand	Kirkwood Formation	Vincentown Formation	Hornerstown Sand	Red Bank Sand	Navesink Formation
Site 2			●			
Site 3		●				
Site 4	●					
Site 5			●			
Site 7					●	
Site 10		●				
Site 11			●			
Site 19		●				
Site 20	●	●				
Site 22		●				
Site 26	●					

Based on water levels measured in July 1986, the principal direction of groundwater flow at NWS Earle is toward the east, with components to the north and south. Groundwater occurs under unconfined conditions and is found within 25 feet of the surface. At Site 5, a localized zone of perched water was observed. The shallow unconfined groundwater generally flows toward the nearest surface water body. Surface water bodies that receive groundwater from the sites investigated are Pine Brook, Mingamahone Brook, Hockhockson Brook, and Compton Creek. However, at Site 11, groundwater flow may be influenced by localized perched groundwater. Also, at Site 3, because of the proximity to Mingamahone Brook, groundwater flow was expected to flow westward toward the stream. A southwestward flow was actually observed. Again, this may be due to a locally perched groundwater zone.

1.4.2 Water Quality

The principal objective of the previously conducted Confirmation Study was to assess the impact, or potential for impact, of any contamination of the environment on public health. For each site, parameters that were detected above quantifiable limits were reviewed and compared with the New Jersey and Federal drinking water guidelines.

On 13 November 1985, the EPA published a set of Maximum Contaminant Levels (MCLs) and Recommended Maximum Contaminant Levels (RMCLs) for drinking water, as summarized in Table 1-2. RMCLs are nonenforceable water quality goals set at levels that result in no known or anticipated adverse health effects with an adequate margin of safety. MCLs are enforceable standards set as close to RMCLs as possible and are based on health, treatment technologies, cost, and other factors. In the absence of MCLs or RMCLs, 10^{-6} cancer risk criteria, acceptable daily intakes, or medical advisory criteria are reported as guidelines for drinking water in Table 1-2.

In October 1988, the EPA set MCLs for eight compounds which will become effective 1 January 1989. These compounds were not found above these levels in the analyses of groundwater and surface waters during the Confirmation Study.

Tabl 1-2

Drinking Wat r Guid lines

Final Recommended Maximum Contaminant Levels
13 November 1985*

Contaminant	RMCL (ug/L)
Benzene	0
Carbon tetrachloride	0
1,4-Dichlorobenzene	750
1,2-Dichloroethane	0
1,1-Dichloroethene	7
1,1,1-Trichloroethane	200
Trichloroethene	0
Vinyl chloride	0

Proposed Primary Maximum Contaminant Levels
13 November 1985*

Contaminant	MCL (ug/L)
Benzene	5
Carbon tetrachloride	5
1,4-Dichlorobenzene	750
1,2-Dichloroethane	5
1,1-Dichloroethene	7
1,1,1-Trichloroethane	200
Trichloroethene	5
Vinyl chloride	1

*EPA, Federal Register, 13 November 1985

Table 1-2
(continued)

Contaminant	10^{-6} Cancer Risk[a]
Methylene chloride	2.5 mg/L
Bis(2-ethylhexyl) phthalate	15.0 mg/L
Di-n-butyl phthalate	34.0 mg/L
N-nitrosodiphenylamine	4.9 ug/L

Contaminant	Acceptable Daily Intake[b]
Acetone	3 mg/day/kg body weight*
2-Butanone	20 ug/day/kg body weight
Nickel	0.1 mg/day/kg body weight

Contaminant	Medical Advisory Criteria[c]
TNT	45 ppb
Nitroglycerin	30 ppb
RDX	35 ppb
HMX	None available

*Value available for inhalation only.
[a]EPA, Federal Register, 28 November 1980
[b]Supplied by Bruce Molholt, EPA Region III
[c]NAVORDSTA, 11 April 1985, Ordnance Environmental Support Office, Indian Head, MD

Table 1-2
(continued)

Primary and Secondary Maximum Contaminant Levels (MCLs)

Parameter (mg/L unless noted)	Federal	State
Physical		
Color (units)	15.0	10
Corrosivity	Noncorrosive	*
Odor (threshold no.)	3.0	*
pH (units)	6.5-8.5	
Taste		Narr[c]
Total dissolved solids	500	*
Turbidity (TU)	1.0	*
Inorganic		
Ammonia		
Chloride	250	*
Cyanide		
Fluoride	1.4-2.4	*
Foaming agents	0.5	*
Hardness		50-250
Nitrate (as N)	10.0	*
Phosphate		
Specific conductance		
Sulfate	250	
Pesticides/PCBs		
Aldrin/dieldrin	0.1	*
2,4-D		
DDT		
Endrin	0.0002	*
Lindane	0.004	*
Methoxychlor	0.1	*
PCBs		
Toxaphene	0.005	*
2,4,5-TP Silvex	0.01	*
Other		
Biochemical oxygen demand		
Chemical oxygen demand		
Oil and grease		
Petroleum hydrocarbons		
Total organic carbon		
Total organic halogen		
Trihalomethanes	0.1	*

Table 1-2
(continued)

Primary and Secondary Maximum Contaminant Levels (MCLs)

Parameter (mg/L unless noted)	Federal	State
Metals		
Arsenic	0.05	*
Barium	1.0	*
Cadmium	0.01	*
Chromium	0.05	*
Copper	0.1	*
Iron	0.3	*
Lead	0.05	*
Manganese	0.05	*
Mercury	0.002	*
Selenium	0.01	*
Silver	0.05	*
Sodium	M	50
Zinc	5.0	*
Acid Extractables		
Phenols		
Base/Neutrals		
Benzidine		

Parameter (mg/L unless noted)	Federal	State
Biological		
Coliform bacteria membrane filter test (#/100 mL) mean	0.1	*
max. allowed (single sample if <20 samples or 5% of all samples)	4.0	*
Radiological		
Beta particle and photon radioactivity (mrem/yr)	4.0	*
Combined Radium 22 and Radium 228 (pCi/L)	5.0	*
Gross alpha (pCi/L)	15.0	*

*Same as Federal standard.
[c]Narrative standard.

From: 1985 Guide to State Groundwater Program and Standards. API Publication No. 4416

SECTION 2

BACKGROUND OF FIELD EFFORTS

2.1 CONFIRMATION STUDY

The field effort conducted during the Confirmation Study at NWS Earle consisted of installation and sampling and analysis of 29 groundwater monitor wells, 2 springs, 3 surface water bodies and associated bottom sediments, and shallow soils at various sites.

The purpose of the sampling program conducted during the Confirmation Study was to identify the location, concentration, and areal extent of contamination in the hydrogeologic environment. From this information, it is possible to determine the general direction in which contaminants are migrating and their probable origins.

Samples of groundwater, surface water, soils, and sediments were obtained and analyzed for selected chemical and physical properties that were determined to be indicative of the waste materials disposed of at the sites. Surface water samples were collected from streams and ponds at Sites 2, 10, and 19 at the time of monitor well sampling. Sediment samples were collected concurrently with the surface water samples at Sites 2, 10, and 19. Two sets of samples were collected at each sampling location, with the second set collected 5 to 6 hours after the first set. At each site, an attempt was made to collect samples at locations upstream and downstream of the site.

Two springs were sampled at Site 4 concurrent with the monitor well sampling. The springs were sampled by digging a hole in the soil to collect enough water to submerge the sample bottles. All digging was done using dedicated stainless steel scoops. The samples were then collected by the same procedures used for surface water samples.

Soil samples were collected at Sites 2, 11, 19, 20, and 22 during January and March 1986. The samples collected in January were collected as split-spoon samples. All drilling rig-accessible locations were sampled at that time. The samples collected in March were collected by hand auger after the soil frost zone had thawed.

At Sites 11, 20, and 22, the samples were collected at discrete intervals at depths of 0.5 to 1 foot and 2 to 3 feet. Samples collected at Sites 2 and 19 were composite samples. At Site 19, soil from depths of 0.5 to 3 feet were composited at each of four sampling locations. At Site 2, three surface soil samples were collected; each was a composite of three grab samples.

Twenty-nine groundwater monitor wells were installed in groups at 9 of the 11 sites investigated at NWS Earle to collect groundwater quality data. Pilot borings were drilled for each well using 6.25-inch I.D. hollow-stem augers. These borings were completed approximately 15 feet below the first occurrence of groundwater. Soils in all pilot borings were sampled for stratigraphic control at 5-foot intervals with a 2-inch diameter, 24-inch long split-spoon sampler using standard penetration techniques (ASTM Method No. D-1586). All soil samples collected from the pilot borings were stored for archival purposes. These samples were described according to Munsell soil color charts and the Unified Soil Classification System. During each sampling operation, an HNu Model PI-101 organic vapor photoionization detector was used to detect any organic vapors emanating from the boring.

Well construction followed New Jersey- and EPA-prescribed methods. Necessary well permits were obtained from the NJDEP Division of Water Resources. Each monitor well was constructed of 4-inch diameter, Schedule 40, polyvinylchloride (PVC), flush-threaded pipe with No. 10 (0.010-inch) machine-slotted PVC screen. An average of 15 feet of screen was used in each well, with a minimum 2 feet of screen above the water table. The casing and screen were steam cleaned prior to installation.

The annular space around the well screen was filled with No. 2 Ottawa sand from the bottom of the borehole to 2 feet above the top of the screen. Bentonite pellets were used to form a seal approximately 2 feet thick on top of the sand pack. A portland cement/bentonite grout mixture (6:1 dry weight) was used to complete the seal in the annular space. All monitor wells were secured by enclosing the PVC riser pipe in a protective steel casing with a locking cap. Monitor wells were developed after installation by pumping (or bailing) until the discharge was free of fine-grained sediments.

Accessibility was limited at a number of monitor well locations; a track-mounted drill rig was used to install 9 of the 29 wells. Drill rigs were initially decontaminated by steam cleaning between each site investigated and before leaving NWS Earle.

2.1.1 Site-Specific Activities

The following subsections detail the findings of the IAS and the Confirmation Study at each site investigated at NWS Earle.

2.1.1.1 Site 2: Ordnance Demilitarization Site

The nature and types of wastes determined to have been potentially disposed of and the permeable formations present at the site necessitated installation of four groundwater monitor wells around the perimeter of the site. The depths ranged from 19 to 30 feet below ground surface. These wells were installed

to provide groundwater quality and flow direction data for the shallow sandy aquifer in the area (see Figure 3-2). The data gathered from the monitor wells, surface water, and sediment analyses were used to determine whether contaminants resulting from the demilitarization operations on the site had migrated into the groundwater. Soil sampling was undertaken to characterize potential contamination in the operation zone.

2.1.1.2 Site 3: Landfill Southwest of "F" Group

The possible breakdown of the materials disposed of on the site and the high potential for migration of contaminants into the underlying soil and groundwater necessitated the installation of three groundwater monitor wells. Depths of these wells were approximately 25 feet below surface. These wells were installed to provide data on water quality and groundwater flow direction for the shallow aquifer (see Figure 3-3). The data generated from this information were used to determine whether contaminants leached from either the municipal or industrial wastes have migrated into the groundwater.

2.1.1.3 Site 4: Landfill West of "D" Group

Field activities included the installation of three groundwater monitor wells to provide data on groundwater flow direction and water quality (see Figure 3-4). Data gathered from these wells and surface water samples were used to determine whether any contaminants have migrated into the groundwater. Depths of the wells ranged from 18 to 30 feet.

2.1.1.4 Site 5: Landfill West of Army Barricades

Four groundwater monitor wells were installed around the perimeter of the site. These wells were to provide data on groundwater flow direction and water quality for the shallow aquifer (see Figure 3-5). Data from these wells were used to determine whether any contaminants have entered the groundwater. Depths of these wells were approximately 30 feet.

2.1.1.5 Site 7: Landfill South of "P" Barricades

Three groundwater monitor wells were installed around the perimeter of the landfill at this site (see Figure 3-6). These well depths ranged from 19 to 39 feet. The wells provided data on groundwater quality and flow direction, particularly to determine whether potential pollutants were present and, if present, whether they were moving off site.

2.1.1.6 Site 10: Scrap Metal Landfill Near Building S-589

Three groundwater monitor wells were installed around the perimeter of the landfill to provide data on groundwater flow direction and water quality in the shallow aquifer (see Figure 3-7). Wells were completed at depths ranging from 22 to 27.5

feet below ground surface. Sediment samples were obtained to determine whether potential contaminants were migrating off site.

2.1.1.7 Site 11: Contract Ordnance Disposal Area

Soil samples were obtained to characterize the soil material contaminants at the disposal area. Because of the possible migration of residual wastes from the demilitarization of ordnance materials and on-site firefighting exercises into the groundwater, three groundwater monitor wells were installed to determine groundwater quality and flow direction in the shallow aquifer underlying the site (see Figure 3-8). Depth of the wells ranged from 18 to 20 feet.

2.1.1.8 Site 19: Paint Chip and Sludge Disposal Area Adjacent to Building S-34

Because of the possible existence of on-site waste material, residue soil samples were obtained. The possible migration of contaminants into the surrounding groundwater and surface water environments was examined through the installation of three groundwater monitor wells. These wells were located around the perimeter of the site (see Figure 3-9). These wells, 24 to 25 feet deep, were installed to provide specific data on flow and groundwater quality in the shallow aquifer.

2.1.1.9 Site 20: Grit Blast Disposal Area at Building 544

The presence of blasting grit on the site resulted in five soil borings being taken to determine soil quality and potential contamination (see Figure 3-10).

2.1.1.10 Site 22: Paint Chip Disposal Area Adjacent to Building D-2

This site was found to consist of approximately 50 square feet of stressed vegetation and discolored (black) soils behind Building D-2, probably resulting from past painting operations. Four soil borings were taken to determine soil quality and potential contamination (see Figure 3-11).

2.1.1.11 Site 26: Explosive "D" Washout Area (Building GB-1)

Field activities at the site included the installation of three groundwater monitor wells, ranging from 22 to 24 feet deep, around the perimeter of the settling basin to determine the groundwater flow direction and the water quality in the shallow aquifer. Locations of these wells are shown in Figure 3-12.

2.2 SITE-SPECIFIC FINDINGS

Pilot borings were drilled and monitor wells were installed from 17 December 1985 to 6 March 1986. Soil samples were collected during January and March 1986. Groundwater, surface

water, and sediment samples were collected from 14 to 25 July 1986. The following is a site-by-site summary description of the findings of the IAS and Confirmation Study regarding types of waste, hydrogeology and groundwater, surface water, and soil quality.

2.2.1 Site 2: Ordnance Demilitarization Site

This site has been used for the demilitarization of ordnance materials on and off base. Demilitarization operations currently employ thermal destruction methods. Some explosives and propellants disposed of at this site include ammonium picrate, trinitrotoluene (TNT), C-4 (waxed RDX), black powder, and double-base propellants (nitroglycerin).

Geology

Based on split-spoon samples taken every 5 feet during the drilling of pilot borings for subsequent monitor well installation, the lithology of Site 2 was described as yellowish-brown and olive, glauconitic medium to coarse sand, with trace amounts of silt. Clayey sand and silt (<5 percent) were found in the upper 10 feet, except at well 2-3.

Hydrogeology

Groundwater occurs under water table conditions at Site 2. Saturated materials were encountered within 9 to 15 feet of the surface. Groundwater levels were measured in July 1986. Based on this information, a water table map was constructed to determine the direction of groundwater flow in the vicinity of Site 2. Groundwater flows toward the northeast with a hydraulic gradient of 0.0035 feet per foot (ft/ft). Well 2-3 is directly downgradient of the site. The groundwater flow direction is toward a branch of Pine Brook and Children's Pond. The stream does not flow all year round and was dry at the time of sampling.

Groundwater Quality

Total organic halogens (TOX) were detected in all Site 2 samples at concentrations ranging from 18 to 35 ug/L. A summary table of the analytical results for this site is included in Appendix A. The concentration of total organic carbon (TOC) in sample 2-3 was almost double that found in the other wells at Site 2. Nitrate/nitrite was detected in wells 2-3 and 2-4 at 0.70 and 0.20 mg/L, respectively. No explosives were detected in any of the Site 2 wells. No base-neutral/acid-extractable organic compounds (BNAs) were detected at this site. Chromium, copper, nickel, silver, and zinc were detected in sample 2-1, but only zinc was detected in samples 2-2, 2-3, and 2-4. Chromium, copper, and nickel were detected in the field blank from the decontaminated bailer used to collect sample 2-1. It is possible that the low levels of metals found in sample 2-1

are field or laboratory contaminants. Field-measured pH ranged from 5.2 at well 2-3 to 7.0 at well 2-2. Laboratory pH measurements were significantly lower than field measurements. Chloride concentrations were low and varied only slightly (5.00 mg/L in sample 2-3 to 8.60 mg/L in sample 2.2). Specific conductance was also fairly low and ranged from 30 micro-mhos per centimeter (umho/cm) in well 2-4 to 40 umho/cm in the remaining wells at Site 2.

Surface Water and Sediment Quality

Surface water and sediment were sampled at a pond at Site 2. Two samples were collected 5 hours apart. Analytical results for the samples indicate that there was no significant change over time in any of the parameters subject to analysis. Total organic halogens were detected in the surface water samples at concentrations similar to those in the groundwater. No significant differences were found in TOX concentrations between groundwater and surface water. The concentration of TOC in the surface water was about the same as that in well sample 2-3 (4.12 mg/L). Nitrate/nitrite was slightly higher in the surface water (1.0 mg/L) than in the groundwater. Explosives were not detected in either the surface water or sediment samples. No BNAs were detected in the surface water. Chromium, copper, nickel, lead, and zinc were detected in the surface water. Surface water pH was 4.20, slightly lower than the groundwater. No chloride was detected in the surface water.

Water Quality Discussion

The following discussion addresses both groundwater and surface water samples collected at Site 2. The concentration of TOX was low (less than 40 ug/L), indicating the probable absence of significant concentrations of volatile organic compounds (VOCs). This is confirmed by the TOC analysis which was less than 10 mg/L. No metals were present at concentrations greater than the drinking water quality guidelines in Table 1-2.

The pH at this site was mildly acidic (5.2 to 6.8) but within the normal range for groundwaters. The range of pH for the formations in Monmouth County is 3.8 to 8.1 (Jablonski, 1968). Nitrate/nitrite was present at concentrations of 0.70 and 0.20 mg/L in groundwater samples 2-3 and 2-4, respectively, as well as in surface water samples at 1.0 mg/L. Wells 2-3 and 2-4 are downgradient of the site, and the surface water sample was taken near well 2-4. It appears that the nitrate/nitrite was picked up by the groundwater and surface water as a result of activities at this site, but the concentration is far below the 10 mg/L allowed for nitrate in drinking water.

Soil Quality

Soil samples were collected at Site 2 and analyzed for explosives. Each sample was a composite of three surface soil grab

samples. Analytical results for the soil samples collected at Site 2 indicate that no RDX, HMX, nor TNT was detected in any of the soil samples. A summary table of the analytical results for this site is included in Appendix A. Sample 2-A contained 0.60 mg/kg nitrate/nitrite. Sample 2-C contained 3.0 ug/g picric acid.

Soil Quality Discussion

Neither nitrate nor explosives were detected in the sediment samples collected at surface water sampling location 2-A. Nitrate/nitrite was detected in surface soil sample 2-A at a concentration of 0.60 mg/kg. Picric acid was detected in surface sample 2-B at a concentration of 3.0 ug/g, which was considered insignificant in terms of potential hazard.

2.2.2 Site 3: Landfill Southwest of "F" Group

The IAS indicates that this 5-acre landfill received approximately 4,800 tons of refuse over its 9-year period of operation. Wastes disposed of here typically included municipal and industrial wastes, such as glass, paper, plastics, solvents, acids, alcohols, caustics, pesticide containers, paint thinner, and paint. Typical paint used at NWS Earle consists of the following chemical compounds: titanium dioxide, zinc oxides, magnesium silicate, alkyd resin solution, petroleum spirits, lead naphthenate, cobalt naphthenate, manganese naphthenate, and xylenes.

Geology

The unconsolidated materials at Site 3 consist mainly of brownish-yellow fine sand, with coarse sand and gravel occurring to 12 feet below ground. In wells 3-2 and 3-3, dark gray silt underlies the sand at a depth of 20 feet. At well 3-1, the silt is interbedded throughout the sand which tends to be finer grained here than elsewhere at the site. Blue-green glauconitic medium sand was found at a depth of 25.5 feet in well 3-1.

Hydrogeology

Groundwater occurs in the shallow sands above the glauconitic sand, as evidenced by the moisture encountered while drilling. However, the shallow sands are poor producers, and none of the wells at Site 3 sustained pumping during development. Groundwater levels were measured in July 1986. Based on this information, a water table map was constructed for the vicinity of Site 3. Groundwater flows toward the south with a hydraulic gradient of 0.03 ft/ft. Well 3-1 is downgradient of the site. Based on the flow map, groundwater flows toward nearby Mingamahone Brook and then toward the Manasquan River.

Groundwater Quality

Analytical results for groundwater samples collected at Site 3 indicate concentrations of TOX ranged from 12.0 to 35.0 ug/L. A summary table of the analytical results for this site is included in Appendix A. Total organic carbon ranged from 3.39 to 7.10 mg/L. Petroleum hydrocarbons were detected at a concentration of 1.00 mg/L in sample 3-1. Nitrate/nitrite was detected in sample 3-3 at a concentration of 0.20 mg/L. Copper, chromium, nickel, and zinc were detected at low levels in samples 3-1 and 3-2. Only zinc was detected in sample 3-3 and duplicate sample 3-3A. No metals were detected in the field blank taken before sample 3-3. Neither pesticides nor BNAs were detected at levels above quantification limits at this site. No VOCs were detected above a quantifiable limit. Field-measured pH values ranged from 3.9 (well 3-1) to 5.5 (well 3-3). Chloride concentrations varied from 5.80 to 8.80 mg/L. Specific conductance was significantly higher in well 3-1 than in well 3-3 (290 and 40 umho/cm, respectively).

Water Quality Discussion

No VOCs were detected above quantifiable limits in groundwater samples collected at Site 3. No metals were present in any samples collected at Site 3 at levels above those specified by the drinking water guidelines in Table 1-2. Petroleum hydrocarbons were present in downgradient well 3-1 at 1.0 mg/L.

The total petroleum hydrocarbons present at Site 3 were regarded as having no significant impact on the water quality. Nitrate/nitrite was present in well 3-3, which is an upgradient well. This indicates that background concentrations may be approximately 0.20 mg/L for nitrate/nitrite. The pH of groundwater at Site 3 ranged from 3.9 to 5.5 for field measurements and 2.9 to 4.7 for laboratory measurements. Upgradient well 3-3 had the highest pH, and downgradient well 3-1 had the lowest pH. The concentration of metals in groundwater is dependent on pH as well as redox potentials (Freeze and Cherry, 1979).

2.2.3 Site 4: Landfill West of "D" Group

The IAS indicates that this 5-acre site received approximately 10,200 tons of municipal and industrial wastes similar to those disposed of at Site 3 over a period of 17 years. Disposal methods used at this site included open trench burning of some wastes before burial. Since the depth of these trenches could not be determined from the IAS, it is assumed that the bottoms of these trenches are very close to the water table, thus posing a high potential for contaminants to migrate into the groundwater.

Ge l gy

The shallow unconsolidated deposits at Site 4 consist of brownish-yellow to light gray medium sand with small amounts of fine sand, coarse sand, and gravel. In well 4-1, light gray fine sand and clay were encountered at 30 feet below ground surface. At well 4-2, reddish-yellow clay was encountered at 18 feet below ground surface.

Hydrogeology

Groundwater occurs under water table conditions at Site 4. Saturated materials were encountered within 10 to 15 feet of the surface. Groundwater levels were measured in July 1986. Monitor well locations and elevations were surveyed during October and November 1986. Based on this information, a water table map was constructed to determine the direction of groundwater flow in the vicinity of Site 4. Groundwater flows toward the east at Site 4, with a hydraulic gradient of 0.01 ft/ft. Well 4-2 is downgradient of the site. The principal direction of flow is toward Hockhockson Creek.

Groundwater Quality

Analytical results for groundwater samples collected at Site 4 indicate that TOX concentrations varied between 17 and 18 mg/L. Analytical results are summarized in a table found in Appendix A. No VOCs were detected above quantifiable limits. Pesticides, nitrate/nitrite, and petroleum hydrocarbons were not detected in any of the Site 4 samples. Total organic carbon varied from 1.94 mg/L in sample 4-1 to 4.74 mg/L in sample 4-2. The base-neutral/acid-extractable organic compound bis-(2-ethylhexyl) phthalate was detected at a concentration of 53 ug/L in sample 4-1. Zinc was detected in the three Site 4 samples at levels below the established primary drinking water standards. Field-measured pH ranged from 5.0 to 6.0. Chloride concentrations were low and varied only slightly. Specific conductance ranged from 40 umho/cm at well 4-3 to 160 umho/cm at well 4-2.

Spring Water Quality

Two springs located along the fire road at Site 4 were sampled over time. Two samples were collected from each spring 5 hours apart. The difference over time was that at spring sampling location 4A, the BNA N-nitrosodiphenylamine was detected at a concentration of 60 ug/L in the second sample collected, while none was detected in the first sample collected. A summary table of the analytical results for this site is included in Appendix A. The TOX concentration was greater at spring 4-A than in the well samples and in the samples at spring 4-B. Total organic carbon was greater in both spring samples than in the well samples. In particular, TOC was present at a concentration an order of magnitude greater than in the well samples.

No VOCs were detected above quantifiable limits in either spring sample. Petroleum hydrocarbons were detected in spring 4-A at concentrations of 45.8 mg/L (1st sample) and 44.0 mg/L (2nd sample). Chromium, copper, nickel, and zinc were detected in all spring samples. The pH and chloride concentrations were not significantly different in the spring samples than in the well samples. Specific conductance was higher in spring 4-A than in the well water and in spring 4-B (63 and 57.7 umho/cm, respectively).

Water Quality Discussion

No VOCs nor petroleum hydrocarbons were detected in well water above quantifiable limits. No nitrate/ nitrite was detected. The BNA bis(2-ethylhexyl) phthalate, a plasticizer found in trash bags and Tygon tubing, was found at a concentration of 53 ug/L in well sample 4-1, which is downgradient of the landfill. This concentration is far below the 10^{-6} cancer risk equivalent of 15,000 ug/L.

No metals were detected in either the well water or the spring water at levels that exceeded drinking water quality standards. Well water pH was 5.0 to 6.0, within the range for groundwaters in Monmouth County. For both spring 4-B samples, no parameters were detected at levels that exceeded any drinking water quality guidelines. However, in spring samples collected at location 4-A, TOC, petroleum hydrocarbons, and specific conductance were elevated above levels that would be considered background at this site. For these parameters, elevated concentrations indicate the possible existence of contaminants. An oily film was observed on the water at spring 4-A. The second sample collected at spring 4-A contained 60 ug/L N-nitrosodiphenylamine, an antioxidant found in cutting oils. This concentration is in excess of the 10^{-6} cancer risk criterion of 4.9 ug/L. N-nitrosodiphenylamine is virtually analytically indistinguishable from diphenylamine, which is used as a stabilizer in nitrocellulose explosives.

No explosives are believed to have been disposed of at this site. However, 2-nitrodiphenylamine is an ingredient in Otto II fuel. Small amounts of fuel waste may have been disposed of at Site 4.

2.2.4 Site 5: Landfill West of Army Barricades

The IAS found that the 6,600 tons of waste disposed of at this 13-acre site over its 10-year period of operation is very similar to the waste described for Site 3.

G ology

Based on split-spoon samples, the shallow unconsolidated deposits were described as olive and yellowish-brown medium sand.

Well 5-1 contained significant coarse sand with little fine sand and silt. Well 5-2 had little fine sand and silt. Well 5-3 had fine sand with 10 to 15 percent silt. Well 5-4 contained high percentages of fine and very coarse sand with smaller amounts of silt.

Hydrogeology

A zone of perched groundwater was encountered in the first 10 feet of drilling across the site, with the exception of well 5-4. Below the perched zone, saturated materials were encountered at depths of 19 to 25 feet. Based on groundwater levels measured in July 1986 and surveyed monitor well locations and elevations, a water table map was constructed for Site 5 to determine groundwater flow directions. Groundwater flows to the northeast with a hydraulic gradient of 0.0025 ft/ft. The principal direction of flow is toward a tributary of Pine Brook.

Groundwater Quality

Total organic halogens were found to be higher in sample 5-1 than in samples 5-2, 5-3, and 5-4 (241, 68.0, 41.0, and 29.0 ug/L, respectively). A summary table of the analytical results for this site is included in Appendix A. Total organic carbon ranged from 1.18 to 7.45 mg/L. The VOCs acetone and 2-butanone were detected in sample 5-1 at concentrations of 110 and 12 mg/L, respectively. These compounds were present in the field blank collected before sample 5-1, but were below quantifiable limits. Methylene chloride was detected in the field blank at 420 mg/L. Acetone was also detected in sample 5-3 at 12 mg/L. The acid-extractable compound pentachlorophenol was detected at quantifiable levels in samples 5-1 and 5-3 (81 and 150 mg/L, respectively). Petroleum hydrocarbons and pesticides were not detected in any samples collected at Site 5. Nitrate/nitrite was detected at a concentration of 0.20 mg/L in sample 5-3. Zinc was detected in all the samples. Chromium, copper, and zinc were detected in sample 5-4. Field pH was fairly consistent, ranging from 4.5 to 5.1. Laboratory pH values were slightly lower than field pH values. Chloride concentrations ranged from 8.60 mg/L (sample 5-4) to 13.7 mg/L (sample 5-3). Specific conductance was reflected in this chloride concentration and varied from 50 to 80 umho/cm.

Water Quality Discussion

Concentrations of TOX were reported for groundwater samples 5-1 and 5-2, which indicate the presence of organic compounds. Acetone was present in sample 5-1 at 110 ug/L and 2-butanone at 12 ug/L. Acetone was also detected in sample 5-3 at 12 ug/L. There is no guideline available for acetone in drinking water. The only acceptable daily intake value for acetone is for inhalation (personal communication with Richard Brunker and Bruce Molholt, Region III, EPA). For 2-butanone, the acceptable daily

intake (oral) is 20 ug/day/kg body weight. For a 70-kg man, 1,400 ug/day is allowable. The concentration of 2-butanone in groundwater at Site 5 is much lower than this value. A concentration of 420 ug/L of methylene chloride was reported for field blank 5-1B. The methylene chloride was interpreted to be contamination present in the deionized water. Pentachlorophenol was detected in samples 5-1, 5-2, and 5-3, but the concentrations were far below the drinking water guideline of 220 ug/L. Pentachlorophenol is used as a wood preservative and may have been present in the small amounts of waste wood disposed of here. The IAS indicates that wood preservatives used at the Ordnance Carpenter Shop may have been disposed of at Site 5. No metals were detected in concentrations above drinking water guidelines. Nitrate/nitrite was detected at a concentration of 0.20 mg/L, which is well below the 10 mg/L standard. Groundwater pH was low (4.5 to 5.1), but within the range for groundwaters in Monmouth County. The boundary of the landfill is thought to coincide with the wooded area to the east and north, the railroad tracks to the south, and the dirt road to the west. A borrow pit is located to the extreme west. From the groundwater flow, it appears that wells 5-2 and 5-3 are upgradient of the landfill. It is not clear whether the organic concentrations in wells 5-2 and 5-3 are coming from some unidentified source or if mounding of the water table due to local stratigraphic variation is causing these wells to receive groundwaters from the landfill.

2.2.5 Site 7: Landfill South of "P" Barricades

This site, located near the waterfront area in Leonardo, operated for approximately 12 years and received less than 2,500 tons of refuse per year. Waste disposed of at this 15-acre landfill typically included munitions shipping material (dunnage, etc.), glass, wood, small amounts of waste paint, solvents, thinners, and some domestic refuse.

Geology

The shallow unconsolidated deposits at wells 7-1 and 7-2 consist of yellowish-brown fine sand (to depths of 9 to 15 feet), overlying brown sandy silt (to depths of 19 to 30 feet), and overlying black silt. White and reddish-brown medium sand were encountered to 31 feet in well 7-3. Black silt was present below the sand.

Hydrogeology

Saturated materials were encountered at 4 feet in well 7-2, at 25 feet in well 7-1, and at 20 feet in well 7-3. Based on groundwater levels measured in July 1986 and surveyed monitor well locations and elevations, a water table map was constructed for Site 7. Groundwater flows toward the west with a hydraulic gradient of 0.05 ft/ft. Compton Creek is located to the west of Landfill 7. Monitor ft/ft well 7-2 is downgradient of the landfill.

Groundwat r Quality

Analytical results for groundwater samples collected at Site 7 indicate that TOX varied in concentration from 18.0 to 23.0 ug/L. The analytical results are summarized in a table found in Appendix A. Total organic halogens were detected in the field blank collected with the decontaminated bailer, which was then used to collect sample 7-2, which showed 12.0 ug/L. Acetone was detected in samples 7-1, 7-2, and 7-2B at concentrations of 22, 380, and 141 ug/L, respectively. Methylene chloride was detected at a concentration of 11 ug/L in the field blank. The BNA di-n-butyl phthalate was detected at a concentration of 54 ug/L in sample 7-1. Zinc was detected at low levels in all the samples for Site 7 but not in the field blank. Field-measured pH ranged from 5.5 to 6.0 in wells 7-1 and 7-3, respectively. Laboratory-measured pH was lower than field-measured. Chloride concentration was higher in sample 7-2 than in 7-1 (32.6 and 12.3 mg/L, respectively). No chloride was detected in sample 7-3. Specific conductance for wells 7-1 and 7-3 was found to vary with chloride concentration.

Water Quality Discussion

Acetone was detected in samples 7-1, 7-2, and 7-2B at concentrations of 22, 380, and 141 ug/L, respectively. Well 7-2 is located downgradient of Landfill 7 and contained the highest concentration of acetone. This landfill received small amounts of solvents during operation. However, because of the high concentration of acetone detected in field blank 7-2B, the high concentration of acetone may be an artifact from field decontamination or laboratory procedures. The BNA di-n-butyl phthalate was found in sample 7-1 at a concentration of 54 ug/L. This compound is found in plasticizers and is ubiquitous in the environment. The 10^{-6} cancer risk criterion for this compound is 34,000 ug/L, much higher than the concentration found in sample 7-1. No analytes were detected in any samples collected at Site 7 at levels above the drinking water quality standards.

2.2.6 Site 10: Scrap Metal Landfill Near Building S-589

The IAS found that this 2-acre site was used to dispose of aluminum and steel containers and spent shell cases. Paint chips and spent blasting grit from maintenance operations were also disposed of at this site.

G ology

At Site 10, the shallow unconsolidated deposits consist of brownish-yellow and olive fine to medium sand with small amounts of silt to depths of 15 to 20 feet. Below these deposits is glauconitic medium sand.

Hydroge l gy

Saturated soils were encountered within 13 to 14 feet of the surface. Based on groundwater levels measured in July 1986 and surveyed monitor well locations and elevations, a groundwater flow map was constructed for Site 10 to interpret groundwater flow direction. Groundwater flows toward the northeast with a hydraulic gradient of 0.015 ft/ft. Well 10-2 is downgradient of the site, as well as Hockhockson Creek.

Groundwater Quality

Analytical results for groundwater samples collected at Site 10 indicate that TOX ranged from 20.0 ug/L in sample 10-3 to 67.0 ug/L in sample 10-1. A summary table of the analytical results for this site is included in Appendix A. However, sample 10-2 contained 36.0 ug/L TOX, while the duplicate sample 10-2A contained 108 ug/L. Total organic carbon was present at low levels and did not vary significantly. Methylene chloride was detected in samples 10-1 and 10-2A at concentrations of 16 and 14 ug/L, respectively. Acetone was present in sample 10-3 at 10 ug/L, and 2-butanone was also present in sample 10-3 at 11 ug/L. No petroleum hydrocarbons were detected. Nitrate/nitrite was detected at 0.10 mg/L in samples 10-1 and 10-3. Base-neutral/acid-extrac table organic compounds were not present at quantifiable levels. Cadmium, copper, nickel, and zinc were present in sample 10-1. Only zinc was present in samples 10-2, 10-2A, and 10-3. The pH was fairly consistent at this site, ranging from 4.0 to 4.4. Chloride was relatively high in sample 10-1 (20.1 mg/L) as compared to samples 10-2 and 10-2A (8.20 and 8.50 mg/L, respectively). Specific conductance was elevated at this site, with the highest level at well 10-1 (140 umho/cm).

Surface Water and Sediment Quality

Samples of surface water and sediments were collected both upstream and downstream of Site 10. Two samples were collected at each location 5 hours apart. A summary table of the analytical results for this site is included in Appendix A. The concentrations of TOX at location 10-A varied from 10.0 to 15.0 ug/L. At location 10-B, the concentration of TOX varied from 43.0 to 29.0 ug/L. Total organic carbon averaged 4.52 mg/L. Neither VOCs nor petroleum hydrocarbons were detected above quantifiable limits. The BNAs N-nitrosodiphenylamine and di-n-butyl phthalate were detected above quantifiable limits in both stream 10-B samples. This compound is found in plasticizers and is ubiquitous. The 10^{-6} cancer risk criterion for this compound is 34 mg/L, much higher than that concentration found in sample 10-B. Stream sample 10-A (6th hour) was not analyzed for metals. Mercury was detected in the first sample collected at location 10-A but not in any of the other samples. Silver was detected in the first stream sample collected at location 10-B.

The pH did not vary significantly between the samples, but it was higher in the stream samples than in the well samples. Chloride concentrations and specific conductance were lower in the stream samples than in the well samples. Total organic halogens were not detected in any of the sediment samples at Site 10. Methylene chloride was detected at concentrations of 300 and 350 ug/g in both 10-A sediment samples. Acetone was detected at concentrations of 760 and 37 ug/g in the second samples collected at location 10-A and 10-B, respectively. Petroleum hydrocarbons were found at concentrations of 89.9 and 91.3 mg/kg in the 10-A samples and 11.2 mg/kg in the first sample collected at location 10-B. Lead was detected in all the sediment samples but was one order of magnitude higher in the 10-A samples than in the 10-B samples. Zinc was detected at 50.3 mg/kg in the first sample collected at location 10-A and at 28.8 mg/kg in the first sample collected at location 10-B.

Water Quality Discussion

Methylene chloride was detected in groundwater samples 10-1 and 10-2 at levels well above the MCLs for drinking water. Similar concentrations were found in field blanks and are considered to be artifacts of field decontamination or laboratory procedures. In wells 10-2 and 10-3, 2-butanone was detected at concentrations that were far below recommended levels. Acetone was detected at concentrations near the detection limit in well 10-3. There are no drinking water standards available for acetone, but this concentration was considered insignificant in the Confirmation Study report. Nitrate/nitrite was detected in wells 10-1 and 10-3 at 0.10 mg/L. Well 10-3 appears to be upgradient of the site, which is bounded by Midway and Munda Roads and the railroad tracks to the east. These concentrations appear to be background concentrations of nitrate/nitrite and are well below the guidelines for drinking water. No metals were present in quantities greater than those set forth in drinking water guidelines.

The pH was low at this site (4.0 to 4.4) but within the range for groundwaters in Monmouth County. The pH of the stream water at Site 10 was much higher (6.6 to 6.7). No parameters were found to exceed drinking water guidelines for the surface water samples at Site 10, except for N-nitrosodiphenylamine, which was detected downstream of Site 10 in sample 10-B at concentrations of 31 ug/L (1st-hour sample) and 30 ug/L (6th-hour sample). These concentrations exceed the 1984 10^{-6} cancer risk factor of 4.90 ug/L. N-nitrosodiphenylamine is difficult to distinguish analytically from diphenylamine, which is used as a stabilizer for nitrocellulose explosives. This site received spent ammunition cases; therefore, the presence of N-nitrosodiphenylamine is not unexpected.

Soil Quality Discussi n

Metals concentrations in sediment samples 10-A and 10-B were all within normal background concentration ranges. Downstream of Site 10, 11.2 mg/kg petroleum hydrocarbons and 37 ug/g methylene chloride were detected at sampling location 10-B. These values are below soil contaminant values acceptable to the NJDEP under the ECRA program. Under this program, the acceptable value for petroleum hydrocarbons in soil is 100 mg/kg. These parameters were not detected in the surface water sample. Upstream of Site 10 (sampling location 10-A), the sediments contained 300 to 350 ug/g methylene chloride and up to 760 ug/g acetone. Petroleum hydrocarbons were found at concentrations of 89.9 mg/kg and 91.3 mg/kg. These sediments contain petroleum hydrocarbons values below the NJDEP ECRA program guideline of 100 mg/kg.

It is unlikely that these concentrations occurred as a result of activities at Site 10. The surface water at this location and the groundwater from nearby well 10-3 do not contain any detectable concentrations of petroleum hydrocarbons nor significant quantities of acetone or methylene chloride. It is possible that the compounds found in the sediments upstream of Site 10 came from Site 20. This is examined in the discussion of Site 20 soil quality.

2.2.7 Site 11: Contract Ordnance Disposal Area

The investigations performed during the IAS found that this 2-acre site was used by an outside contractor to dispose of obsolete ordnance material using thermal destruction techniques. It was also used as a training area for firefighting exercises for approximately 3 years. The exercises were conducted in two unlined pits measuring roughly 30 feet in diameter and 2 feet in depth using oil-soaked, reject airplanes and vehicles. Any remaining unburned oil was left in the pit and allowed to soak into the soil. The area was secured at a later date (after 1977) by removing the soil and regrading the area.

Geology

At Site 11, the shallow unconsolidated deposits consist of yellowish-brown to light olive brown fine to medium sand. At well location 11-2, glauconitic medium sand is interbedded with yellowish-brown fine to medium sand. Small amounts of silt were found at this site.

Hydrogeology

Saturated materials were encountered within 2 to 7 feet below surface. Groundwater occurs under water table conditions at

Site 11. Based on groundwater levels measured in July 1986 and surveyed monitor well locations and elevations, a water table contour map was constructed for Site 11 to determine the direction of flow. Groundwater flows toward the west with a hydraulic gradient of 0.016 ft/ft. Well 11-3 is downgradient of the site.

Groundwater Quality

Analytical results for groundwater samples collected at Site 11 indicate that TOX concentrations were elevated in samples 11-1 and 11-3 (202 and 169 ug/L, respectively) in comparison to sample 11-2. A summary table of the analytical results for this site is included in Appendix A. Concentrations of TOC were also elevated in samples 11-1 and 11-3 (11.9 and 7.66 mg/L, respectively). The acid-extractable organic compound pentachlorophenol was detected at 120 ug/L in sample 11-1. Neither oil and grease nor explosives were detected in any of the Site 11 wells. However, TNT was detected in the field blank taken before sample 11-2. Nitrate/nitrite was present at a concentration of 0.30 mg/L in sample 11-1. Zinc was detected in all samples as well as the field blank at Site 11. The pH was fairly consistent for all the samples and ranged from 4.5 to 5.0. Chloride and specific conductance values were approximately 8 mg/L and 65 umho/cm.

Water Quality Discussion

Total organic halogens and TOC concentrations in samples 11-1 and 11-3 were higher than sample 11-2. Well 11-3 is located downgradient of the site. Pentachlorophenol was detected at 120 ug/L in sample 11-1; this concentration is below the RMCL of 220 ug/L. Pentachlorophenol is used mainly as a wood preservative and is also found in certain glues. Samples from this site were not analyzed for VOCs. The elevated TOX and TOC indicate that VOCs may be present. It does not appear that the disposal activities at this site adversely affected the groundwater quality since no explosives or oil and grease were detected. Nitrate/nitrite was present in well 11-1 at 0.3 mg/L, which is below the MCL of 10 mg/L. This is probably a background concentration. No metals were detected above concentrations set for drinking water.

S il Quality

Soil samples were collected at Site 11 and were analyzed for oil and grease. At each sampling location, samples were collected at depths of 6 to 9 inches and 2 to 2.5 feet. Oil and grease was detected in all samples. A summary table of the analytical results for this site is included in Appendix A. Concentration decreased with depth of sample collection in all cases. The highest concentration was found in sample 11-A, which contained 37,300 mg/kg oil and grease at 6 to 9 inches.

Soil Quality Discussi n

There are no set guidelines for oil and grease in soils. However, excessive amounts of oil and grease were found at sampling location 11-A (37,300 mg/kg). The soil at this location was brownish-black and had an oil-like odor. Sample 11-B contained a concentration of oil and grease 10 times greater than samples 11-C and 11-D. The concentration of oil and grease attenuated quickly with depth and was significantly reduced at a depth of 2 feet.

2.2.8 Site 19: Paint Chip and Sludge Disposal Area

Investigations performed during the IAS found that this site was used for the periodic renovation of depth charges for approximately 20 years. Operations at this site involved the removal of loose paint and rust on the exterior of the munitions including wire brushing aided by solvent baths, followed by a final wash with water. After reviewing past site disposal practices, the specific quantity of waste residue disposed of on and off site could not be determined.

Geology

The shallow unconsolidated deposits at Site 19 consist of 15 to 20 feet of brownish-yellow and olive fine to medium sand with some coarse sand and silt overlying glauconitic medium sand. At 25 to 26 feet, a thin (0.5-foot) brownish-yellow silty clay layer is present.

Hydrogeology

Saturated materials were encountered within 15 feet of the surface. Based on groundwater levels measured in July 1986 and surveyed monitor well locations and elevations, a water table map was constructed for Site 19 to determine groundwater flow direction. Groundwater flows toward the northwest with a hydraulic gradient of 0.015 ft/ft. Wells 19-2 and 19-3 are down-gradient of the site, as is the small stream located west of the site.

Groundwater Quality

Analytical results for groundwater samples collected indicate TOX were detected at concentrations of 50.0 and 63.0 ug/L (19-3 and 19-1, respectively). These results are summarized in the table found in Appendix A. Total organic carbon concentration ranged from 4.01 mg/L (sample 19-1) to 6.95 mg/L (sample 19-2). Methylene chloride was detected at 14 ug/L (sample 19-1) and 13 ug/L (sample 19-2) and was estimated at 8 ug/L for sample 19-3. Acetone was detected at 16 ug/L in sample 19-3; 2-butanone was present in sample 19-3 at 10 ug/L. Nitrate/

nitrite was detected in sample 19-1 at 0.80 mg/L. Neither BNAs nor petroleum hydrocarbons were detected above quantifiable limits.

Cadmium, chromium, lead, and zinc were detected in sample 19-1 at low levels. Cadmium, nickel, and zinc were detected at low levels in sample 19-2. Cadmium and zinc were detected at low levels in sample 19-3. The normal, naturally occurring background levels for these metals has not been determined for the waters at Site 19. The pH was in the range of 4.3 to 4.6. Chloride concentrations ranged from 7.60 mg/L (sample 19-1) to 11.4 mg/L (sample 19-2). Specific conductance was elevated in well 19-1 (160 umho/cm).

Surface Water and Sediment Quality

Surface water and sediment samples were collected at two locations over time. Two samples were taken 5 hours apart at each sampling location. In the first sample, 19-A, the concentration of TOX was 65.0 ug/L for the first sample and 9.00 ug/L for the second sample. The duplicate sample for 19-A (1st hour) contained 29.0 ug/L TOX. Sample 19-B contained 49.0 ug/L (1st hour) and 36.0 ug/L (6th hour). Total organic carbon was elevated to 30 mg/L for the stream samples. No VOCs were detected above quantifiable limits. Nitrate/nitrite and BNAs were not detected. Petroleum hydrocarbons were detected at 4.20 mg/L in stream sample 19-B (6th hour). Chromium, copper, nickel, and zinc were detected in the 19-A blank. This was a field blank taken by pouring deionized water directly into the sample bottles. The pH ranged from 5.20 for sample 19-A to 4.80 for sample 19-B. Chloride concentrations were slightly higher in the stream samples than in the groundwater samples. Specific conductance averaged 57 umho/cm (range 53.7 to 61.9 umho/cm) for the stream samples. A summary table of analytical results is included in Appendix A.

Water Quality Discussion

Analytes, with the exception of methylene chloride, were detected in both groundwater and surface water samples collected at Site 19 at concentrations below those recommended for drinking water guidelines. Similar concentrations of methylene chloride were found in the field blanks and are considered to be artifacts of field decontamination or laboratory procedures. Total organic halogens concentrations were slightly elevated for groundwater samples 19-1 (63 ug/L) and 19-3 (50 ug/L) and surface water sample 19-A (1st hour) (65 ug/L).

Well 19-1 is located upgradient of the site, and the concentration of TOX was approximately equal to that in the stream located downgradient of the site. Therefore, the past activities at this site appear to have had no impact on the concentration of TOX in the water.

Nitrate/nitrite was detected only in sample 19-1. The concentration of 0.80 mg/L could possibly be a background concentration. Petroleum hydrocarbons were detected in stream sample 19-B (6th hour) at a concentration of 4.20 mg/L. There are no guidelines for petroleum hydrocarbons in water. There was no oily film observed at this location, and this concentration was regarded as insignificant in the Confirmation Study. Concentrations of TOC were elevated for the stream samples, as expected for surface waters.

Total organic halogens were not detected in the sediment samples. However, acetone was present at 230 ug/kg (sample 19A, 6th hour) and 1,200 to 730 ug/kg in samples 19-B (1st hour) and 19-B (6th hour), respectively. Methylene chloride was detected at 75 ug/kg in sample 19-A (1st hour) duplicate and at 210 ug/kg in 19-B (1st hour). Methylene chloride was not reported for 19-A (6th hour) and 19-B (6th hour) because of dilutions. Chloroform was present in both stream sediment samples 19-A duplicate and 19-B (1st hour). Toluene and 2-butanone were present in sediment sample 19-B (1st hour) at 170 and 240 ug/kg, respectively.

Elevated levels of petroleum hydrocarbons were found in sediment samples at Site 19. These levels varied from 14.9 mg/kg in sample 19A (6th hour) to 681 mg/kg in 19-B (6th hour). Lead was detected in all sediment samples; the highest levels were in the 19-B samples. Mercury was found at 0.423 mg/kg in sample 19-A (6th hour) only. Silver and zinc concentrations were detected in sample 19-B (1st hour).

S il Quality

Four soil samples were collected at Site 19. Composite samples were collected from depths of 0.5 to 3 feet. A summary table of the analytical results for this site is included in Appendix A. Acetone and 2-butanone were detected at concentrations of 460 and 67 ug/kg, respectively, in soil sample 19-A. Cadmium, chromium, lead, and zinc were present at concentrations of 26,800, 59.6, 49.5, and 289 mg/kg, respectively, in soil sample 19-A. Soil sample 19-B also had elevated concentrations of the analyzed-for metals: cadmium (31,900 mg/kg), chromium (639 mg/kg), lead (1,560 mg/kg), and zinc (776 mg/kg). Methylene chloride and acetone were detected above quantifiable limits. Soil samples 19-C and 19-D had less of chromium, lead, and zinc. Dichlorobenzenes were present at 18 ug/kg in soil sample 19-C. Petroleum hydrocarbons were detected in soil samples 19-B, 19-C, and 19-D. Soil sample 19-D had high concentrations of petroleum hydrocarbons (751 mg/kg).

Soil Quality Discussion

Elevated acetone concentrations were found in the stream sediments and in soil sample 19-A. Stream sampling location 19-B

was a marsh-type environment rather than a flowing stream. The sediments had high water and organic matter contents.

Concentrations of methylene chloride, chloroform, 2-butanone, and toluene were observed which were higher than expected for an uncontaminated site. Concentrations of petroleum hydrocarbons (445 to 681 mg/kg) above the NJDEP suggested action levels were also detected. Lead and silver were present at sampling location 19-B at concentrations above the normal background ranges for soils. Petroleum hydrocarbons were detected at levels of 14.9 to 129 mg/kg in sediment samples collected at location 19-A. Mercury was also detected at concentrations greater than normal background ranges for sediment sample 19-A. The concentration of mercury present is only slightly elevated (0.423 mg/kg). Mercury is not considered toxic to plant life below 10 ppm. The only mercury reported to have been used was at Building MA-3 where a mercurous/mercuric chloride fungicide was used for mine reconditioning. This breaks down into mercuric chloride and metallic mercury in sunlight. Building MA-2 is located approximately 1 mile from Site 19 and does not share the same surface drainage.

Soil sample 19-B contained petroleum hydrocarbons in excess of the 100 mg/kg action level recommended by NJDEP. Concentrations of cadmium, lead, and zinc also exceeded normal expected ranges for soil sample 19-B. Cadmium and lead concentrations were elevated above background for soil sample 19-A. The lead concentration was elevated in soil sample 19-C. The solvents acetone, 2-butanone, and toluene were expected to be present at Site 19. Cadmium, lead, and zinc were also expected to be present. The presence of chloroform and methylene chloride (cleansing agents), mercury, and silver in the sediments at Site 19 was not expected. It is unlikely that these constituents came from the reported activities at Site 19.

2.2.9 Site 20: Grit Blast Disposal Area at Building 544

Building 544 houses blasting operations for the removal of paint from mines. The paint removed from mines, along with spent grit, is disposed of in a 15- x 100-ft area behind Building 544. Assuming a steady-state operation (i.e., paint applied this year will be removed over subsequent years), approximately 3 gallons of zinc chromate primer, 40 gallons of latex and lead-based paints, and 10 gallons of copper-based paints are stripped per year. Thus, a volume of paint chips equivalent to roughly 53 gallons of wet paint per year was disposed of at this site. These paint chips typically contain lead and zinc.

Soil Quality

Soil samples were taken at discrete intervals at four sampling locations at Site 20. Neither petroleum hydrocarbons nor Extraction Procedure (EP) Toxicity metals were detected in sample

20-A. A summary table of the analytical results for this site is included in Appendix A. Petroleum hydrocarbons were detected at concentrations of 65.7 mg/kg in sample 20-B at a depth of 0.5 to 1 foot and at 2.20 mg/kg in sample 20-C at a depth of 0.5 to 1 foot. Lead was detected in sample 20-C at 1.64 mg/kg. Samples 20-D and 20-E were collected in July 1986 and were analyzed using graphite furnace atomic absorption, which has much lower detection limits than the inductively coupled plasma atomic emission used for the other samples. Therefore, no EP Toxicity metals were detected in samples 20-D or 20-E under the more stringent detection limits appropriate for these analyses.

Soil Quality Discussion

Analytical results of soil samples are included in a summary table for this site in Appendix A. The analyses used the EP Toxicity procedures and indicate that the EP Toxicity metals detected were present at concentrations below the drinking water standards criteria. Petroleum hydrocarbons were detected at concentrations below the 100 mg/kg action level. At Site 20, both acetone and water-repellent grease were included in the residual wastes reported in the IAS. Though not detected at or above action levels, the fact that these wastes were generated at Building 554 could account for their presence in the sediments upgradient of Site 10.

2.2.10 Site 22: Paint Chip Disposal Area Adjacent to Building D-2

This site was found to consist of approximately 50 square feet of stressed vegetation and discolored (black) soils behind Building D-2, probably resulting from past painting operations.

S il Quality

Soil samples were taken at discrete intervals at four sampling locations at Site 22. Analytical results for soil samples collected at Site 22 indicate no EP Toxicity metals (as analyzed through the EP Toxicity tests) were detected in any samples collected at Site 22. Petroleum hydrocarbons were detected in samples 22-C and 22-D with increased concentrations at depth. Petroleum hydrocarbons ranged from 4.20 to 39.0 mg/kg in sample 22-C and from 6.30 to 45.8 mg/kg in sample 22-D.

2.2.11 Site 26: Explosive "D" Washout Area, Building GB-1

This site was used for the removal and recovery of ammonium picrate (Explosive "D") from 5-inch shells for a 1-year period. High-pressure hot water was used to wash out the soluble explosive (1 g in 78 mL of H_2O at 20°C). The discharge containing the explosive compound flowed into a chain of cascading tanks,

allowing the water to cool and precipitate the ammonium picrate. The discharge from these tanks flowed through an open tile pipeline into an unlined settling basin behind the building. The effluent was then allowed to evaporate from the basin or to percolate into the soil.

G ology

The shallow unconsolidated deposits at Site 26 consist of brownish-yellow and gray fine to medium sand with some coarse sand. Reddish-yellow silty clay was encountered at 26 feet in well 26-1.

Hydrogeology

Saturated deposits were encountered within 10 feet of the surface. Based on groundwater levels measured in July 1986 and surveyed monitor well locations and elevations, a water table contour map was constructed for Site 26 to determine the direction of groundwater flow. Groundwater flows toward the south with a hydraulic gradient of 0.0055 ft/ft. The flow direction is toward the Manasquan River.

Groundwater Quality

Analytical results for groundwater samples collected at Site 26 indicate picric acid was not detected in any samples collected at Site 26. The pH ranged from 4.0 to 4.8, and specific conductance was 60, 225, and 50 umho/cm for wells 26-1, 26-2, and 26-3, respectively.

Water Quality Discussion

Picric acid was the major analyte of concern at this site but was undetected in any of the groundwater samples collected at this site. A summary table of the analytical results for this site is included in Appendix A. Well 26-1 is located downgradient of the open tile drain and the settling basin. Effluent traveled along this drain to the settling basin located at the end of the drain. Based on the flow map, there is one well located downgradient of the settling basin. No picric acid was detected in this well.

Soil Quality Discussion

Analytical results for soil samples at Site 26 show that picric acid was not found above detectable limits.

SECTION 3

PROPOSED PLAN OF ACTION

3.1 OVERVIEW

A plan of action for the RI/FS is outlined in the following subsections. The sites that will be addressed in this proposed plan are the 11 sites that were studied during the Confirmation Study.

The elements of the plan are selected to accomplish several distinct goals. These goals include the following:

- Defining the volume and boundaries of the waste materials on the sites.
- Defining the characteristics and properties of the waste.
- Defining potential pathways and receptors of the waste constituents, which includes defining the extent and concentration of contaminants in each potentially affected medium.
- Identifying potentially applicable technologies to be used in the cleanup or stabilization of the waste materials.
- Defining regulated levels and cleanup levels for the contaminants found on the sites.
- Determining the quantitative risk of the sites at present and of the cleaned up sites.

Previous work, detailed in Section 2, began the process through which these goals can be achieved for the sites located at NWS Earle, Colts Neck, New Jersey. After a detailed review of the site information and an analysis of comments from the regulatory agencies, the following work is proposed for an extended site investigation to identify and quantify the contaminants and their potential for migration.

This clarification of the basic data gathered during the Confirmation Study will be used in a baseline multimedia risk assessment to quantify the potential impacts on public health, welfare, and the environment and to eliminate, if possible, inappropriate response actions.

This proposed work is to include the following:

- Drilling and installing groundwater wells at specific locations on the sites to maximize the hydrogeologic data to be gathered.

The analysis of several sets of historical aerial photographs is necessary to help identify the limits of the operations that deposited the wastes on the sites. A definitive boundary on most sites identifying areas of operations does not exist.

The integrated interpretation of the historical aerial photographs and the topographic maps will be used in the determination of the demographic profiles of the facility and vicinity. This demographic study will be used in the assessment of the public health baseline risk assessment.

Data from many sources will be used in the baseline risk assessment. Work in the IAS contains much of the required data concerning regional water surveys and biologic surveys. The data will be updated and clarified in light of additional information currently available. Specific investigations of contaminant transport in the biologic community on a site-specific basis is currently being considered. Information that is necessary on a facility-wide basis, including the facility's peripheral areas, includes updates of the F.C. Hart biologic inventory, groundwater/surface water use information, groundwater/surface water inventories in light of current land development, and current land use. This information must be obtained during the initial phases of the RI/FS.

3.1.1.2 G ohydrologic Information Needs

The combined interpretation of the topography, aerial photographs, and analytical results of the Confirmation Study will aid in the identification of additional site characterization work that may be required. Further clarification and substantiation of the groundwater flow directions will be obtained from this analysis. The data obtained from the Confirmation Study and the additional work that will be performed during the extended site characterization may be used to assess the rate of groundwater flow and potential contaminant transport. When contaminants are identified, aquifer characterization such as a determination of aquifer transmissibility and flow velocities will be used in the data analysis as appropriate. These data can be evaluated in conjunction with the Regional Aquifer System Analysis model that the United States Geologic Survey is developing for the region. Twenty-six new monitor wells are proposed.

3.1.2 Additional Data Needs

The identification of applicable and relevant or appropriate regulations (ARARs) should be identified. The NWS Earle sites are proposed for inclusion on the National Priorities List (NPL). The ARARs for the sites should be identified and clearly addressed by the RI/FS.

The data that will be required to be collected can be shown in the following matrix, Figure 3-1.

	Site 26	Site 22	Site 20	Site 19	Site 11	Site 10	Site 7	Site 5	Site 4	Site 3	Site 2	Facility Wide
Topographic Map	●	●	●	●	●	●	●	●	●	●	●	●
Demographic Study												●
Groundwater Use Study												●
Groundwater/Surface Water Inventory												●
Groundwater/Surface Water Flow Path Determinati n											●	●
Additional Geologic Characterization				●	●	●	●	●	●	●	●	
Soil Boring/Soil Sampling	●			●	●		●		●	●	●	
Monitor Well Sampling	●				●	●	●		●	●	●	
New Monitor Well Installation				●	●	●	●	●	●	●	●	
Borehole Geophysical Survey				●		○	●	●	●	●	●	
Pump Test/Slug Test											○	
Porosity/Permeability Lab Test				○				○	○	○	○	
Historical Aerial Photo Interpretation		●	●			●	●	●	●	●	●	
Surface Water Sampling				●		●	●		●			
Electromagnetics						○			○			

● Definite Activity

○ Possible Activity

FIGURE 3-1 RI/FS ACTIVITY MATRIX

3.2 SITE-SPECIFIC PLANS

Based on the prior investigation performed by WESTON at NWS Earle, Colts Neck, New Jersey, and the background information detailed in the IAS, the additional information detailed in this subsection will be directed toward further defining the extent of contamination at each of the nine sites. Two sites (Sites 20 and 22) require only confirmation of site activities through interpretation of detailed topographic maps and historical aerial photographs.

3.2.1 Site 2: Ordnance Demilitarization Site

Additional Data Requirements

The additional data requirements needed to determine the impact of the site activities on the subsurface soils and groundwater consist of the following activities:

- Install three groundwater monitor wells in close proximity to the detonation area.
- Install one groundwater monitor well northeast of the site, between the site and Pine Brook.
- Conduct a geophysical survey of a well using gamma ray logging.
- Determine a measuring point elevation for each monitor well, measure groundwater levels, and construct a potentiometric map for the site.
- Obtain soil samples at three soil boring locations around the detonation area. These soil borings should be completed into the groundwater interface and sampled continuously from the ground surface.
- Collect representative samples from all groundwater monitor wells. The aqueous samples should be analyzed for nitrate/nitrite, picric acid, TCL metals, TOX, and 2,4,6-TNT.
- Analyze soil samples for nitrate/nitrite, picric acid, and metals.
- Identify and sample one down gradient monitor well for the entire TCL list of analytes. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.
- Conduct a slug test on two to three groundwater monitor wells at the site.

Obtain current and historical aerial photographs and detailed topographic maps of the site.

Justification for Additional Data Needs

The additional groundwater monitor wells and the soil borings, shown in Figure 3-2, have been selected based on the groundwater flow direction defined in the Confirmation Study. These well and soil sampling locations are essential to determine whether elevated concentrations of nitrate/nitrite are present in the groundwater beneath the site. The analytical results of the soil samples will determine the existence of residual contamination within the sandy soils above the groundwater table. The information gained from analyses of the additional soil borings will be necessary in the remediation phase. The slug test is necessary to determine the aquifer characteristics for this site. The geophysical log is necessary to provide correlation with lithogic logs developed during drilling as well as to identify potential aquicludes.

The topographic maps will provide data on the movement of surface water runoff and will provide a quality assurance check of the groundwater and groundwater monitor well elevation points. Historical aerial photographs will provide information on past site activities involving the groundwater monitor wells. The historical aerial photographs will also be used to identify site boundaries.

3.2.2 Site 3: Landfill Southwest of "F" Group

The extent of this landfill was not clearly defined during the Confirmation Study. The groundwater quality data do not support the reported groundwater flow direction. The additional effort for this site includes the following activities:

- Install three groundwater monitor wells hydraulically up- and downgradient of the groundwater flow direction, as indicated in Figure 3-3. The locations of the wells will be determined after a confirmation of groundwater flow direction. Three additional monitor wells may have to be located after site boundaries are determined. Soil samples collected during the drilling phase of the groundwater monitor wells will be preserved for analysis.

- Measure groundwater levels, establish a measuring point elevation for each groundwater monitor well, and construct a potentiometric map of the site.

- Collect representative groundwater samples from all groundwater monitor wells, and analyze for volatile and semivolatile organic compounds, TOX, and total petroleum hydrocarbons.

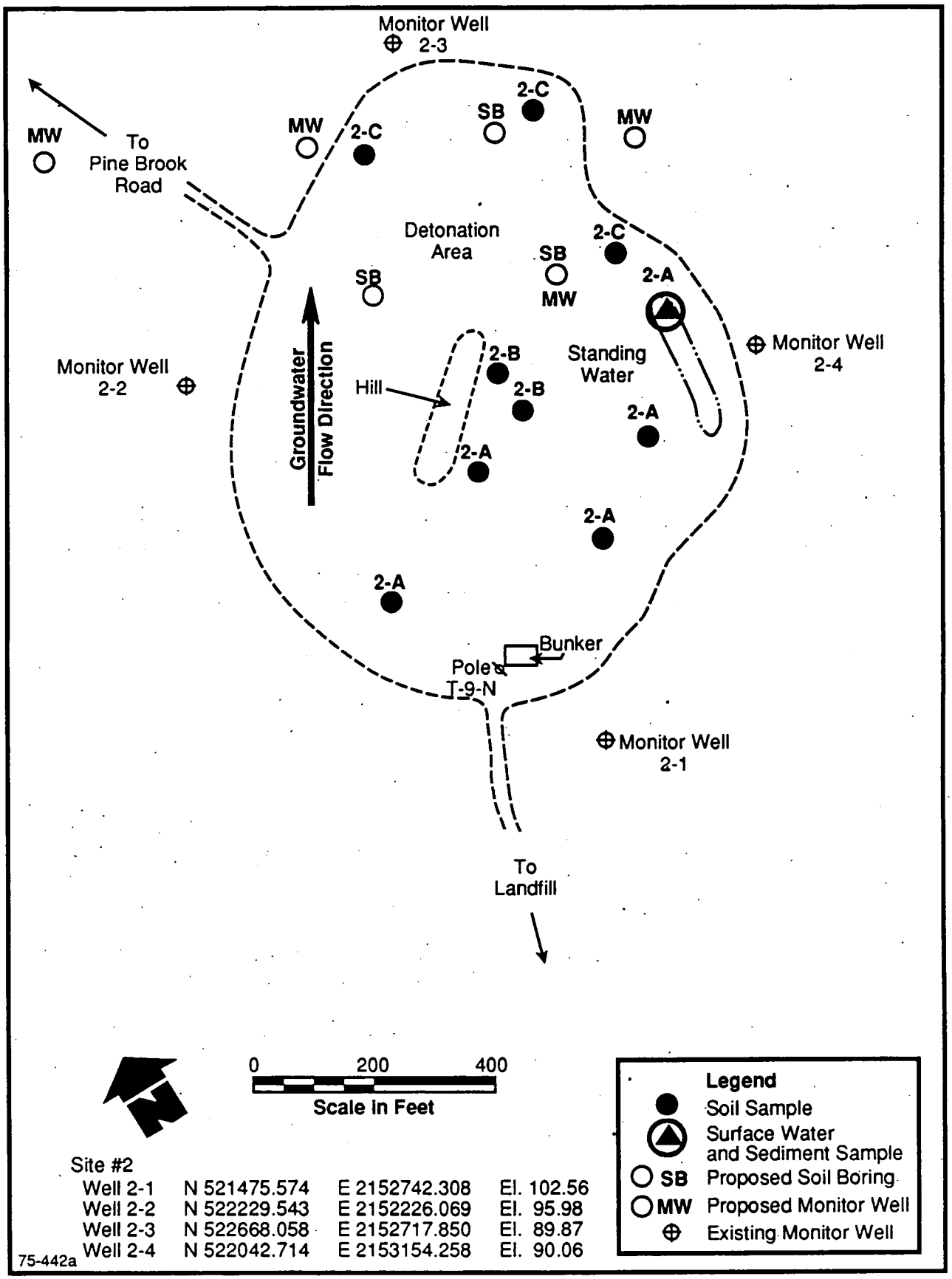


FIGURE 3-2 SITE 2 - ORDNANCE DEMILITARIZATION SITE MONITOR WELL AND SAMPLING LOCATIONS

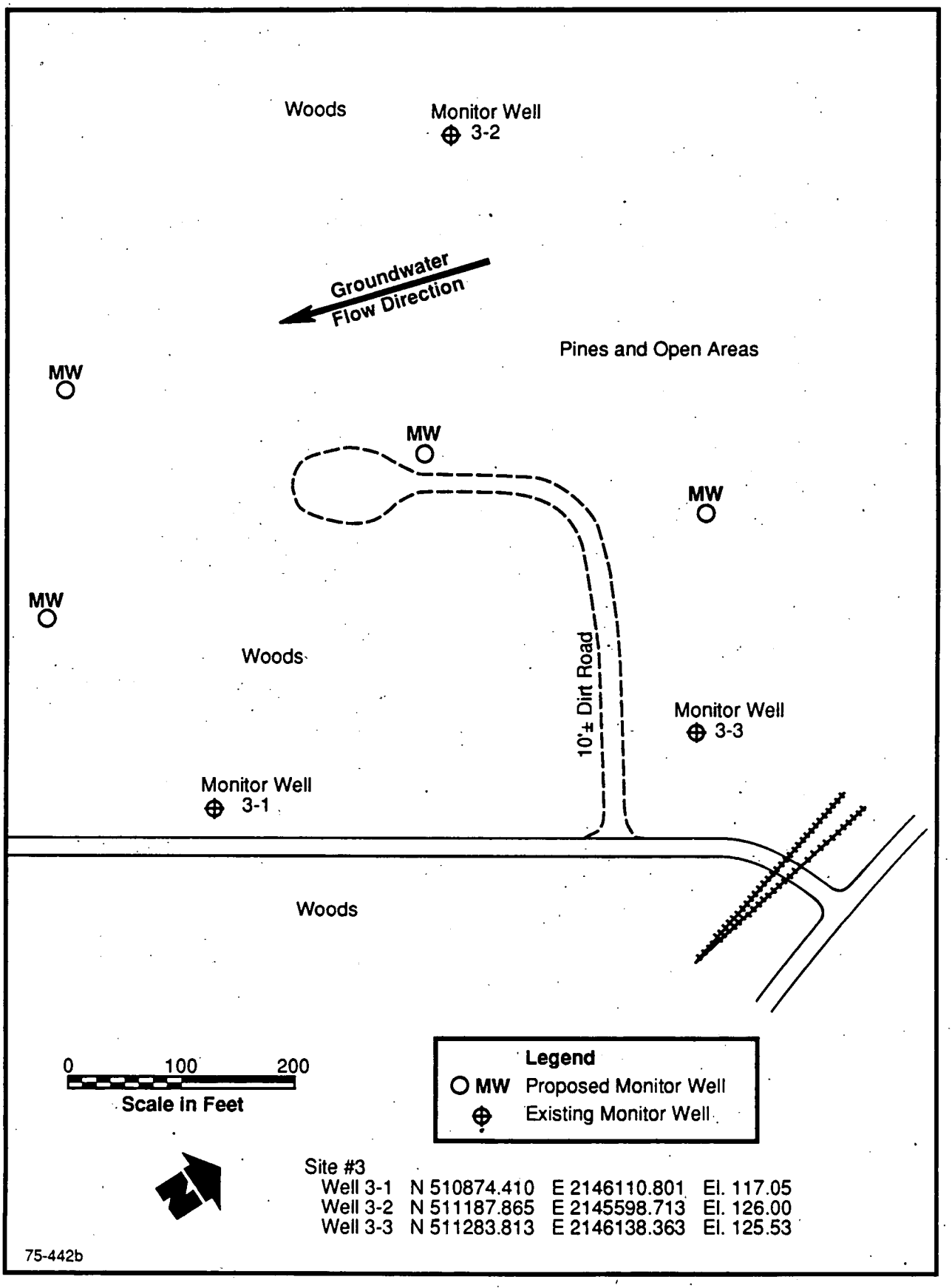


FIGURE 3-3 SITE 3 - LANDFILL SOUTHWEST OF "F" GROUP MONITOR WELL LOCATIONS

Identify and sample one downgradient monitor well for the entire list of TCL analytes. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.

- Obtain a detailed topographic map and historical aerial photographs of the site.

- Conduct a geophysical well log of the deepest groundwater monitor well.

Justification for Additional Data Acquisition

Additional groundwater monitor wells will be used for better definition of site boundaries. The monitor wells will also define the extent of the contaminants identified in groundwater monitor wells 3-1 and 3-3. The topographic map will be used to select monitor well locations. The historical aerial photographs and the topographic maps will be used to define the site boundaries. The soil samples and the geophysical well logs will be used to define the site lithology. Groundwater quality data will be used to determine the extent of contaminant migration and any possible upgradient sources of groundwater contamination.

3.2.3 Site 4: Landfill West of "D" Group

The lack of historical data on the type of wastes disposed of in this landfill and the depth of the trenches in which the wastes were buried indicates that a potential for groundwater contamination exists. Soil borings and additional groundwater monitor wells proposed for this site are illustrated in Figure 3-4. The following major activities are planned for this site:

- Install up to four groundwater monitor wells hydraulically up- and downgradient of the site, as well as one groundwater monitor well close to the emergent point of the springs.

- Collect soil samples from three soil boring locations.

- Survey a measuring point elevation at each groundwater monitor well, measure groundwater levels, and construct a potentiometric map for the site.

- Sample springs, if present.

- Analyze groundwater samples from all monitor wells, surface water, and selected soil samples for VOCs, TOX, BNAs, total petroleum hydrocarbons, explosives common to the facility, and TOC.

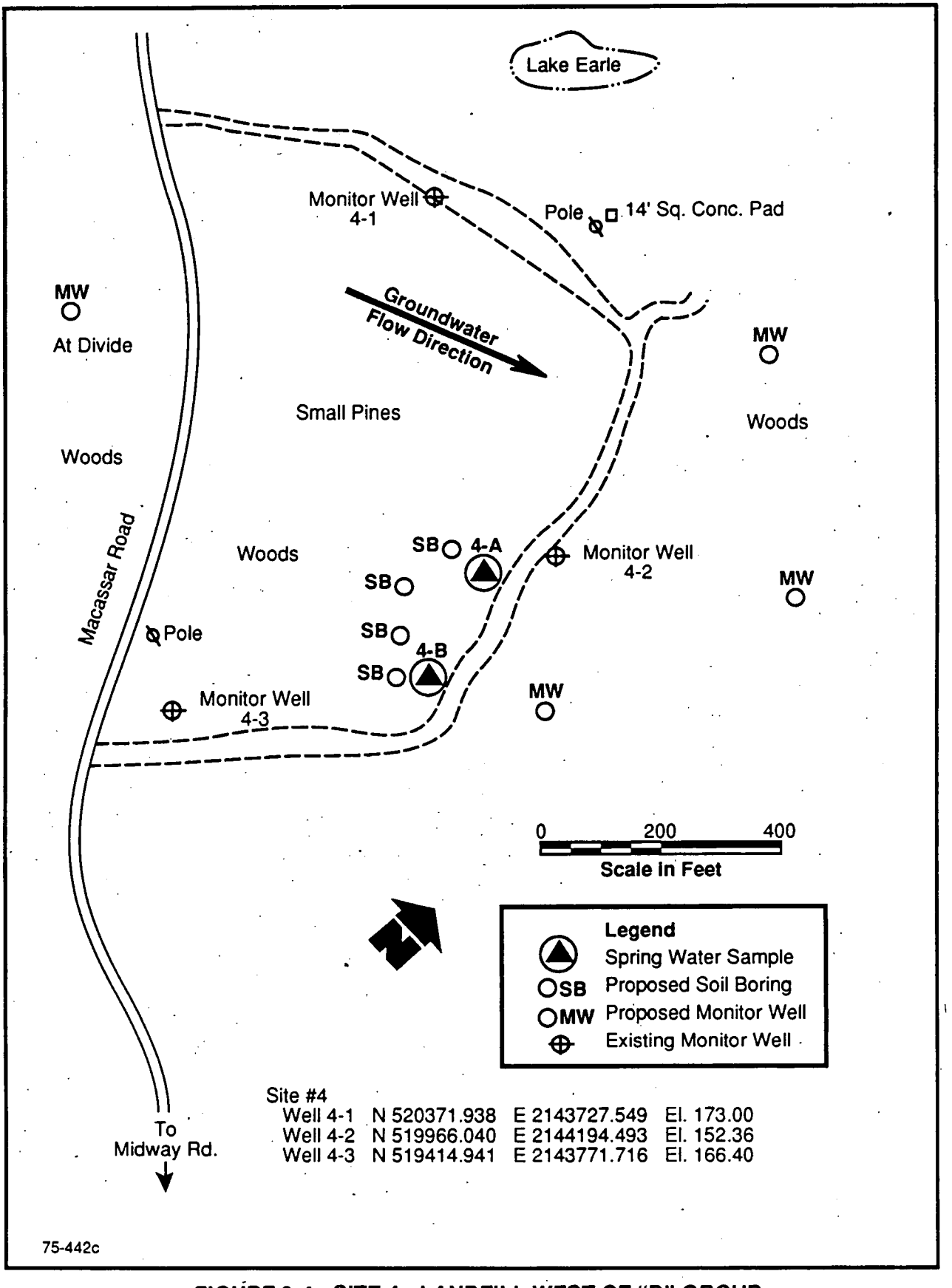


FIGURE 3-4 SITE 4 - LANDFILL WEST OF "D" GROUP MONITOR WELL AND SAMPLING LOCATIONS

Identify and sample one downgradient monitor w ll for the entire list of TCL analyt s. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.

- Obtain a detailed topographic map and historical aerial photographs of the site.

- Conduct a geophysical well log of the deepest monitor well.

Justification for Additional Data

Additional groundwater monitor wells will determine the potential for groundwater contamination from the infiltration of contaminated surface water. The groundwater monitor wells will also provide additional information on the direction of groundwater flow and site lithology.

The soil borings around the discharge springs at the base of the landfill will provide information on the horizontal and vertical extent of contaminants in the soil and potential infiltration from the surface water. The sampling and analysis of the groundwater, the soils, and the springs will provide a basis for determining the pathway for contaminant migration from the landfill.

The topographic map and the historical aerial photographs will be needed to determine past site activities, surface water runoff, and the extent of the landfill. The geophysical well logs will provide details about site lithology and serve as a backup to the geological logs and soil descriptions.

Don't like

3.2.4 Site 5: Landfill West of Army Barricades

- Three groundwater monitor wells (see Figure 3-5) are proposed for this site.

- Two additional monitor wells may be necessary once boundary limits are defined.

- Associated activities include groundwater level measurements, monitor well measuring point elevations, and collecting groundwater samples. The samples should be analyzed for TOX, VOCS, BNAs, pH, and specific conductance.

- One downgradient monitor well will be identified and sampled for the entire list of TCL analytes. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.

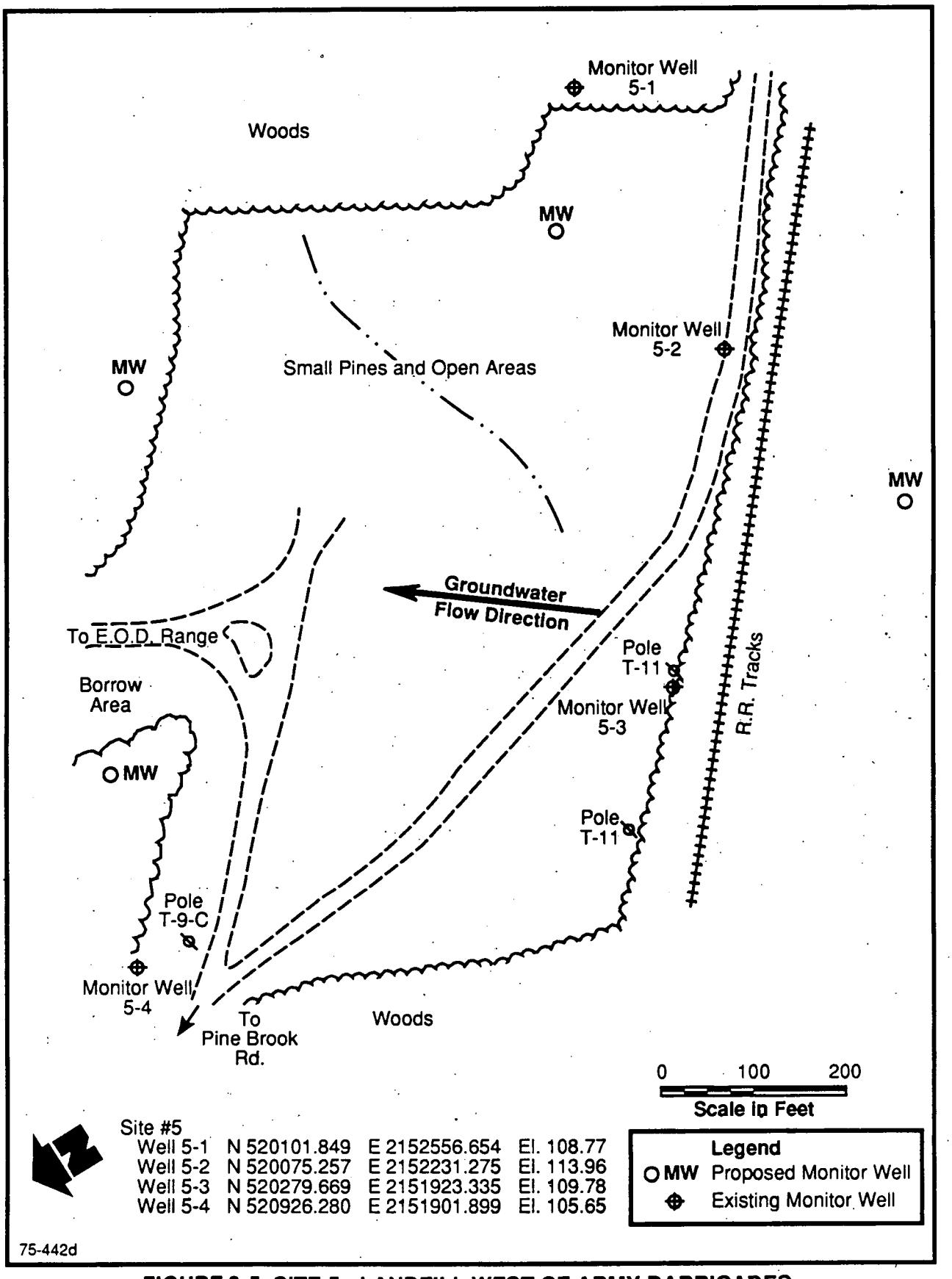


FIGURE 3-5 SITE 5 - LANDFILL WEST OF ARMY BARRICADES MONITOR WELL LOCATIONS

- Additional information requirements include topographic maps and historical aerial photographs of the site.

- A geophysical survey using electromagnetics should also be conducted.

Justification for Additional Data

Groundwater monitor wells placed up and down the currently defined hydraulic gradient are needed to define further the direction of groundwater flow. WESTON's Confirmation Study identified contaminants in proximity to the railroad tracks, which are identified as being upgradient of the site. The additional groundwater monitor wells and the analyses of the collected groundwater samples will better define the extent of these contaminants.

An electromagnetic survey of the landfill will be needed to define the landfill boundaries if historical aerial photographs are not available. The topographic maps and the historical aerial photographs are needed to provide information about the current topography of the site, as well as past site activities.

3.2.5 Site 7: Landfill South of "P" Barricades

This site, located near the waterfront area, is in the recharge area of the Englishtown Formation. This aquifer is a major source of groundwater for community and noncommunity potable water supplies. The lack of any appreciable confining layers identified in the Confirmation Study illustrates a concern for potential contaminant migration downward into the groundwater. The activities planned for this site include:

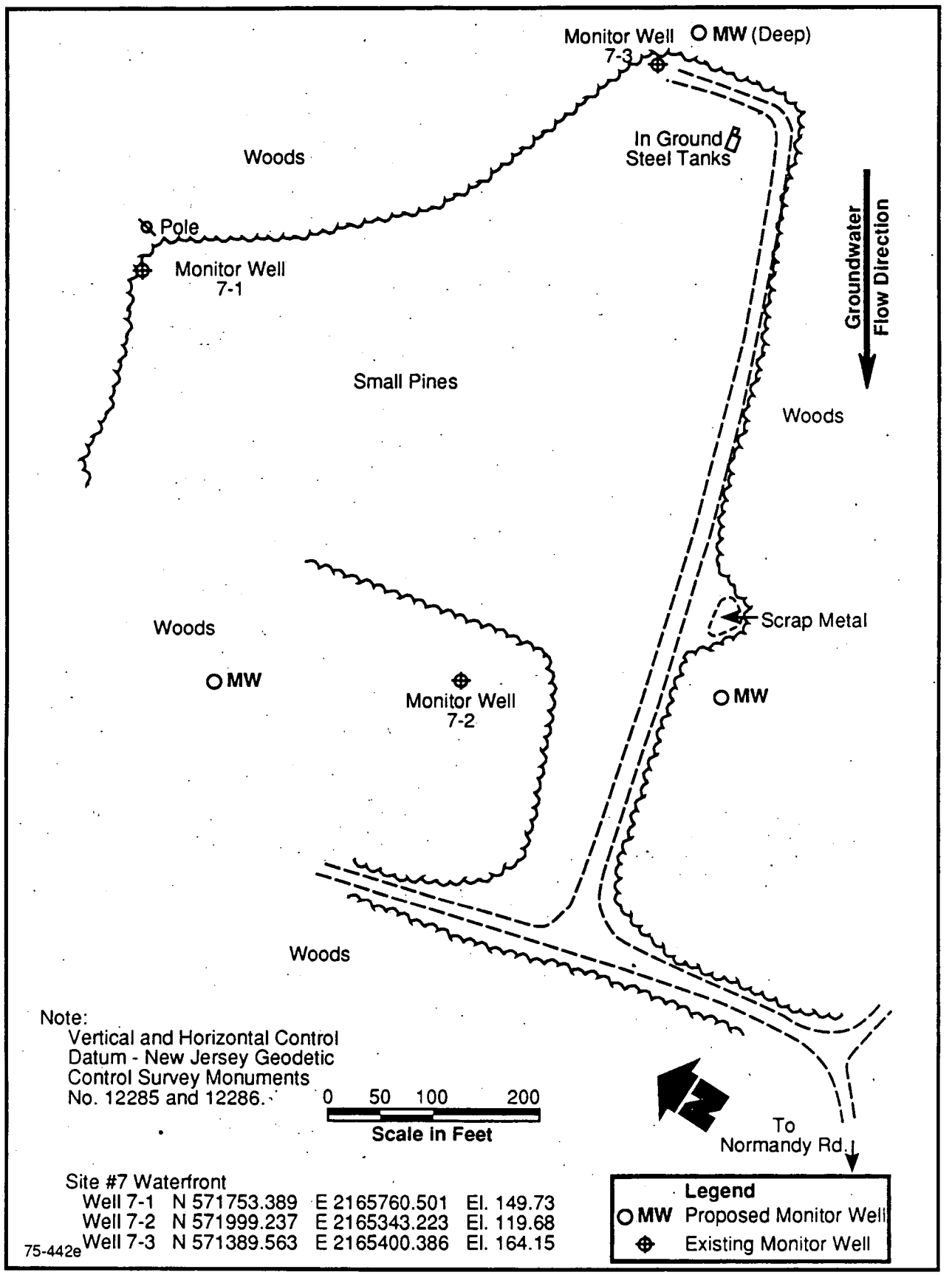
- Installation of two shallow groundwater monitor wells and one deep groundwater monitor well. A geophysical well log should be performed on the deep well. These proposed locations are illustrated in Figure 3-6.

- Water samples should be collected from Compton Creek at groundwater seepage points, preferably during low tide.

- Soil samples should be collected at locations to be determined around the scrap metal area, currently located within the boundaries of Site 7.

- Identifying and sampling one additional monitor well may be necessary downgradient of the deep well.

- All samples collected from and around this site should be analyzed for VOCs, BNAs, TOC, and TCL metals.



75-442e

FIGURE 3-6 SITE 7 - LANDFILL SOUTH OF "P" BARRICADES MONITOR WELL LOCATIONS

Identify and sampl one down gradient monitor well for the entire list of TCL analytes. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.

- Historical aerial photographs and detailed topographic maps of the site should be examined.

Justification for Additional Data Needs

The additional shallow monitor wells that are recommended are located downgradient of the site on gradient with groundwater monitor well 7-2. The analyses of the groundwater samples from these wells will be necessary to confirm the results of prior groundwater quality results. The deep monitor well, placed and screened at the base of the Englishtown Formation, is necessary to determine whether a potential exists for contaminants to migrate into this important and widely used aquifer. The geophysical well log is necessary to correlate observed lithologic horizons with the exact depth within the Englishtown Formation.

Since this landfill is located at the headwaters of Compton Creek, a potential exists for the movement of contaminants from the landfill into Compton Creek using groundwater as the pathway. Sampling of the groundwater at these seepage points along the banks at low tide is necessary to determine this impact. The analyses of the soil samples will provide information regarding the impact of this metal salvage site on the groundwater quality and observed soil conditions hydraulically downgradient of this area.

Topographic maps of the site will provide information on the surface water drainage direction and will help identify well and soil boring locations. The historical aerial photographs will help to determine the extent of past activities at the site.

3.2.6 Site 10: Scrap Metal Landfill

This site is bounded by the intersection of Munda Road and Midway Road and a railroad spur, and groundwater flow at this site is easterly. The three groundwater monitor wells that were installed during the Confirmation Study are not hydraulically downgradient of the site. Observations of the site conditions during the previous study did not provide adequate evidence of past site activities.

Additional work planned for this site consists of the following:

- Installing four monitor wells, as illustrated in Figure 3-7; measuring groundwater levels.

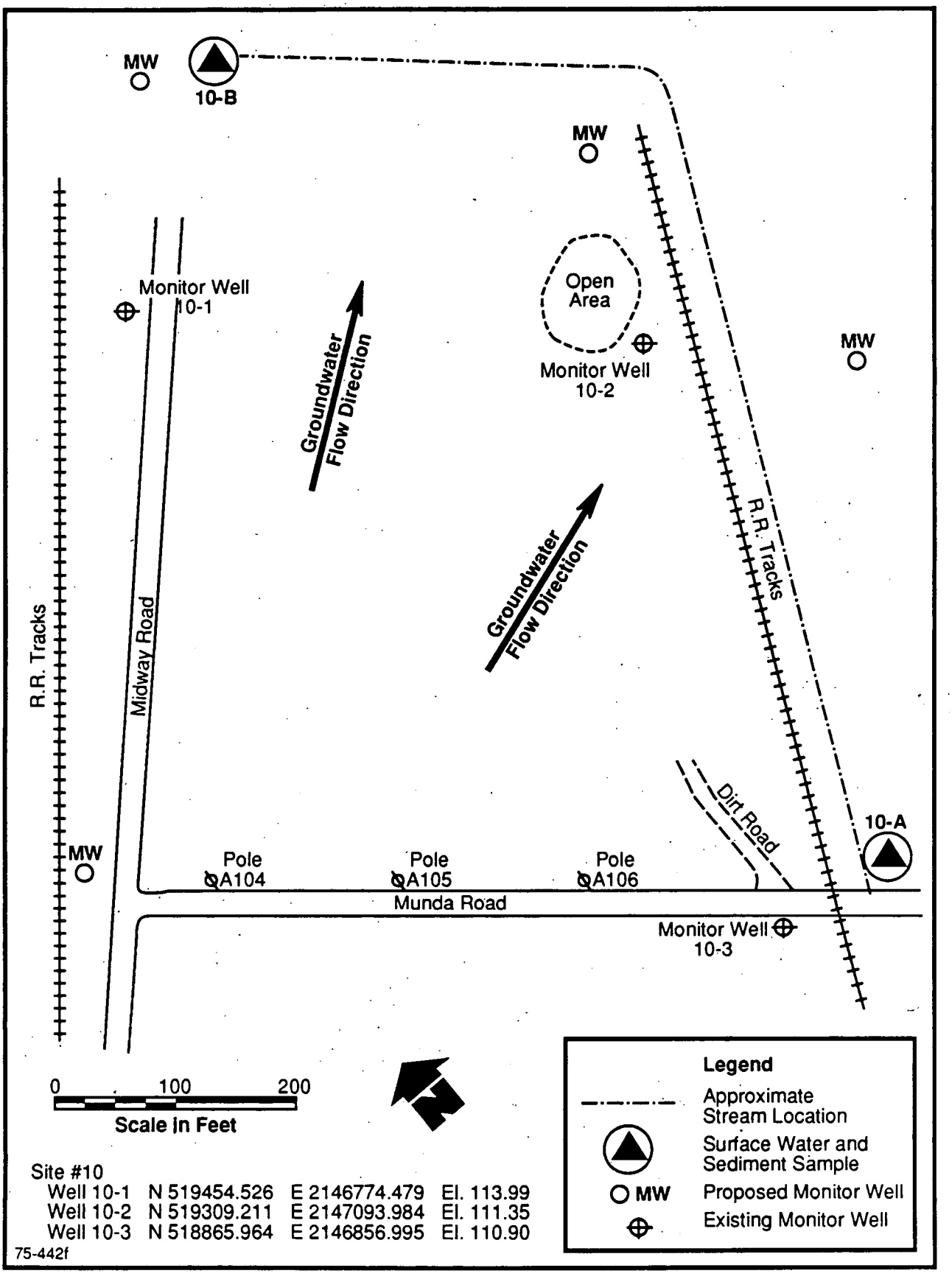


FIGURE 3-7 SITE 10 - SCRAP METAL LANDFILL MONITOR WELL AND SAMPLING LOCATIONS

Establishing the elevation of the top of each monitor well; collecting samples from all groundwater monitor wells.

- Taking a surface water sample at location 10-B.
- Conducting a geophysical survey of the site.
- Analyzing the samples for TOC, volatile and semi-volatile organic compounds, TCL metals, explosives common to the facility, and nitrate/nitrite.
- Identifying and sampling one downgradient monitor well for the entire list of TCL analytes. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.
- Examining historical aerial photographs and topographic maps of the site.

Justification for Additional Data Needs

The lack of evidence supporting reports of past activities supports the need for a geophysical survey of the site. The information from this survey will show landfill boundaries and disposal areas. This information will also be used to locate the proposed groundwater monitor wells. The proposed groundwater monitor well locations are downgradient of the site and are necessary to determine the extent of groundwater contamination and to determine whether the stream, which bounds the site to the east, is a hydraulic boundary to groundwater flow. The groundwater quality results are necessary to evaluate the site and to determine whether the stream is hydraulically connected to the groundwater. The historical aerial photographs and the topographic site map will provide information about past site activities and landfill practices, as well as surface runoff pathways.

3.2.7 Site 11: Contract Ordnance Disposal Area

The extent of the contaminants identified in soil sample 11-A during the Confirmation Study will require further delineation in the next phase of study, including:

- Soil samples taken from the soil borings should be continuous from the surface down to the saturated zone of the groundwater table. These samples should be analyzed for oil and grease and total petroleum hydrocarbons. During the sampling of the soils in this area, small splits of the samples should be placed in glass jars and saturated with potable or deionized water. The soil boring will be terminated when there

is no sheen present on the water surface in the glass jar. This method is used to perform a preliminary screening of potentially oil and grease-contaminated soils from soils with very low levels of these contaminants. Those soils with sheens will be analyzed for petroleum hydrocarbons.

- As indicated in Figure 3-8, one groundwater monitor well, screened across the groundwater table and located north of monitor well 11-3, is proposed for this site.

- Additional proposed work associated with the groundwater hydrology of the site includes groundwater level measurements, establishing the elevation of the top of the proposed groundwater monitor well, and confirmation of the elevation of the top of the well casings of the existing groundwater monitor wells.

- All groundwater monitor wells should be sampled, and the groundwater samples should be analyzed for VOCs, TOX, total petroleum hydrocarbons, and nitrate/nitrite.

- One downgradient monitor well will be identified and sampled for the entire list of TCL analytes. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.

- Additional information requirements for the site consist of historical aerial photographs and a site topographic map.

Justification for Additional Data Needs

The additional soil borings and sampling will determine the lateral and vertical extent of the elevated oil and grease concentrations identified in soil sample 11-A. The extent of the presence of petroleum hydrocarbons compounds should be determined to recommend remediation activities for this site.

The groundwater flow direction reported in the Confirmation Study is different from the predicted direction. The observed groundwater flow direction also contradicts the surface topography. Measuring the groundwater levels and verifying the measuring point elevations established for each monitor well will establish the validity of the previously reported groundwater elevations and flow direction. The proposed groundwater monitor well will provide an additional groundwater elevation data point for the potentiometric map.

The quality of the groundwater will be re-evaluated based on the results of the prior study and the addition of the proposed

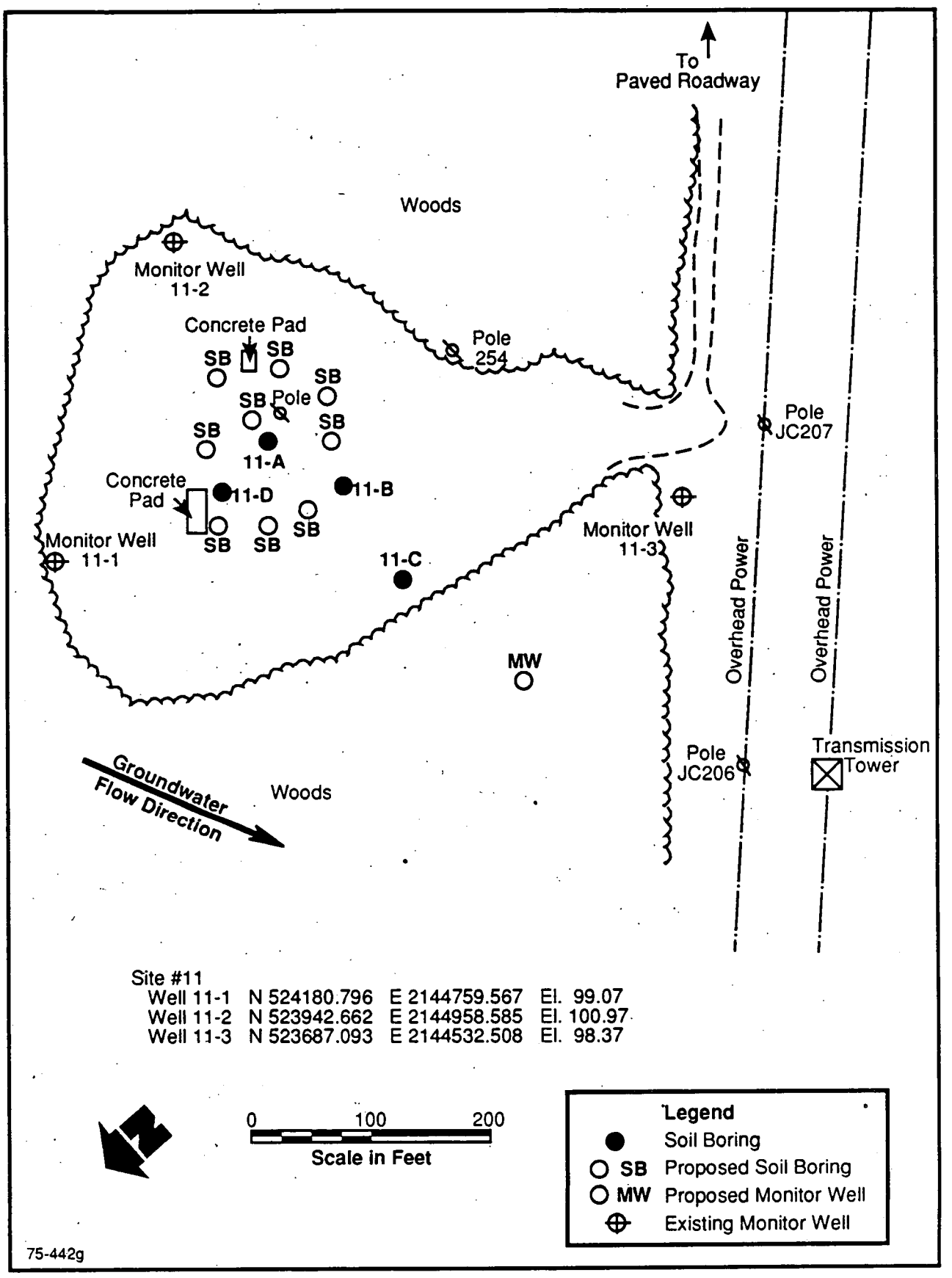


FIGURE 3-8 SITE 11 - CONTRACT ORDNANCE DISPOSAL AREA MONITOR WELL AND SAMPLING LOCATIONS

groundwater monitor well. The analyses of the groundwater samples should also include VOCs because of the high concentrations of organic halogens.

The topographic map and the historical aerial photographs will aid in locating the proposed groundwater monitor well, confirming the elevations of the groundwater monitor wells, and deterining the location of past site activities.

3.2.8 Site 19: Paint Chip and Sludge Disposal Area

The additional data requirements for this site include soil borings, groundwater monitor wells, and groundwater quality data. Contaminants identified in the previous study will require further definition of extent and impact downgradient of the site. The site investigation entails the following proposed activities:

- Twelve soil borings, as located in Figure 3-9, from the surface down to the groundwater saturated soils.
- Three groundwater monitor wells installed hydraulically up- and downgradient of the site, as illustrated in Figure 3-9.
- Sampling of the two surface water locations, 19-A and 19-B.
- Analyses of the groundwater samples for VOCs, TOX, total petroleum hydrocarbons, and TCL metals. The surface water samples should be analyzed for TOX, VOCs, and TCL metals. The analyses of the soil samples should include volatile and semivolatile organic compounds, total petroleum hydrocarbons, and TCL metals.
- One downgradient monitor well will be identified and sampled for the entire list of TCL analytes. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.
- Detailed topographic map of the site and historical aerial photographs should be examined.

Justification for Additional Data Needs

The soil borings and the additional groundwater monitor wells are needed to define the extent of the identified on-site contaminants. This additional information is needed to determine the impact on the groundwater downgradient of the site. The proposed groundwater monitor well upgradient of monitor well 19-1 will provide a basis for comparing analytical results.

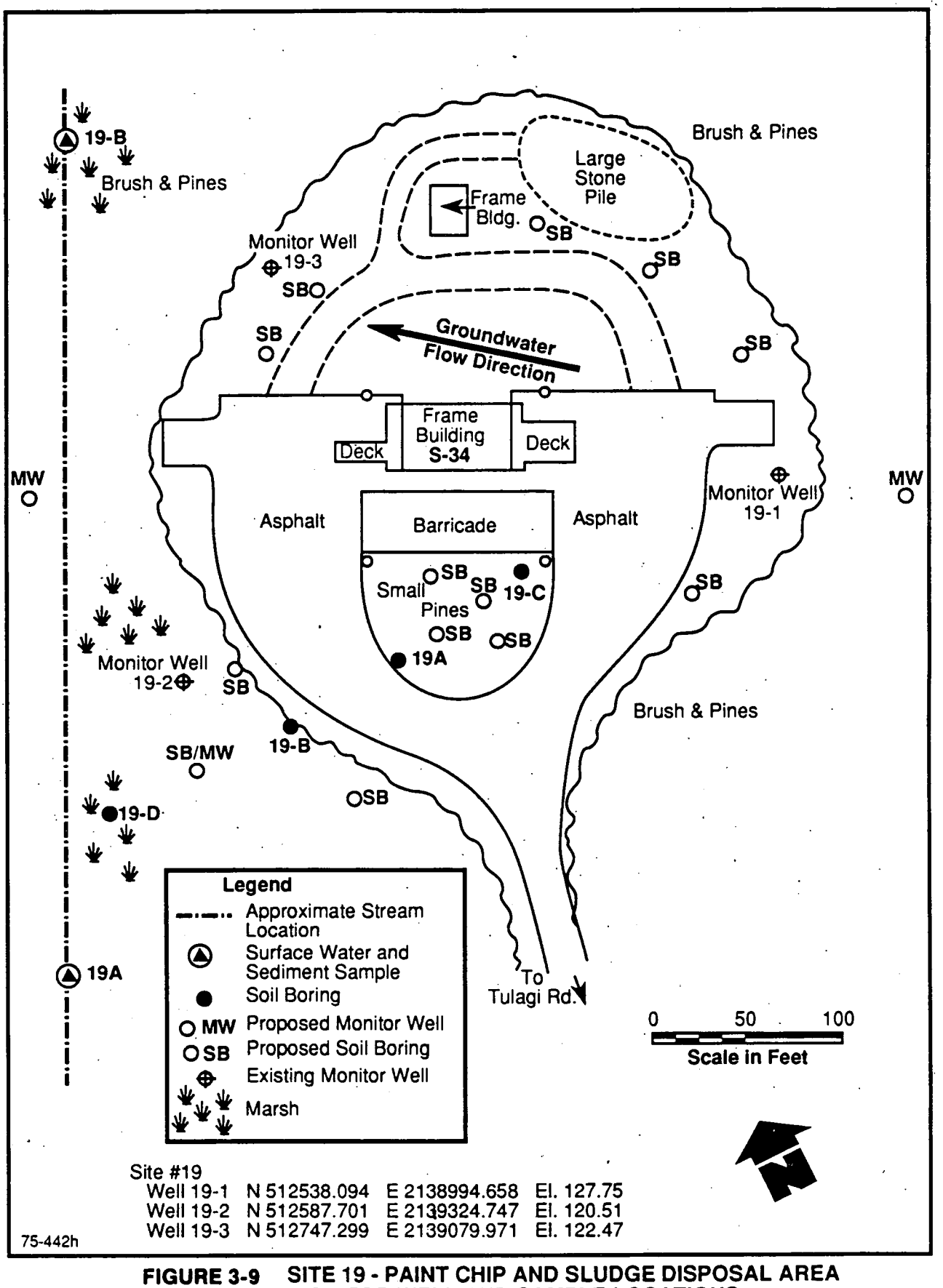


FIGURE 3-9 SITE 19 - PAINT CHIP AND SLUDGE DISPOSAL AREA MONITOR WELL AND SAMPLE LOCATIONS

The acquisition and analysis of soil borings at the northeastern portion of the site is necessary to determine whether the origin of the cadmium present in the groundwater is due to on-site sources. Sampling of the surface water is necessary to determine the impact of the discharged wastewater from the on-site operations on the surface water. The downgradient groundwater monitor wells are needed to determine the impact on the groundwater.

A detailed topographic map of the site and the surrounding area is needed to determine the surface water runoff pathway, potential upgradient sources, and possible locations for additional groundwater monitoring points. The historical aerial photographs will be used to locate past disposal and stockpile areas.

3.2.9 Site 20: Grit Blasting Disposal Area, Building 544

The additional data requirements for this site are:

- A detailed topographic map of the site and historical aerial photographs of the site area, shown in Figure 3-10.
- A topographic map will be used to determine surface water flow and monitor well locations. The topographic map will also provide information on surface features, including low points where runoff from the settling basin may have accumulated.

Justification for Additional Data Needs

The historical aerial photographs will be used to locate past disposal activities and stockpile areas to confirm that the proper locations, those most likely to have contaminants present, have been sampled.

3.2.10 Site 22: Paint Chip Disposal Area Adjacent to Building D2

The additional data requirements for this site are:

- A detailed topographic map of the site and historical aerial photographs of the site area, shown in Figure 3-11.
- A topographic map will be used to determine surface water flow and monitor well locations. The topographic map will also provide information on surface features, including low points where runoff from the settling basin may have accumulated.

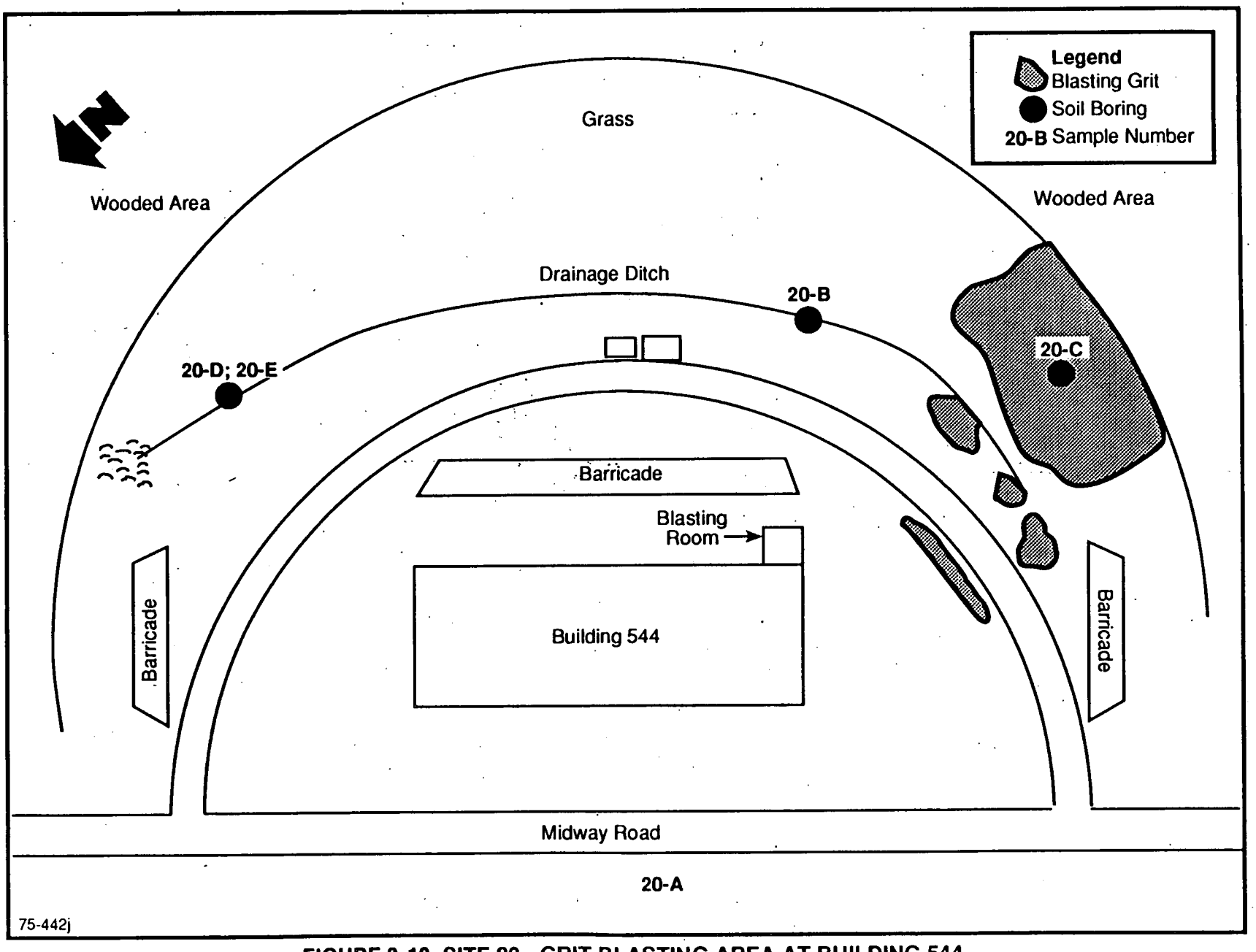


FIGURE 3-10 SITE 20 - GRIT BLASTING AREA AT BUILDING 544

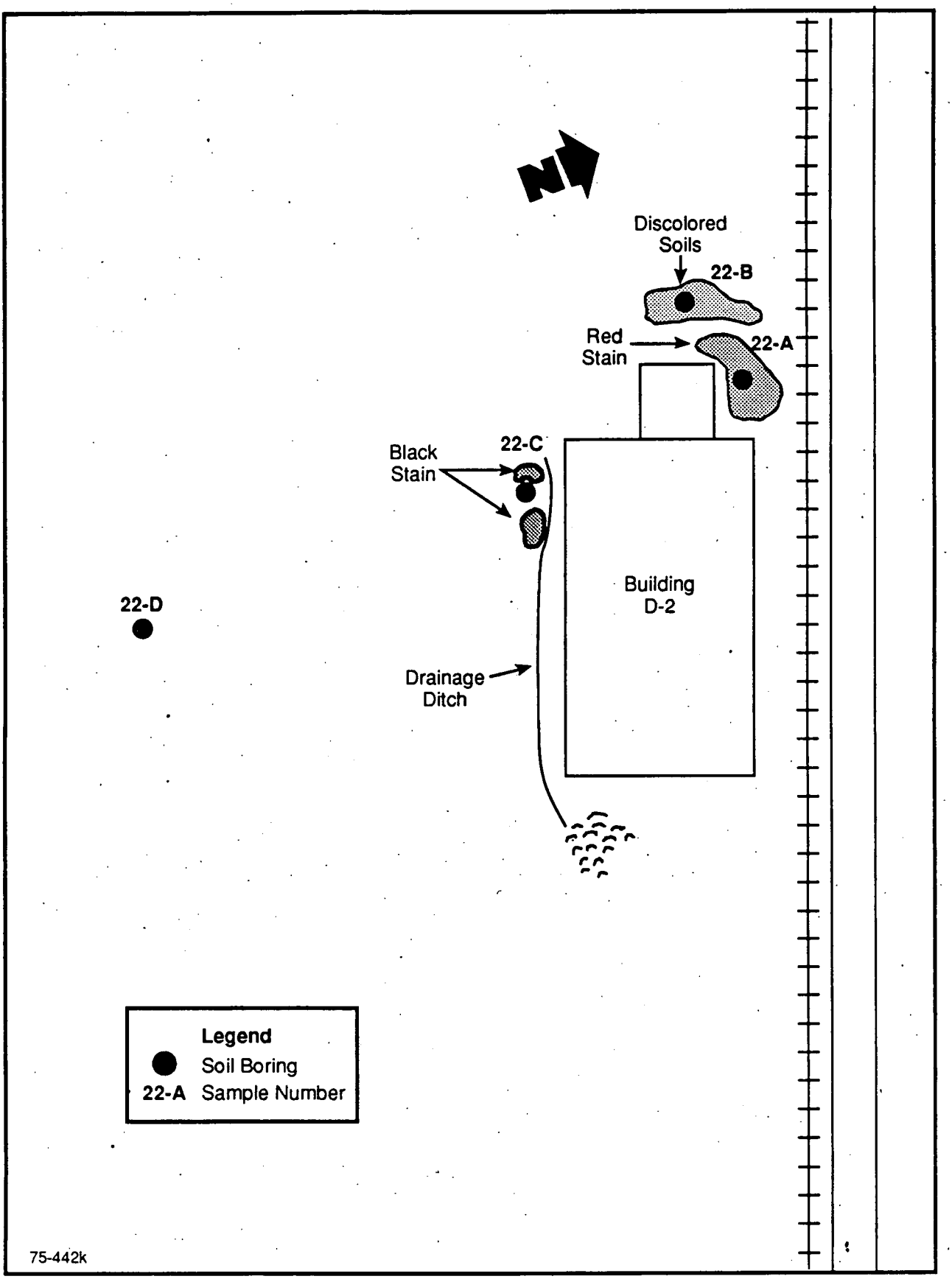


FIGURE 3-11 SITE 22 - PAINT CHIP DISPOSAL AREA

Justification for Additi nal Data N eds

The historical aerial photographs will be used to locate past disposal activities and stockpile or disposal areas. This analysis is to confirm that the soils most likely to have been contaminated have been sampled.

3.2.11 Site 26: Explosive "D" Washout Area

The additional data requirements for this site are:

- A topographic map will be used to determine surface water flow and monitor well locations. The topographic map will also provide information on surface features, including low points where runoff from the settling basin may have accumulated.

- One groundwater monitor well downgradient of the settling basin, west of monitor well 26-1, will be installed.

- One downgradient monitor well will be identified and sampled for the entire list of TCL analytes. These analyses would include metals, nonmetals, PCBs, and pesticides, but would not include dioxins, which have not been identified to have been used on the facility.

- Soil samples within the settling basin will be obtained. The soil will be analyzed for nitrate/nitrite and picric acid.

- The location of the proposed groundwater monitor well, illustrated in Figure 3-12, will be used as an additional groundwater data point. This groundwater monitor well will allow groundwater level measurements and sampling.

- Additional requirements for the next phase of work also include resampling of all wells for pH, picric acid, specific conductance, and nitrate/nitrite.

Justification for Additional Data Needs

The groundwater monitor well will be used to determine the groundwater quality hydraulically downgradient of the settling basin. The soil samples taken in the settling basin and in low points downslope of the settling basin will be used to determine the presence of picric acid or nitrate/nitrite in the soils and to evaluate possible remedial actions.

The topographic map will be used to identify optimal soil sampling sites in the basin and downslope, as well as surface water runoff pathways and groundwater monitor well locations.

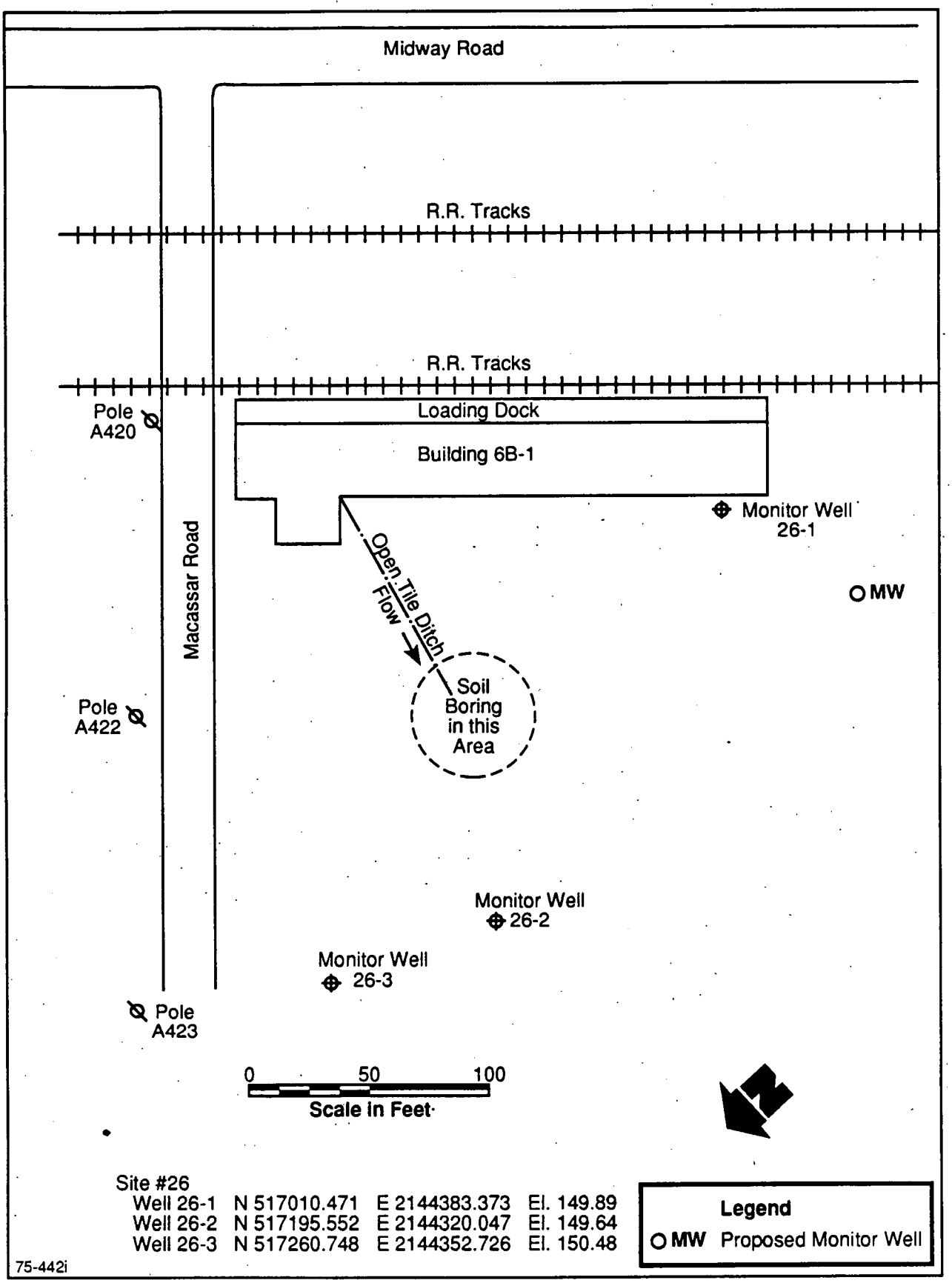


FIGURE 3-12 SITE 26 - EXPLOSIVE "D" WASHOUT AREA MONITOR WELL LOCATIONS

3.3 PROJECT LOGIC AND TASKS

The schedule for the execution of the foregoing tasks is determined by the approval of the plans and the task durations and the relationships of data gathering and interpretation. The project logic flow diagram is included to illustrate the proposed scenario of data acquisition and analysis (see Figure 3-13). The critical path and interrelationships between tasks have been determined and are shown on this PERT diagram.

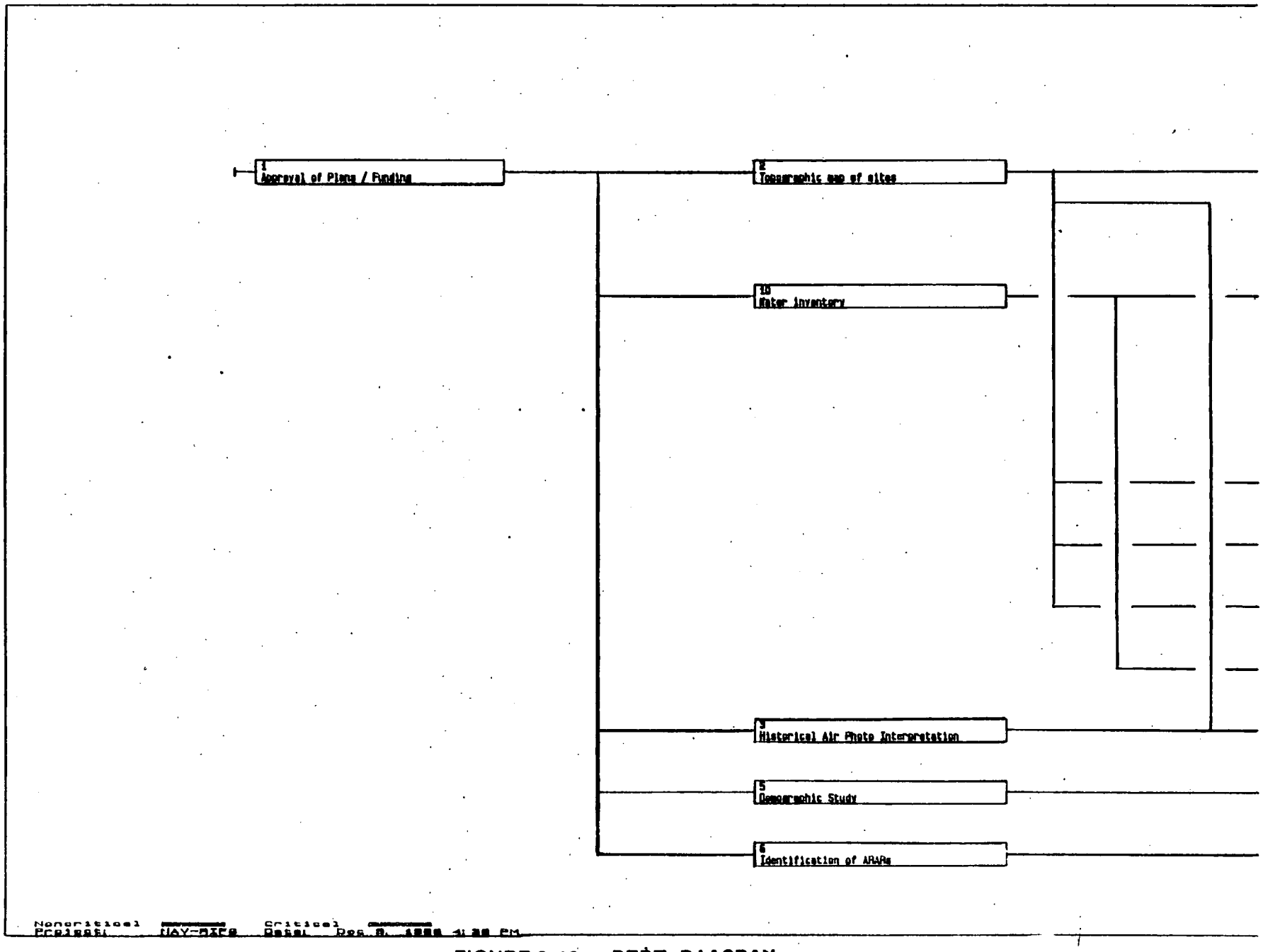


FIGURE 3-13 PERT DIAGRAM

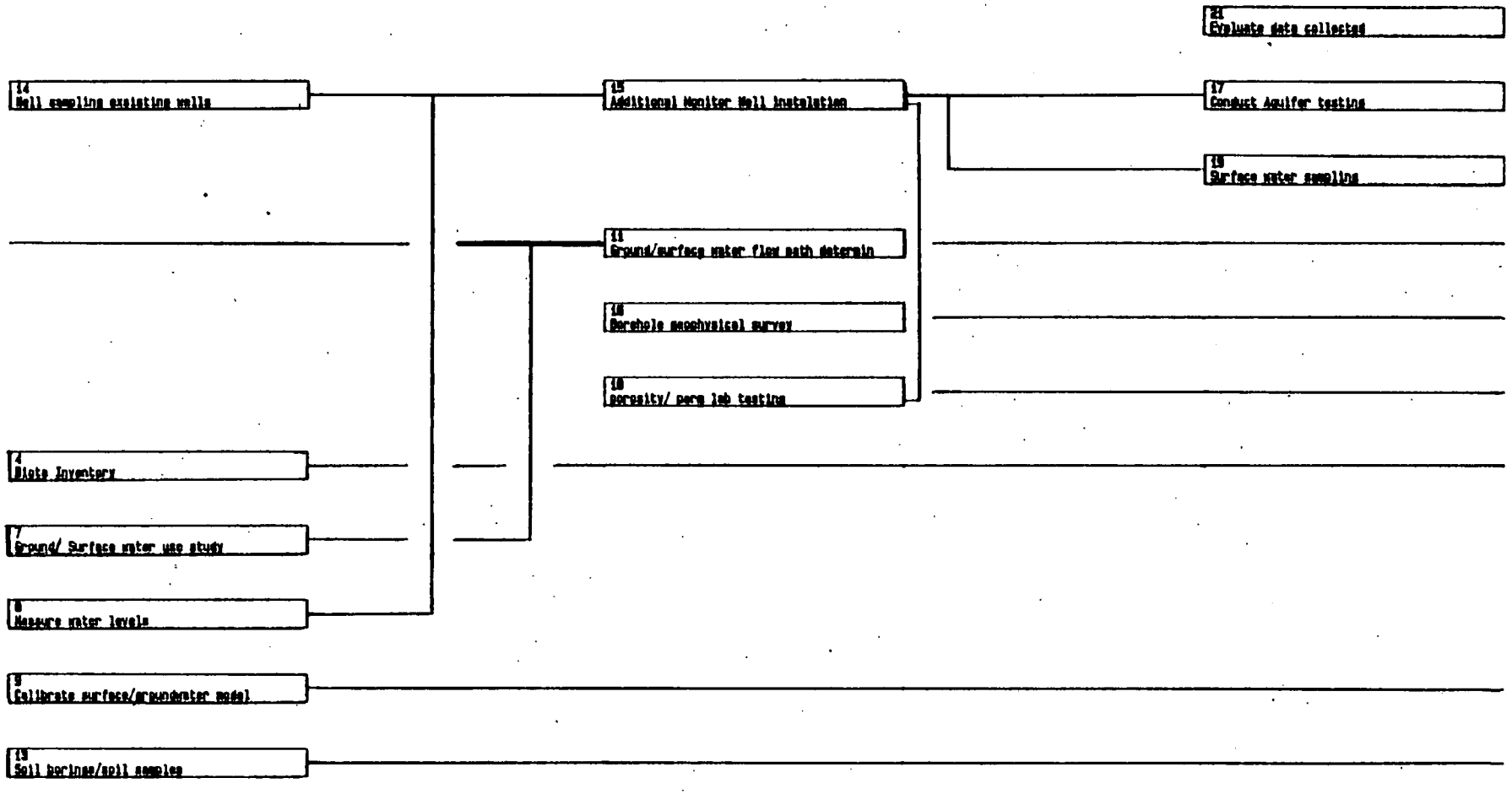


FIGURE 3-13 (CONTINUED)

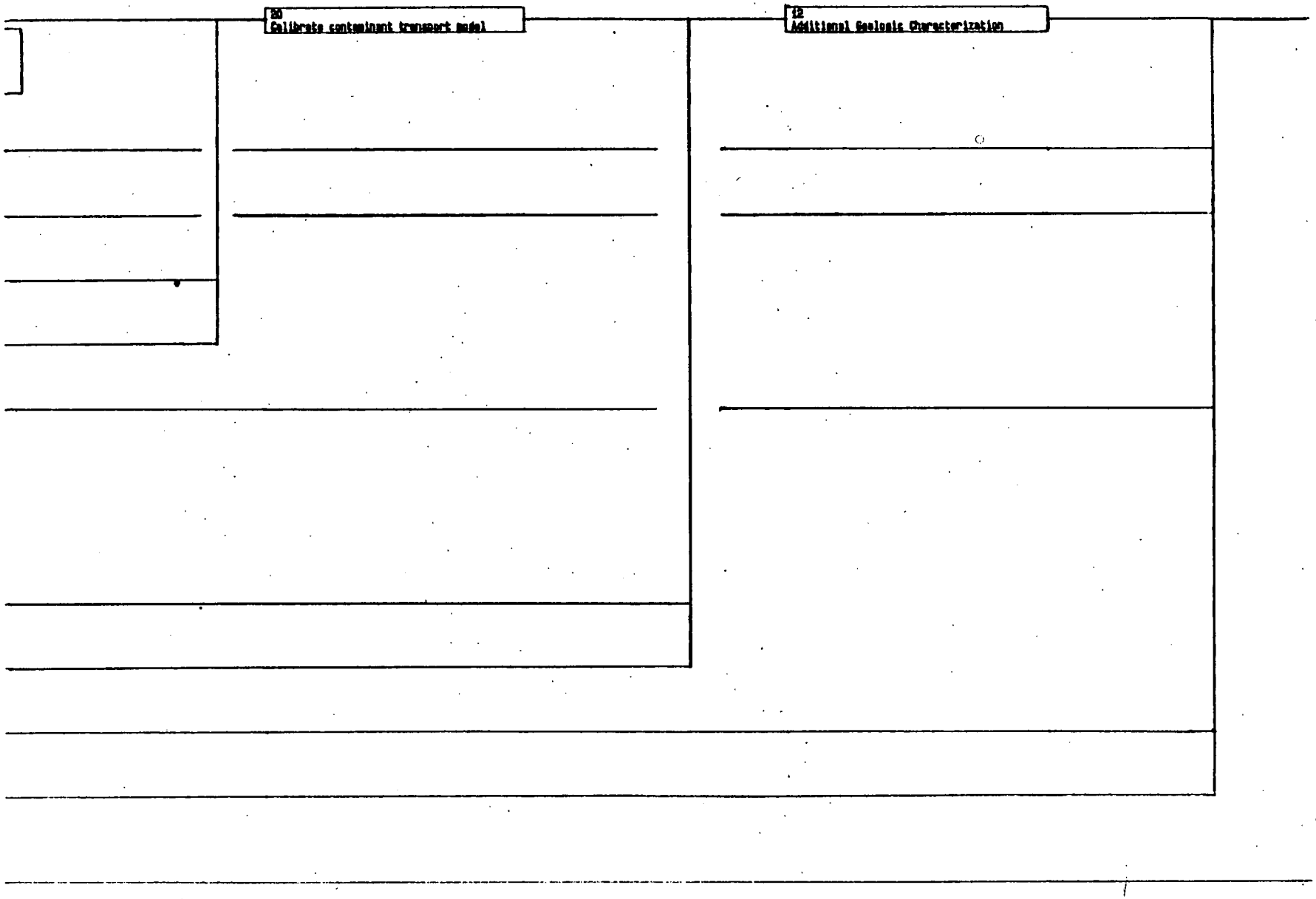


FIGURE 3-13 (CONTINUED)

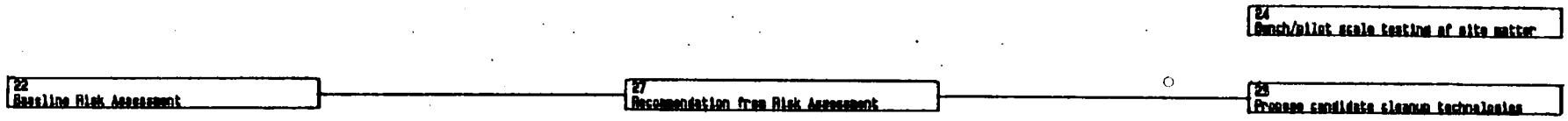


FIGURE 3-13 CONTINUED

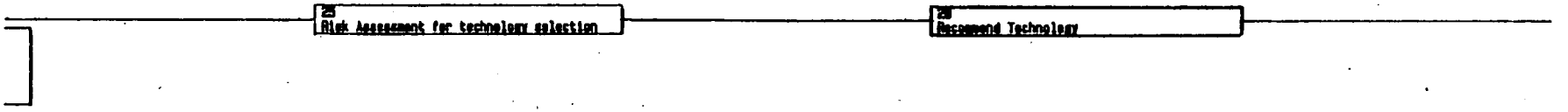


FIGURE 3-13 (CONTINUED)

AIRS NWS EARLS
PERT Diagram
FARWCS 2.0

FIGURE [illegible] (CONTINUED)

REFERENCES

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WESTON

Appendix A
Analytical Results Summary Tables

The regulatory concentrations compared in the following tables ar as follows:

Groundwater - NJAC 7:9-6, Groundwater standards
Surface Water - NJAC 7:9-4, Surface water criteria
Soil and Sediments - NJDEP Soil Cleanup Objectives

TABLE 3-3A

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 2

Analyte	Sample Number 2-1	2-1B	2-2	2-3	2-4	Regulatory Limit
Total Organic Halogens (ug/l)	20.0	1.00	35.0	18.0	27.0	NRC
Total Organic Carbon (mg/l)	2.39	1.58	2.25	4.12	2.25	NRC
Nitrate/Nitrite (mg/l)	ND	ND	ND	0.70	0.20	10
Base/Neutral/Acid Compounds (ug/l)	ND	ND	ND	ND	ND	100
Explosives:						
HMX (ug/l)	ND	ND	ND	ND	ND	NRC
RDX (ug/l)	ND	ND	ND	ND	ND	NRC
2,4,6-TNT (ug/l)	ND	ND	ND	ND	ND	NRC
Nitroglycerin (mg/l)	ND	NR	ND	ND	ND	NRC
Picric Acid (ug/l)	ND	ND	ND	ND	ND	NRC
Soluble Metals (mg/l):						
Sb	ND	ND	ND	ND	ND	NRC
As	ND	ND	ND	ND	ND	0.050
Be	ND	ND	ND	ND	ND	NRC
Cd	ND	ND	ND	ND	ND	0.010
Cr	0.023	0.014	ND	ND	ND	0.050
Cu	0.024	0.014	ND	ND	ND	NRC
Pb	ND	ND	ND	ND	ND	0.050
Hg (ug/l)	ND	ND	ND	ND	ND	0.002
Ni	0.03	0.04	ND	ND	ND	NRC
Se	ND	ND	ND	ND	ND	0.010
Ag	0.004	ND	ND	ND	ND	0.050
Tl	ND	ND	ND	ND	ND	NRC
Zn	0.016	ND	0.03	0.04	0.02	NRC
pH (Lab Measured)	5.10	6.10	4.90	4.80	4.90	
pH (Field Measured)	5.3	NR	7.0	5.2	6.8	
Chloride (mg/l)	7.00	ND	8.60	5.00	7.60	NRC
Specific Conductance (umhos)	40.6	1.12	50.1	47.2	38.6	NRC
Specific Conductance* (umhos)	40	NR	40	40	30	NRC
Temperature (C)	20	NR	14	16	14	NRC

ND Not Detected
NR Analysis Not Requested
NRC No Specific Regulatory Concentration

* Field Measured

A Duplicate Sample
B Field Blank

TABLE 3-38

ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES COLLECTED IN JULY 1986

SITE 2

Analyte	Sample Number			
	2-A (1st Hour)	2-A (6th Hour)	2-A BLANK	Regulatory Limit
Total Organic Halogens (ug/l)	40.0	35.0	NR	NRC
Total Organic Carbon (mg/l)	4.13	4.13	NR	NRC
Nitrate/Nitrite (mg/l)	1.0 (1.0)**	1.0	ND	NRC
Base/Neutral/Acid Compounds (ug/l)	ND	ND	NR	NRC
Explosives:				
HMX (ug/l)	ND	ND	ND	NRC
RDX (ug/l)	ND	ND	ND	NRC
2,4,6-TNT (ug/l)	ND	ND	ND	NRC
Nitroglycerin (mg/l)	ND	ND	ND	NRC
Picric Acid (ug/l)	ND	ND	ND	NRC
Soluble Metals (mg/l):				
Sb	ND	ND	NR	NRC
As	ND	ND	NR	0.050
Be	ND	ND	NR	NRC
Cd	ND	ND	NR	0.010
Cr	0 .016	0.017	NR	0.050
Cu	0.021	0.022	NR	NRC
Pb	0.014	0.014	NR	0.050
Hg (ug/l)	ND	ND	NR	0.020
Ni	0.04	0.04	NR	NRC
Se	ND	ND	NR	0.010
Ag	ND	ND	NR	0.050
Tl	ND	ND	NR	NRC
Zn	0.018	0.045	NR	NRC
pH (Lab Measured)	4.20	4.20	NR	
Chloride (mg/l)	ND	ND	NR	NRC
Specific Conductance (umhos)	36.1	35.8	NR	NRC

ND Not Detected

NR Analysis Not Requested

NRC No Specific Regulatory Concentrations

** Duplicate Sample

TABLE 3-3C

ANALYTICAL RESULTS FOR SEDIMENT SAMPLES COLLECTED IN JULY 1986

SITE 2

Analyte	Sample Number				
	2-A (1st Hour)	2-A (6th Hour)	2-A DUP	2-A BLANK	Regulated Limits
Nitrate/Nitrite (ug/g)	ND	ND	ND	ND	NRC
HMX (ug/g)	ND	ND	ND	ND	NRC
RDX (ug/g)	ND	ND	ND	ND	NRC
2,4,6-TNT (ug/g)	ND	ND	ND	ND	NRC
Nitroglycerin (ug/g)	ND	ND	ND	ND	NRC
Picric Acid (ug/kg)	ND	ND	ND	ND	NRC

ND Not Detected

NRC No Specific Regulated Concentration

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 3

Analyte	Sample Number 3-1	3-2	3-3	3-3A	3-3B	Regulatory Limit
Total Organic Halogens (ug/l)	28.0	12.0	25.0	35.0	17.0	NRC
Total Organic Carbon (mg/l)	7.10	4.44	3.60	3.39	2.15	NRC
Volatile Organic Compounds (ug/l)	ND	ND	ND	ND	ND	10
Petroleum Hydrocarbons (mg/l)	1.00	ND	ND	ND	ND	1
Pesticides (ug/l)	ND	ND	ND	ND	ND	compond specific
Nitrate/Nitrite (mg/l)	ND	ND	0.20	NR	ND	10
Base/Neutral/Acid Compounds (ug/l)	ND	ND	ND	ND	ND	100
Soluble Metals (mg/l):	ND	ND	ND	ND	ND	
Sb	ND	ND	ND	ND	ND	NRC
As	ND	ND	ND	ND	ND	0.050
Be	ND	ND	ND	ND	ND	NRC
Cd	0.008	ND	ND	ND	ND	0.010
Cr	0.017	0.013	ND	ND	ND	0.050
Cu	0.015	0.016	ND	ND	ND	NRC
Pb	ND	ND	ND	ND	ND	0.050
Hg (ug/l)	ND	ND	ND	ND	ND	0.002
Ni	0.05	0.05	ND	ND	ND	NRC
Se	ND	ND	ND	ND	ND	0.010
Ag	ND	ND	ND	ND	ND	0.050
Tl	ND	ND	ND	ND	ND	NRC
Zn	0.226	0.087	0.11	0.20	ND	NRC
pH (Lab Measured)	2.90	3.80	4.70	NR	7.10	
pH (Field Measured)	3.9	--	5.5	NR	NR	
Chloride (mg/l)	8.80	5.80	7.80	NR	ND	NRC
Specific Conductance (umhos)	609	103	54.3	NR	2.48	NRC
Specific Conductance* (umhos)	290	100	40	NR	NR	NRC
Temperature (C)	17	18	17	NR	NR	NRC

ND Not Detected
NR Analysis Not Requested
NRC No Specific Regulatory Concentration

* Field Measured

A Duplicate Sample
B Field Blank

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 4

Analyte	Sample Number 4-1	4-2	4-3	Regulatory Limit
Total Organic Halogens (ug/l)	17.0	18.0	17.0	NRC
Total Organic Carbon (mg/l)	1.94	4.74	2.15	NRC
Volatile Organic Compounds (ug/l)	ND	ND	ND	10
Petroleum Hydrocarbons (mg/l)	ND	ND	ND	1
Pesticides (ug/l)	ND	ND	ND	compound specific
Nitrate/Nitrite (mg/l)	ND	ND	ND	10
Base/Neutral/Acid Compounds (ug/l):		ND	ND	100
bis(2-Ethylhexyl)Phthalate	53	ND	ND	
Soluble Metals (mg/l):				
Sb	ND	ND	ND	NRC
As	ND	ND	ND	0.050
Be	ND	ND	ND	NRC
Cd	ND	ND	ND	0.010
Cr	ND	ND	ND	0.050
Cu	ND	ND	ND	NRC
Pb	ND	ND	ND	0.050
Hg (ug/l)	ND	ND	ND	0.002
Ni	ND	ND	ND	NRC
Se	ND	ND	ND	0.010
Ag	ND	ND	ND	0.050
Tl	ND	ND	ND	NRC
Zn	0.06	0.03	0.06	NRC
pH (Lab Measured)	4.50	6.50	4.50	
pH (Field Measured)	5.0	6.0	5.0	
Chloride (mg/l)	6.80	6.40	6.40	NRC
Specific Conductance (umhos)	77.8	72.3	56.0	NRC
Specific Conductance* (umhos)	60	160	40	NRC
Temperature (C)	14	17	14	NRC

ND Not Detected * Field Measured
NR Analysis Not Requested
NRC No Specific Regulatory Concentration

TABLE 3-6

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 5

Analyte	Sample Number					Regulatory
	5-1	5-1B	5-2	5-3	5-4	Limit
Total Organic Halogens (ug/l)	241	NR	68.0	41.0	29.0	NRC
Total Organic Carbon (mg/l)	6.44	NR	1.18	7.45	4.85	NRC
Volatile Organic Compounds (ug/l):						
Methylene chloride	8J	420	8J	7J	5J	
Acetone	110	5J	6J	12	ND	
2-Butanone	12	7J	6J	8J	9J	
Petroleum Hydrocarbons (mg/l)	ND	NR	ND	ND	ND	1
Pesticides (ug/l)	ND	ND	ND	ND	ND	compound specific
Nitrate/Nitrite (mg/l)	ND	NR	ND	.20	ND	10
Base/Neutral/Acid Compounds (ug/l):						100
Pentachlorophenol	81	NR	10J	150	ND	
Soluble Metals (mg/l):						
Sb	ND	NR	ND	ND	ND	NRC
As	ND	NR	ND	ND	ND	0.050
Be	ND	NR	ND	ND	ND	NRC
Cd	ND	NR	ND	ND	ND	0.010
Cr	ND	NR	ND	ND	0.019	0.050
Cu	ND	NR	ND	ND	0.022	NRC
Pb	ND	NR	ND	ND	ND	0.050
Hg (ug/l)	ND	NR	ND	ND	ND	0.002
Ni	ND	NR	ND	ND	0.04	NRC
Se	ND	NR	ND	ND	ND	0.010
Ag	ND	NR	ND	ND	ND	0.050
Tl	ND	NR	ND	ND	ND	NRC
Zn	0.017	NR	0.016	0.033	0.035	NRC
pH (Lab Measured)	4.25	NR	4.25	4.20	4.40	
pH (Field Measured)	5.1	NR	4.5	5.0	5.1	
Chloride (mg/l)	10.5	NR	9.80	13.7	8.60	NRC
Specific Conductance (umhos)	72.3	NR	68.6	142	76.0	NRC
Specific Conductance* (umhos)	50	NR	50	80	70	NRC
Temperature (C)	16	NR	15	16	18	NRC

ND Not Detected
NR Analysis Not Requested
J Estimated concentration less than quantification limits but greater than instrument detection limits
NRC No Specific Regulatory Concentrations

* Field Measured
A Duplicate Sample
B Field Blank

TABLE 3-7

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 7

Analyte	Sample Number 7-1	7-2	7-2B	7-3	Regulatory Limit
Total Organic Halogens (ug/l)	23.0	18.0	12.0	18.0	NRC
Total Organic Carbon (mg/l)	1.73	6.51	1.42	2.15	NRC
Volatile Organic Compounds (ug/l):					NRC
Mehtylene chloride	7J	9J	11	6J	
Acetone	22	380	141	ND	
Petroleum Hydrocarbons (mg/l)	ND	ND	ND	ND	1
Pesticides (ug/l)	ND	ND	ND	ND	compound specific
Nitrate/Nitrite (mg/l)	ND	ND	ND	.20	10
Base/Neutral/Acid Compounds (ug/l):		ND	ND	ND	100
di-n-Butyl Phthalate	54	ND	ND	ND	
Soluble Metals (mg/l):			ND	ND	
Sb	ND	ND	ND	ND	NRC
As	ND	ND	ND	ND	0.050
Be	ND	ND	ND	ND	NRC
Cd	ND	ND	ND	ND	0.010
Cr	ND	ND	ND	ND	0.050
Cu	ND	ND	ND	ND	NRC
Pb	ND	ND	ND	ND	0.050
Hg (ug/l)	ND	ND	ND	ND	0.002
Ni	ND	ND	ND	ND	NRC
Se	ND	ND	ND	ND	0.010
Ag	ND	ND	ND	ND	0.050
Tl	ND	ND	ND	ND	NRC
Zn	0.03	0.03	ND	0.09	NRC
pH*(Lab Measured)	4.70	4.20	6.70	4.70	
pH (Field Measured)	5.5	--	NR	6.0	
Chloride (mg/l)	12.3	32.6	11.1	ND	NRC
Specific Conductance (umhos)	63.3	235	1.23	90.6	NRC
Specific Conductance* (umhos)	40	--	NR	60	NRC
Temperature (C)	14	--	NR	16	NRC

ND Not Detected
NR Analysis Not Requested
J Estimated concentration less than quantification limits but greater than instrument detection limits
NRC No Specific Regulatory Concentration

* Field Measured
A Duplicate Sample
B Field Blank

ANALYTICAL RESULTS FOR SEDIMENT SAMPLES COLLECTED IN JULY 1986

SITE 10

Analyte	Sample Number				Regulated Concentration (ECRA Limits)
	10-A (1st Hour)	10-A (6th Hour)	10-B (1st Hour)	10-B (6th Hour)	
Total Organic Halogens (ug/kg)	ND	ND	ND	ND	NRC
Volatile Organic Compounds (ug/g):					
Methylene Chloride	300	350	8J	ND	1
Acetone	760	41J	10J	37	
Dilution Factor	6.51	5.58	1.22	2.91	
Detection Limit	65	56	12	29	
Petroleum Hydrocarbons (mg/kg)	89.9	91.3	11.2	ND	100
Total Metals (mg/kg):					
Sb	<26.9	<24.2	<13.0	<12.7	NRC
As	<5.41	<5.41	<2.57	<2.49	20
Be	<26.9	<24.2	<13.0	<12.7	1
Cd	<1.35	<1.21	<0.6	<2.0	3
Cr	<53.8	<48.3	<25.9	<25.3	100
Cu	<26.9	<24.2	<13.0	<12.7	170
Pb	14.9	12.9	3.16	2.94	250-1000
Hg	<.250	<.250	<.250	<.250	1
Ni	<23.8	<48.3	<25.9	<25.3	100
Se	<5.40	<2.7	<1.28	<1.25	4
Ag	<5.40	<4.8	<2.57	<2.49	5
Tl	<5.41	<4.83	<2.57	<2.49	NRC
Zn	50.3	<24.2	28.8	<12.7	350

ND Not Detected
NR Analysis Not Requested
J Estimated concentration less than quantification limits but greater than instrument detection limits
Sample detection limits denoted by "<" sign
NRC - NO SPECIFIC REGULATORY CONCENTRATIONS

ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES COLLECTED IN JULY 1986

SITE 10

Analyte	Sample Number				
	10-A (1st Hour)	10-A (6th Hour)	10-B (1st Hour)	10-B (6th Hour)	Regulatory Limit
Total Organic Halogens (ug/l)	10.0	15.0	43.0	29.0	NRC
Total Organic Carbon (mg/l)	3.93	4.03	4.34	4.85	NRC
Volatile Organic Compounds (ug/l)	ND	ND	ND	ND	NRC
Petroleum Hydrocarbons (mg/l)	ND	ND	ND	ND	none detectable
Nitrate/Nitrite (mg/l)	ND	ND	ND	ND	NRC
Base/Neutral/Acid Compounds (ug/l):					
n-nitrosodiphenylamine(1)	ND	ND	31	30	NRC
di-n-butyl-phthalate	ND	2J	70	42	NRC
Soluble Metals (mg/l):					
Sb	ND	--	ND	ND	NRC
As	ND	--	ND	ND	0.050
Be	ND	--	ND	ND	NRC
Cd	ND	--	ND	ND	0.010
Cr	ND	--	ND	ND	0.050
Cu	ND	--	ND	ND	NRC
Pb	ND	--	ND	ND	0.050
Hg (ug/l)	0.3	--	ND	ND	0.020
Ni	ND	--	ND	ND	NRC
Se	ND	--	ND	ND	0.010
Ag	ND	--	0.004	ND	0.050
Tl	ND	--	ND	ND	NRC
Zn	ND	--	ND	ND	NRC
pH (Lab Measured)	6.70	6.70	6.60	6.60	
pH (Field Measured)	NR	NR	NR	NR	
Chloride (mg/l)	6.80	7.20	7.20	6.80	NRC
Specific Conductance (umhos)	74.6	78.8	81.6	81.3	NRC
Specific Conductance* (umhos)	NR	NR	NR	NR	NRC
Temperature (C)	NR	NR	NR	NR	NRC

ND Not Detected
NR Analysis Not Requested
NRC No Specific Regulatory Concentration

* Field Measured
-- Sample Not Analyzed

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 10

Analyte	Sample Number 10-1	10-2	10-2A	10-3	Regulatory Limit	
Total Organic Halogens (ug/l)	67.0	36.0	108	20.0	NRC	
Total Organic Carbon (mg/l)	4.62	5.73	4.92	3.81	NRC	
Volatile Organic Compounds (ug/l):					10	
Methylene chloride	16	9J	14	9J		
Acetone	ND	7J	ND	10		
2-Butanone	ND	10	ND	11		
Petroleum Hydrocarbons (mg/l)	ND	ND	ND	ND	1	
Nitrate/Nitrite (mg/l)	.10	ND	ND	.10	10	
Base/Neutral/Acid Compounds (ug/l)	ND	ND	ND	ND	100	
Soluble Metals (mg/l):						
Sb	ND	ND	ND	ND	NRC	
As	ND	ND	ND	ND		0.050
Be	ND	ND	ND	ND	NRC	
Cd	0.006	ND	ND	ND		0.010
Cr	ND	ND	ND	ND		0.050
Cu	0.03	ND	ND	ND	NRC	
Pb	ND	ND	ND	ND		0.050
Hg (ug/l)	ND	ND	ND	ND		0.002
Ni	0.014	ND	ND	ND	NRC	
Se	ND	ND	ND	ND		0.010
Ag	ND	ND	ND	ND		0.050
Tl	ND	ND	ND	ND	NRC	
Zn	0.09	1.01	0.82	0.08	NRC	
pH (Lab Measured)	4.40	4.25	4.30	4.35		
pH (Field Measured)	4.4	4.3	NR	4.0		
Chloride (mg/l)	20.1	8.20	8.50	11.0	NRC	
Specific Conductance (umhos)	161	125	122	135	NRC	
Specific Conductance* (umhos)	140	105	NR	85	NRC	
Temperature (C)	13	16	NR	16	NRC	

ND Not Detected
NR Analysis Not Requested
J Estimated concentration less than quantification limits but greater than instrument detection limits
NRC No Specific Regulatory Concentration

* Field Measured
A Duplicate Sample
B Field Blank

Analytical Results for Soil Samples Collected in March 1986

SITE 11

Sample Number	Oil and Grease (Method 413.3) (mg/kg)
11-A	
(6" - 9")	37,300
(2' - 2.5')	76.3
11-B	
(6" - 9")	112
(2' - 2.5')	15.5
11-C	
(6" - 9")	2.60
(2' - 2.5')	1.75
11-D	
(6" - 9")	8.20
(2' - 2.5')	3.70
Detection Limit	1.0
Regulated Limit	No Specific Regulatory Limit Established

TABLE 3-9A

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 11

Analyte	Sample Number 11-1	11-2	11-2B	11-3	11-3A	Regulatory Limit
Total Organic Halogens (ug/l)	202	60.0	13.0	169	123	NRC
Total Organic Carbon (mg/l)	11.9	3.91	.977	7.66	8.77	NRC
Base/Neutral/Acid Compounds (ug/l):						100
Pentachlorophenol	120	ND	ND	ND	ND	
Oil and Grease	ND	ND	ND	ND	ND	NRC
Nitrate/Nitrite (mg/l)	.30	ND	ND	ND	ND	10
Explosives:						
HMX (ug/l)	ND	ND	ND	ND	ND	NRC
RDX (ug/l)	ND	ND	ND	ND	ND	NRC
2,4,6-TNT (ug/l)	ND	ND	1.85	ND	NR	NRC
Nitroglycerin (mg/l)	ND	ND	ND	ND	NR	NRC
Picric Acid (ug/l)	ND	ND	ND	ND	ND	NRC
Soluble Metals (mg/l):						
Sb	ND	ND	ND	ND	ND	NRC
As	ND	ND	ND	ND	ND	0.050
Be	ND	ND	ND	ND	ND	NRC
Cd	ND	ND	ND	ND	ND	0.010
Cr	ND	ND	ND	ND	ND	0.050
Cu	ND	ND	ND	ND	ND	NRC
Pb	ND	ND	ND	ND	ND	0.050
Hg (ug/l)	ND	ND	ND	ND	ND	0.002
Ni	ND	ND	ND	ND	ND	NRC
Se	ND	ND	ND	ND	ND	0.010
Ag	ND	ND	ND	ND	ND	0.050
Tl	ND	ND	ND	ND	ND	NRC
Zn	0.03	0.07	0.010	0.06	0.04	NRC
pH (Lab Measured)	4.50	3.95	7.30	4.25	4.95	
pH (Field Measured)	5.0	4.5	NR	4.7	NR	
Chloride (mg/l)	6.20	9.60	ND	7.60	8.50	NRC
Specific Conductance (umhos)	53.6	77.7	1.78	64.6	63.7	NRC
Specific Conductance* (umhos)	40	70	NR	50	NR	NRC
Temperature (C)	20	20	NR	18	NR	NRC

ND Not Detected
NR Analysis Not Requested
NRC No Specific Regulatory Concentration

* Field Measured

A Duplicate Sample
B Field Blank

ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES COLLECTED IN JULY 1986

SITE 19

Analyte	Sample Number					
	19-A (1st Hour)	19-A (6th Hour)	19-A Dup	19-A Blank	19-B (1st Hour)	19-B (6th Hour)
Total Organic Halogens (ug/l)	65.0	9.00	29.0	NR	49.0	36.0
Total Organic Carbon (mg/l)	17.3	30.0	17.0	.962	22.6	19.3
Volatile Organic Compounds (ug/l)	ND	ND	ND	ND	ND	ND
Petroleum Hydrocarbons (mg/l)	ND	ND	ND	ND	ND	4.20
Nitrate/Nitrite (mg/l)	ND	ND	ND	ND	ND	ND
Base/Neutral/Acid Compounds (ug/l)	ND	ND	ND	ND	ND	ND
Soluble Metals (mg/l):						
Sb	ND	ND	ND	ND	ND	ND
As	ND	ND	ND	ND	ND	ND
Be	ND	ND	ND	ND	ND	ND
Cd	ND	ND	ND	ND	ND	ND
Cr	0.014	0.016	0.021	0.018	0.014	0.014
Cu	0.018	0.017	0.018	0.019	0.017	0.018
Pb	ND	ND	ND	ND	ND	ND
Hg (ug/l)	ND	ND	ND	ND	ND	ND
Ni	0.03	0.04	0.04	0.04	0.04	0.03
Se	ND	ND	ND	ND	ND	ND
Ag	ND	ND	ND	ND	ND	ND
Tl	ND	ND	ND	ND	ND	ND
Zn	0.027	0.028	0.033	ND	0.122	0.014
pH (Lab Measured)	5.20	5.20	5.10	6.00	4.80	4.80
pH (Field Measured)	NR	NR	NR	NR	NR	NR
Chloride (mg/l)	15.0	13.2	14.6	ND	14.6	13.8
Specific Conductance (umhos)	56.6	53.7	55.6	1.03	61.9	55.2
Specific Conductance* (umhos)	NR	NR	NR	NR	NR	NR
Temperature (C)	NR	NR	NR	NR	NR	NR

ND Not Detected

NR Analysis Not Requested

NRC No Specific Regulatory Concentrations

* Field Measured

Regulatory
Limit

NRC
NRC
NRC
none detectable

NRC

NRC
0.050
NRC
0.010
0.050
NRC
0.050
0.020
NRC
0.010
0.050
NRC
NRC

NRC
NRC
NRC
NRC

TABLE 3-10C

ANALYTICAL RESULTS FOR SEDIMENT SAMPLES COLLECTED IN JULY 1986

SITE 19

Analyte	Sample Number			
	19-A (1st Hour)	19-A (6th Hour)	19-A Dup	19-A Blank
Total Organic Halogens (ug/g)	ND	ND	ND	NR
Volatile Organic Compounds (ug/kg):				
Methylene Chloride	8J	NRP	75	7J (ug/l)
Acetone	7J	230	53	2J
Chloroform	ND	ND	25	ND
2-Butanone	ND	ND	ND	ND
Toluene	ND	2J	ND	ND
Dilution Factor	1.46	1.48	1.55	1.0
Detection Limit	15	15	16	10
Petroleum Hydrocarbons (mg/kg)	82.8	14.9	129	ND
Total Metals (mg/kg):				
Sb	<14.1	<14.4	<13.0	<0.05
As	<2.82	<2.89	<2.76	<0.01
Be	<14.1	<14.4	<13.0	<0.05
Cd	<0.7	<0.7	<0.7	<.0025
Cr	<28.2	<28.8	<26.0	<0.1
Cu	<14.1	<14.4	<13.0	<0.05
Pb	5.83	4.65	6.86	<0.005
Hg	<.250	0.423	<.250	<.250
Ni	<28.2	<28.8	<26.0	<0.1
Se	<1.41	<1.44	<1.38	<0.005
Ag	<2.82	<2.89	<2.75	<0.01
Tl	<2.82	<2.89	<2.76	<0.01
Zn	<14.1	<14.4	<13.0	<0.05

ND Not Detected
NR Analysis Not Requested
J Estimated Concentration less than quantification limits but greater than instrument detection limits
NRP Not Reported; see lab report
* Sample 19-B sediment had high water content
NRC - No Specific Regulated Concentration

19-8*(1st Hour)	19-8*(6th Hour)	Regulated Concentration (ECRA Limits)
ND	ND	NRC
		1
210	NRP	
1200	730	
37	ND	
240	ND	
170	ND	
13.1	11.1	
130	110	
445	681	100
<100	<123.5	NRC
<19.9	<25.0	20
<100	<123.5	1
<5	<6.25	3
<200	<247.0	100
<100	<123.5	170
94.7	96.0	250-1000
<.250	<.250	1
<200	<247	100
<9.95	<12.5	4
286	<25.0	5
<19.9	<25.0	NRC
214	<331	350

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 19

Analyte	Sample Number 19-1	19-2	19-3	Regulatory Limit	
Total Organic Halogens (ug/l)	63.0	71.0	50.0	NRC	
Total Organic Carbon (mg/l)	4.01	6.95	4.92	NRC	
Volatile Organic Compounds (ug/l):				10	
Methylene chloride	14	13	8J		
Acetone	ND	ND	16		
2-Butanone	ND	ND	10		
Petroleum Hydrocarbons (mg/l)	ND	ND	ND	1	
Nitrate/Nitrite (mg/l)	.80	ND	ND	10	
Base/Neutral/Acid Compounds (ug/l)	ND	ND	ND	100	
Soluble Metals (mg/l):					
Sb	ND	ND	ND	NRC	
As	ND	ND	ND		0.050
Be	ND	ND	ND	NRC	
Cd	0.007	0.006	0.004		0.010
Cr	0.015	ND	ND		0.050
Cu	ND	ND	ND	NRC	
Pb	0.006	ND	ND		0.050
Hg (ug/l)	ND	ND	ND		0.002
Ni	0.02	0.016	ND	NRC	
Se	ND	ND	ND		0.010
Ag	ND	ND	ND		0.050
Tl	ND	ND	ND	NRC	
Zn	0.09	0.09	0.06	NRC	
pH (Lab Measured)	3.85	3.95	4.10		
pH (Field Measured)	4.3	4.6	4.5		
Chloride (mg/l)	7.60	11.4	10.5	NRC	
Specific Conductance (umhos)	189	103	80.5	NRC	
Specific Conductance* (umhos)	160	70	60	NRC	
Temperature (C)	20	17	17	NRC	

ND Not Detected * Field Measured A Duplicate Sample
NR Analysis Not Requested B Field Blank
J Estimated concentration less than quantification limits but greater than instrument detection limits
NRC No Specific Regulatory Concentration

TABLE 3-10D

Analytical Results for Soil Samples Collected in January 1986

	SITE 19 SAMPLE NUMBER				Regulated
	19-A Composite	19-B Composite	19-C Composite	19-D Composite	Concentrati (ECRA Limit
TOX (ug/g)	.320	2.15	ND	ND	NRC
Volatile Organic Compounds (ug/kg)					1
Chloromethane	3J	4J	NR	ND	
Methylene Chloride	NR	12	NR	ND	
Dichlorobenzenes	NR	NR	18	ND	
Acetone	460	14	NR	ND	
2-Butanone	67	7J	NR	ND	
Dilution Factor	1.3	1.1	1.1	1.3	
Detection Limit	13	11	11	13	
Petroleum Hydrocarbons (mg/kg)	ND	751	7.60	2.50	100
Total Metals (mg/kg):					
Sb	<.005	.747	<2.49	<2.49	NRC
As	1.53	4.53	1.51	1.15	20
Be	<.637	<.561	<.993	<.989	1
Cd	26800	31900	<.248	<.247	3
Cr	59.6	639	69.2	5.94	100
Cu	4.84	13.5	5.16	2.57	170
Pb	49.5	1560	25.5	7.23	250-1000
Hg	<.285	<.300	<.250	<.250	1
Ni	1.4	2.5	<3.97	<3.96	100
Se	<.637	<.637	<.493	<.500	4
Ag	<.251	<.222	1.10	<.989	5
Tl	<.251	<.222	<.993	<.989	NRC
Zn	289	776	39.2	6.03	350

ND Not Detected

J Estimated concentration less than quantification limit but greater than instrument detection limit

NRC No Specific Regulatory Concentration

Analytical Results for Soil Samples Collected in March 1986

SITE 20

Sample Number	Analyte Petroleum Hydrocarbons (mg/kg)	EPTOX (mg/l) Zn	Cr	Pb	Ti
20-A					
(.5' - 1')	ND	ND	ND	ND	ND
(2.5' - 3')	ND	ND	ND	ND	ND
20-B					
(.5' - 1')	65.7	ND	ND	ND	ND
(2.5' - 3')	ND	ND	ND	ND	ND
20-C					
(.5' - 1')	2.20	ND	ND	1.64	ND
(2.5' - 3')	ND	ND	ND	ND	ND
20-D*					
(.5' - 1')	ND	<.05	<.50	.051	.41
(2.5' - 3')	ND	<.05	<.50	.05	.039
20-E*					
(.5' - 1')	ND	<.05	<.50	.072	<.003
(2.5' - 3')	ND	<.05	<.50	.057	.024
Detection Limits		.50	.50	.50	.50
Regulatory limits	100	350	100	100	NRC
ND Not Detected		.50	.50	.50	.50

NRC No Specific Regulatory Limit

* Samples collected July 1986

TABLE 3-12

Analytical Results for Soil Samples Collected in March 1986

SITE 22

Sample Number	Analyte Petroleum Hydrocarbons (mg/kg)	EPTOX (mg/kg) Zn	Cr	Pb	Ti
22-A					
(.5' - 1')	ND	ND	ND	ND	ND
(2.5' - 3')		ND	ND	ND	ND
22-B					
(.5' - 1')	ND	ND	ND	ND	ND
(2.5' - 3')		ND	ND	ND	ND
22-C					
(.5' - 1')	4.20	ND	ND	ND	ND
(2' - 2.5')	39.0	ND	ND	ND	ND
22-D					
(.5' - 1')	6.30				
(2' - 2.5')	45.8	ND	ND	ND	ND
		ND	ND	ND	ND
Regulatory Limits	100	350	100	100	NRC

ND = Not Detected

NRC No Specific Regulatory Concentration

TABLE 3-13

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED IN JULY 1986

SITE 26

Analyte	Sample Number						Regulatory
	26-1	26-1B	26-2	26-2A	26-2B	26-3	Limit
Picric Acid	ND	ND	ND	ND	ND	ND	NRC
Field Measured Parameters:							
pH	4.8	NR	4.0	NR	NR	4.5	
Temperature (C)	18	NR	17	NR	NR	17	NRC
Specific Conductance (umhos)	60	NR	225	NR	NR	50	NRC

NRC No Specific Regulatory Concentration