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Remedial Investigation Concept Plan for Picatinny Arsenal

Volume 2: Descriptions of and Sampling Plans for Remedial Investigation Sites

March 1991 *(Final Report)*

Environmental Assessment and Information Sciences Division
Argonne National Laboratory, Argonne, Illinois 60439-4801

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Volume 2: Descriptions of and Sampling Plans for Remedial Investigation Sites

by P.A. Benioff, M.H. Bhattacharyya,* C. Biang, S.Y. Chiu, S. Miller, T. Patton, R. Pearl, A. Yonk, and C.R. Yuen

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Argonne National Laboratory has prepared a Remedial Investigation (RI) Concept Plan for Picatinny Arsenal in New Jersey. Based on types of activity and location, the 156 RI Sites identified during the study are grouped into 16 Areas. The plan assesses the environmental status and identifies additional data needed for each RI Site in each Area. The plan was developed to comply with state and federal hazardous waste and water quality regulations. The plan also provides a ranking of the 16 Areas according to their potential for impacts on public health and the environment. Volume 1 describes the environmental setting of Picatinny Arsenal, discusses applicable federal and state environmental regulations, briefly describes the Areas and the Sites within each Area, provides a ranking of the Areas, summarizes the proposed RI sampling plan for each Site in each Area, and gives supplementary information. Volume 2 describes the history, geology and hydrology, existing contamination, closure plan (if any), and proposed RI plan for each Site within each Area.

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NOTATION

ACRONYMS, INITIALISMS, AND ABBREVIATIONS

Ag	silver
ANL	Argonne National Laboratory
App.	appendix
ARDEC	Armament Research, Development and Engineering Center
As	arsenic
Ba	barium
BDL	below detection level
B2EHP	bis-2-ethylhexyl phthalate
Bldg.	building
BTX	benzene, toluene, and xylenes
Cd	cadmium
CFR	Code of Federal Regulations
COD	chemical oxygen demand
Cr	chromium
CTF	chlorine trifluoride
Cu	copper
2,4-D	2,4-dichlorophenoxyacetic acid
11DCE	1,1-dichloroethane
12DCE	1,2-dichloroethylene
DCLB	dichlorobenzene
DDD	dichlorodiphenyldichloroethan
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DEH	Division of Housing and Engineering
DNT	dinitrotoluene
DRMO	Defense Reutilization and Marketing Office
ECGS	electromagnetic-conducting geophysical survey
EM	electromagnetic
EOD	explosive ordnance demolition
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
FED	Facilities and Engineering Division
Fed. Reg.	Federal Register
Fig.	figure
GC	gas chromatography

GPR	ground-penetrating radar
Hg	mercury
HMX	cyclotetramethylene tetranitramine
IRFNA	inhibited red-fuming nitric acid
IWTP	industrial waste treatment plant
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MH	manhole
MSL	mean sea level
NA	not analyzed
NC	nitrocellulose
ND	not detected
NG	nitroglycerin
NJAC	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NJPDES	New Jersey Pollutant Discharge Elimination System
No.	number
NPL	National Priorities List
Pb	lead
PCB	polychlorinated biphenyl
PETN	pentaerythritol tetranitrate
PTA	Picatinny Arsenal
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RC	resin coated
RCRA	Resource Conservation and Recovery Act of 1976
RDX	hexahydro-1,3,5-trinitro-1,3,4-triazine [also known as cyclonite and cyclotrimethylenetrinitramine]
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RNA	red nitric acid
Sec.	section
SOP	standard operating procedure
SRT	stockpile reliability testing
TCA	trichloroethane
TCE	trichloroethylene
TCL	target compound list
TCLP	toxicity characteristic leaching procedures
TDS	total dissolved solids
TECUP	Toxic Energetics Cleanup Program
tetryl	2,4,6-trinitrophenylmethylnitramine

TNT	trinitrotoluene
TOC	total organic carbon
TOX	total organic halogens
TPH	total petroleum hydrocarbons
TSS	total suspended solids
UDMH	unsymmetrical dimethylhydrazine
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UST	underground storage tank
UXO	unexploded ordnance
VOC	volatile organic compound
Vol.	volume

UNITS OF MEASURE

°C	degree(s) Celsius	mCi	millicurie(s)
cm	centimeter(s)	mg	milligram(s)
d	day(s)	mi	mile(s)
ft	foot (feet)	mL	milliliter(s)
ft^2	square foot (feet)	mm	millimeter(s)
g	gram(s)	mo	month(s)
gal	gallon(s)	ppb	part(s) per billion
h	hour(s)	ppm	part(s) per million
ha	hectare(s)	psi	pound(s) per square inch
in.	inch(es)	qt	quart(s)
kg	kilogram(s)	s	second(s)
km	kilmeter(s)	wk	week(s)
lb	pound(s)	yd	yard(s)
L	liter(s)	yr	year(s)
m	meter(s)	μg	microgram(s)
m^2	square meter(s)	μmho	micromho(s)

1 INTRODUCTION

Picatinny Arsenal (PTA) is a large and complex installation that has been in operation for many years. This installation would be expected to have a large number of areas containing hazardous materials or disposed hazardous waste. Between 1976 and 1989, PTA and the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), with the assistance of Argonne National Laboratory (ANL), have identified 156 remedial investigation Sites (RI Sites) at PTA. These Sites have been grouped into 16 Areas, based on location and the type of activities that occurred at the Sites. Details on the Site selection process and the grouping of Sites into Areas are given in Sec. 4 of Volume 1.

The Areas are presented in order of their ranking with respect to the need for RI activity. Within each Area, Sites are presented in Site number order. Details on Area ranking and Site numbering are given in Sec. 4 of Volume 1. References are provided at the end of this volume.

This volume gives a brief description of the Sites in each Area. In addition, material is presented that describes the known history, discusses the local environment, identifies known or potential contamination, and proposes an RI sampling plan for each Site. Maps are provided for most sites; many of the symbols used on these maps are shown in Fig. 1.1.

The proposed sampling plans for each Site are fairly detailed and compose a summary work plan. Details, such as sampling depths and intervals, are given for many sampling activities. Unless stated otherwise, some procedures are the same for all Sites. Also, where a plan calls for the "disposal of" contaminated materials, such materials should be disposed of in approved hazardous waste disposal facilities.

The sampling plan for each Site is divided into phases. Activities in Phase I should be carried out unconditionally and independently of any closure sampling, Phase II activities are contingent on the results of Phase I, and Phase III activities (if any) are contingent on the results of Phase II. The only exception would be for Phase I sampling activities that depend on the results of Site inspections and surveys that are also included in Phase I.

Conditional activities (i.e., in Phase II or III) are often expressed in the proposed RI plans with terms such as "if significant contaminant concentrations are found, ..." or "if the Phase I samples are significantly contaminated, ..." The levels of "significant" contaminant concentrations, which will differ among parameters, will be those selected as mutually agreeable to the U.S. Army, the U.S. Environmental Protection Agency (EPA), and the New Jersey Department of Environmental Protection (NJDEP).

Analytical parameters for the samples to be collected at each Site are often given as names of standardized lists or categories of parameters, including Target Compound List (TCL) metals, TCL volatiles, TCL semivolatiles, toxicity characteristic leaching procedure (TCLP) parameters, explosives, propellants, herbicides, pesticides,

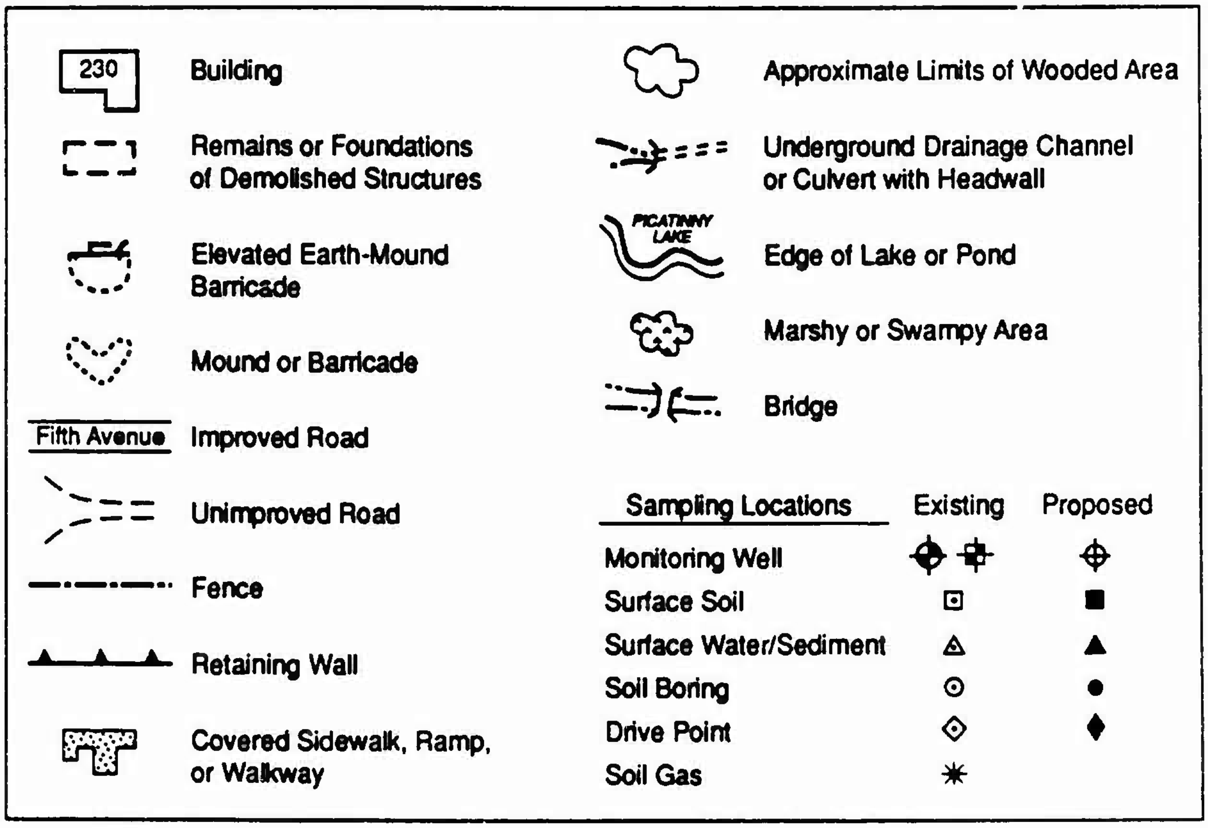

FIGURE 1.1 Symbols Used on Site Maps

macroparameters, and others. The specific chemical parameters in each of the categories used in this report are listed in separate tables in App. C (see Volume 1).

Analyses for pesticides or herbicides are recommended in the RI sampling plans for several Sites. This recommendation is made because pesticides and herbicides were used at the Arsenal to control pests and weeds at many locations, including buildings housing explosive or propellant operations (Rigassio et al. 1975; USAEHA 1979a).

Consideration should be given to collecting background samples for each Area and analyzing the samples for metal and inorganic parameters. However, finding locations for sampling representative of true background conditions might be difficult because Picatinny Arsenal has been active for more than 100 years. It is difficult to be sure that concentrations of metal or inorganic parameters measured at an assumed background location are naturally occurring, because they may represent contamination from undocumented activities that occurred in the past. Background concentrations of organic parameters of interest (App. C) should be essentially zero.

Soil borings and additional monitor wells are recommended at many Sites. Unless otherwise specified, soil borings should be drilled down to bedrock or the water table, whichever comes first. Three samples should be collected for analysis from each boring: one from the top, one from the middle, and one from the bottom. Each sample should be collected over a 0.6-m (2-ft) interval. Adequate safety precautions must be implemented during the drilling of soil borings, especially at sites where borings are recommended at locations of geophysical survey anomalies.

Unless otherwise specified, the sampling protocol for both new and existing monitor wells should consist of collecting one sample for analysis from each recommended well on two successive quarters (a total of two samples per well). In general, monitoring should stop for each well for which the two samples show no significant contamination. However, quarterly monitoring should continue for any well for which the samples show significant contamination. Continued monitoring of wells that are close to and downgradient of any well showing significant contamination should also be considered.

For each Site, all activities described in the proposed RI plans are to be carried out using quality assurance and quality control (QA/QC) procedures given by USATHAMA (1987a, 1987b). The procedures are incorporated here by reference. Appropriate health and safety procedures must also be carried out during all proposed RI activities.

Brief summaries of the Resource Conservation and Recovery Act of 1976 (RCRA) closure plans are included in the sampling plan summaries for each Site for which closure plans will be implemented. For most of the Sites with closure plans, it cannot be documented that hazardous waste has not been stored at the Site for more than 90 days at some point during the past. These Sites will be closed in accordance with New Jersey hazardous waste regulations because they never had interim status. The closure plans and their revisions are described in Foster Wheeler (1988a, 1988b, 1988c, 1988d, 1988e, 1989), Soiecki (1989a), and ARDEC (undated).

For each Site with a closure plan, the proposed phased sampling activities are designed to complement the closure plan and avoid duplication of sampling efforts. Also, the proposed activities will be carried out independent of implementation of the closure plan. All closures are scheduled to be clean closures, that is, decontamination to the extent that the regulatory agency (e.g., NJDEP) certifies that no measures are needed to restrict the future use of or access to a Site. If, for any Site, clean closure is not possible, the proposed RI sampling plan may have to be modified.

2 AREA A: BURNING GROUNDS

2.1 INTRODUCTION

Only one Site, the Burning Grounds, is contained in Area A because, among all the Sites, this Site has the highest priority in terms of the need for RI activity. The basis for this ranking is provided in Sec. 4 of Volume 1.

2.2 SITE 34 — LOWER BURNING GROUND

2.2.1 Site History

Site 34 consists of about 7 acres near the southern boundary of the Arsenal. Green Pond Brook forms the western Site boundary. Swamp land surrounds the Site on all other sides. The burning ground is bounded on the north and south ends by drainage ditches, which receive surface runoff from the Site and drain the surrounding swamp area. The ditches empty into the brook. It has been in use since WWII for burning explosively contaminated material. In 1985, burning directly on the ground was discontinued. Currently, wastes are placed in pans, ignited, and covered. Figure 2.1 gives the Site location and other pertinent details.

Wastes from a variety of sources were sent to the burning ground. In 1974, about 500,000 lb of waste explosives and explosively contaminated material was burned. Much of the material was sludge and sediment that settled out of wastewater from the manufacture of explosives and dust from wet vacuum filtration systems. There are three major categories of manufacture at Picatinny that sent explosively contaminated sludge and sediment to the burning ground (Wingfield 1976):

- Process water (red water) containing nitrobodies, suspended explosive material, organics, and acids.
- Condensate waters from concentration and recycling of sulfuric and nitric acid.
- Finishing process wash water containing suspended explosives and organics.

2.2.2 Geology and Hydrology

The lower burning ground is in an area of reclaimed marsh or swamp land. It is underlain by unconsolidated glacial deposits of the Pleistocene Age, ranging in size from clay to boulders. The bedrock below the glacial deposits is Kitatinny limestone (Bayha 1985).

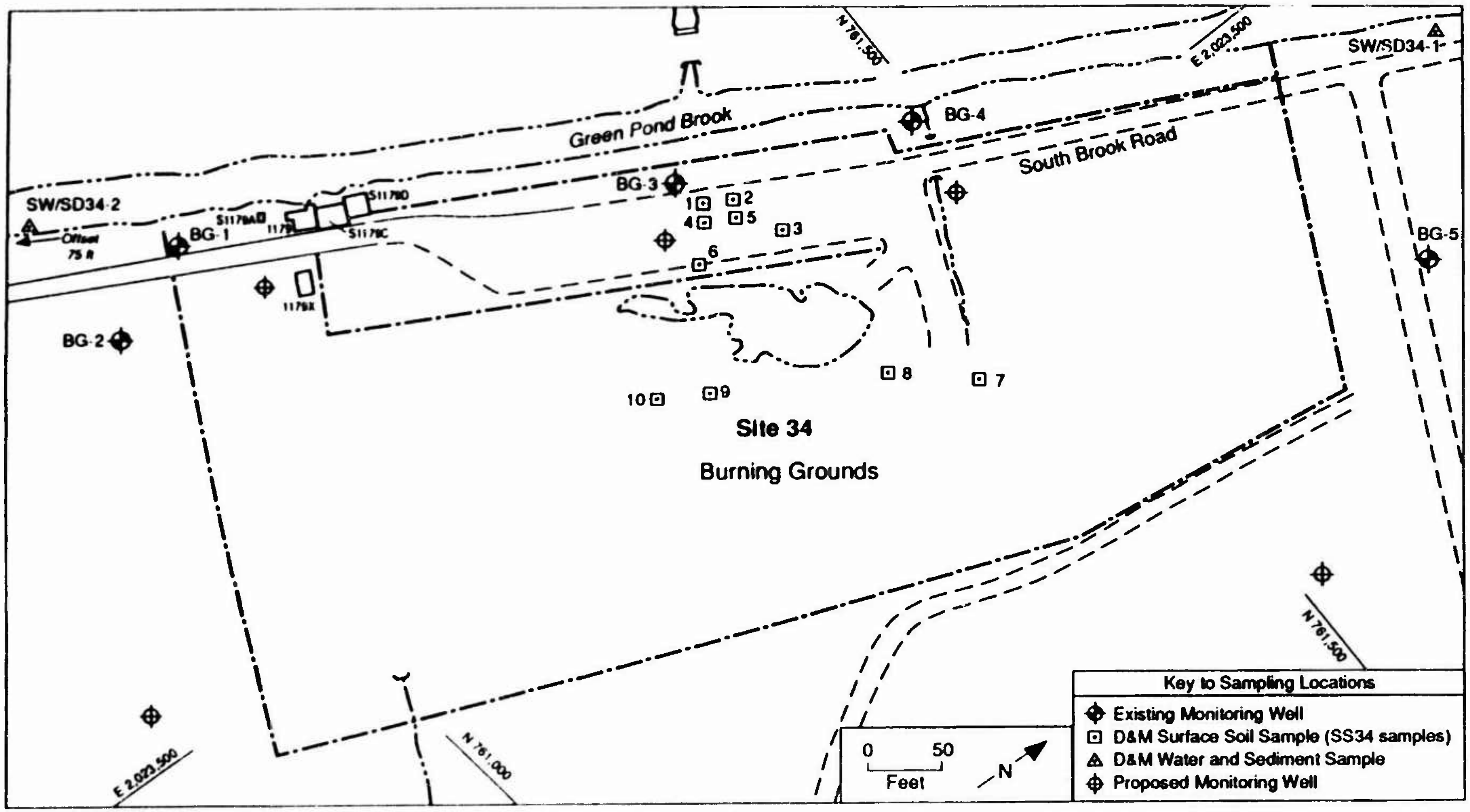

FIGURE 2.1 Layout of Site 34, the Lower Burning Ground (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

No information regarding Site-specific soil classification is available. Generally, the soils in this area are classified as the Carlisle Muck Series. The Carlisle Muck is a deep, nearly level, poorly drained organic soil formed in low swampy areas. It may be high in peat content, consisting of the remains of sphagnum moss. These soils have a high water table (3.7-6.6 ft) and are compressible under load (Bayha 1985; Sargent 1988).

2.2.3 Existing Contamination

Selected data from 1988 sampling is presented in the following sections. Sampling locations are shown in Fig. 2.1.

2.2.3.1 Soil

A waste pile associated with the Site was in a fenced-in area, 24 by 12 m (80 by 40 yd), on the northeastern section of the burning ground. Explosive-contaminated material from the pile was burned in the open. Decontaminated material was then removed and disposed of as scrap. The waste pile's bulk was estimated at about 225 tons. There is no inventory for this material at the Site.

Inorganic results for surface soil showed elevated values for arsenic, cadmium, chromium, lead, and zinc (Table 2.1). These levels are to be expected based on the previously described waste streams. As shown by the data, burning largely destroyed the organic fraction of the wastes. There are some elevated values for HMX, RDX, and nitroglycerin.

Data from sediment sampling are presented in Table 2.2. Even though contaminant levels are not significantly elevated, they indicate that there is runoff from the Site.

2.2.3.2 Water

Samples from Green Pond Brook did not contain elevated levels of contaminants. Since samples were not filtered, the analyses represent total concentrations and the dissolved concentrations are unknown.

Groundwater monitoring wells BG-1 through BG-5 were not installed following recommended procedures. Available information confirms that these wells were installed using a backhoe (Bayha 1985). The wells were sampled, but the value of the data is questionable and they are not presented.

2.2.4 Proposed RI Plan

A geophysical survey should be conducted in order to locate any buried shells and contaminated areas. A ground-penetrating radar (GPR) survey should then be conducted

TABLE 2.1 Selected Analytical Results for Surface Soil Samples 1-10 from Site 34[a]

Contaminant	Sample Depth (ft)	Concentration in Sample (ppm)									
		1	2	3	4	5	6	7	8	9	10
Arsenic	4.9	9.77	7.40	4.05	8.89	8.83	12.0	>10.0	>10.0	19.0	>10.0
Barium	0.5	>100	>100	>100	>100	>100	>100	>100	>100	-	-
	4.9	-	-	-	-	-	-	-	-	>100	>100
Beryllium	0.5	0.480	0.429	0.590	0.657	-	0.415	0.964	4.23	-	-
	4.9	-	-	-	-	-	-	-	-	0.659	0.530
Cadmium	4.9	7.80	7.50	0.840	8.83	6.40	0.500	4.90	81.0	80.0	96.0
Chromium (total)	4.9	140	45.0	5.00	81.0	52.0	180	>5.00	140	130	120
Copper	0.5	50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	3,600		
	4.9	-	-	-	-	-	-	-	-	2,200	5,600
Lead	4.9	1,100	3,900	91.0	3,200	520	2,700	370	>5.00	>5.00	>5.00
Nickel	0.5	13.2	>20.0	14.4	>20.0	>20.0	>20.0	>20.0	-	-	-
	4.9	-	-	-	-	-	-	-	-	11.0	-
Zinc	0.5	402	>400	211	>400	>400	>400	>400	4,699	-	-
	4.9	-	-	-	-	-	-	-	-	4,800	4,400
Chloroform	0.5	-	-	-	-	0.007	-	0.495	-	-	-
Chloromethane	0.5	-	-	0.043	-	0.007	-	-	-	-	-
HMX	0.5	24.4	-	-	>24.4	>24.4	>24.4	-	-	-	-
Methylene chloride	0.5	0.124	0.032	0.032	0.033	0.432	0.033	-	0.127	-	0.050
	0.5										
Nitrocellulose	4.9	330	280	-	270	-	600	-	-	-	-
Nitroglycerin	0.5	-	-	400	-	-	-	-	-	1.10	-
RDX	0.5	48.5	25.6	5.42	158	-	45.3	-	-	-	-
2,4,6-TNT	0.5	8.44	-	-	-	145	-	0.111	-	-	-

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Dames & Moore 1989.

to investigate the possibility that a buried stream channel is present beneath the Site.

Continuous core samples should be collected to characterize the particle size, distribution, porosity, and hydraulic conductivity of soils in the area.

A remedial investigation/ feasibility study (RI/FS) will be completed for this Site. A task order was issued by USATHAMA in Jan. 1990. The proposed action for this Site is to implement the RI/FS.

TABLE 2.2 Selected Analytical Results (ppm) for Sediment Samples 1 and 2 from Site 34

Contaminant	Ditch Sample (No. 1)	Creek Sample (No. 2)
Arsenic	6.10	7.42
Cadmium	13.0	79.0
Chromium	85.0	270
Lead	50.0	140
Zinc	92.4	371

Source: Dames & Moore 1989.

3 AREA B: SOUTHERN BOUNDARY, WEST OF GREEN POND BROOK

3.1 INTRODUCTION

Area B contains two Sites, both close to Green Pond Brook and the southern boundary of the Arsenal. One of the Sites is a test range and the other is a former landfill. The potential for migration of contaminants off the Arsenal exists for both Sites.

3.2 SITE 20 — PYROTECHNIC TESTING RANGE

3.2.1 Site History

The pyrotechnic testing range is at the southern end of the Arsenal just off Horney Road about 0.25 mi west of Green Pond Brook. It is a 3-acre Site that is completely encompassed by Site 24, a former sanitary landfill. Figure 3.1 provides details of the Site.

This range is used occasionally for test firing of munitions that are being developed. Several piles of scrap metal are stored in a large cleared area. A metal stand for pyrotechnic testing is situated on a circular gravel pad. The cleared area has numerous metallic fragments remaining from the tests. The potential hazard of unexploded ordnance exists.

3.2.2 Geology and Hydrology

The bedrock formation directly underlying the Site is the Leithsville Formation. Studies characterizing Site-specific geology were not available.

Soils in this part of the Arsenal have been characterized as the Preakness Series. These soils have moderately rapid permeability, a seasonally high water table, and are subject to flooding. A dark surface variant of the Preakness sandy loam occupies the area adjacent to Green Pond Brook. It has a black mucky surface layer more commonly found in the upland areas (Sargent 1988).

3.2.3 Existing Contamination

3.2.3.1 Soil

Surface soil samples and sediment samples from the downgradient pond were obtained in 1988 (Dames & Moore 1989). Results show elevated levels of lead, zinc, and arsenic. Selected data are presented in Tables 3.1 and 3.2. Sampling points are shown in Fig. 3.1.

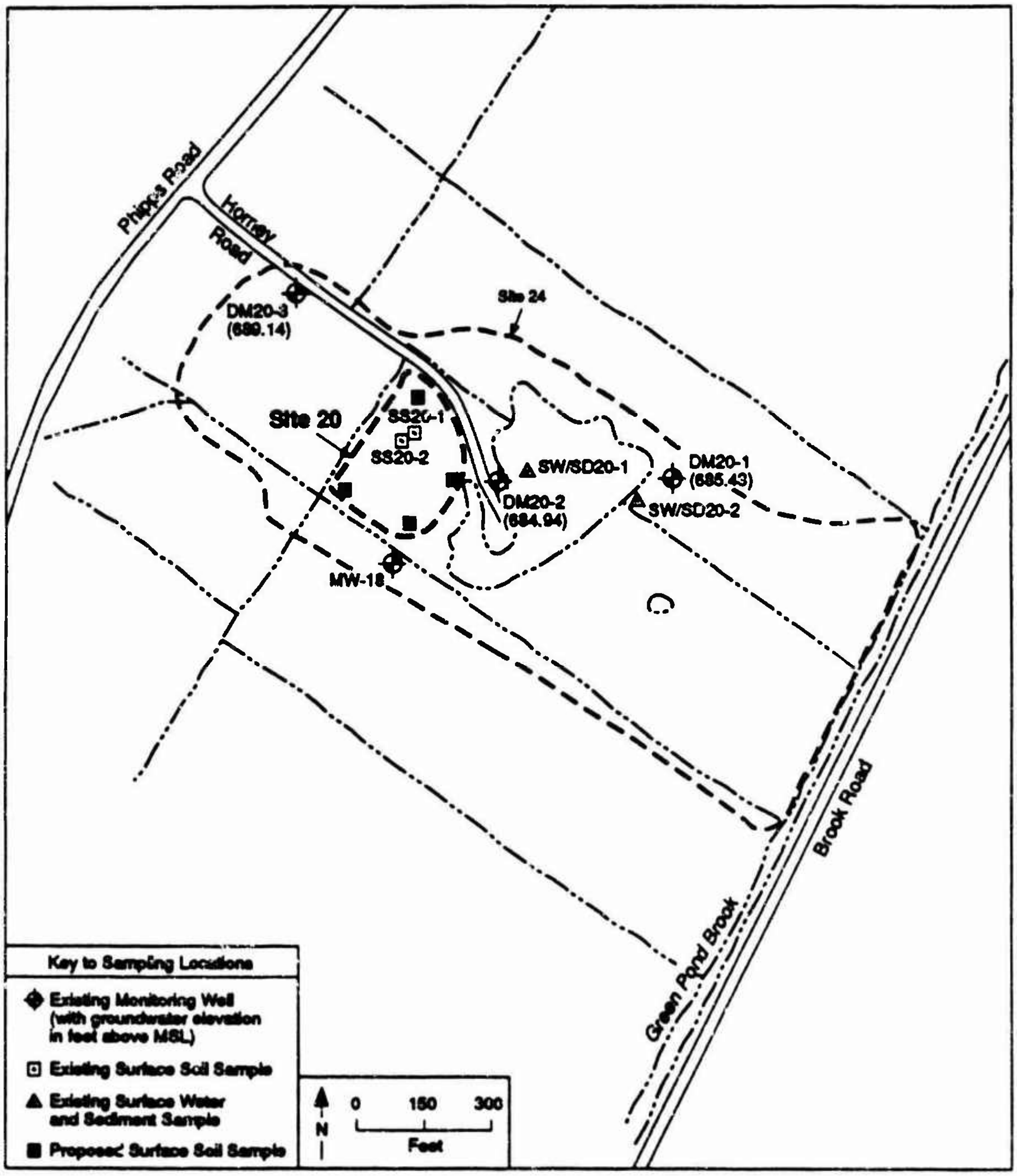

FIGURE 3.1 Layout of Site 20, the Pyrotechnic Testing Range (Source: Adapted from Dames & Moore 1989)

TABLE 3.1 Selected Analytical Results for Surface Soil Samples 1 and 2 from Site 20

Contaminant	Sample Depth (ft)	Concentration in Sample (ppm) 1	2
Arsenic	4.9	9.08	7.95
Barium	4.9	89.3	45.8
Beryllium	4.9	0.638	0.431
Cadmium	4.9	4.40	0.490
Chromium	4.9	15.0	4.50
Copper	4.9	48.5	17.3
Lead	4.9	460	31.0
Zinc	4.9	65.6	58.0
Methylene chloride	0.5	0.077	0.120

Source: Dames & Moore 1989.

TABLE 3.2 Selected Analytical Results for Pond Sediment Samples 1 and 2 from Site 20

Contaminant	Sample Depth (ft)	Concentration in Sample (ppm) 1	2
Arsenic	19.7	24.0	7.30
Cadmium	19.7	7.20	2.90
Chromium	19.7	44.0	9.00
Lead	19.7	170	15.0
Zinc	19.7	1,600	67.9
Methylene chloride	2.0	0.125	0.086

Source: Dames & Moore 1989.

3.2.3.2 Water

Two surface water samples were taken from the nearby pond. Sample SW/SD20-1 contained 5 μg/L vinyl chloride, and SW/SD20-2 contained 6 μg/L vinyl chloride. It is questionable whether these values reflect contamination from Site 20.

Three groundwater monitoring wells were installed in 1988, as shown in Fig. 3.1. Selected data from these wells and from well MW-18 show slightly elevated values for methylene chloride: wells DM20-1, DM20-2, DM20-3, and MW-18 contained 3 μg/L, 3 μg/L, 4 μg/L, and 5 μg/L, respectively. These are probably the result of lab contamination.

Upgradient well DM20-3 also showed detectable levels of metals and phenol. These contaminants may not be attributable to Site 20, but to Site 24, the sanitary landfill. The details for Site 24 are presented in Sec. 3.3.

3.2.4 Proposed RI Plan

Four surface soil samples should be obtained and analyzed for TCLP leachability. Figure 3.1 shows suggested locations. Due to the fact that this Site is completely encompassed by Site 24, all other sampling activities recommended for this general area are included in the Site 24 recommendations.

3.3 SITE 24 — SANITARY LANDFILL

3.3.1 Site History

The sanitary landfill is about 0.25 mi from the southern boundary of the Arsenal near the junction of Phipps and Horney roads. The 11-acre Site consists of a fill area and an adjacent wetland. Two ponds within the area are outlined for study. There is a large pond (1 acre) in the central portion, and a much smaller pond northeast of monitoring well 15. A man-made drainage ditch connects the large pond with Green Pond Brook (Dames & Moore 1989). Figure 3.2 shows Site features and the general location of the former landfill.

Since the Site has been covered and closed since 1972, an exact record of disposal at this Site was not available. Information indicates that in addition to sanitary waste, fly ash, ordnance, industrial waste, and treatment plant sludge were also placed in the landfill (Dames & Moore 1989).

3.3.2 Geology and Hydrology

The bedrock formation directly underlying the Site is the Leithsville Formation. Studies characterizing Site-specific geology were not available.

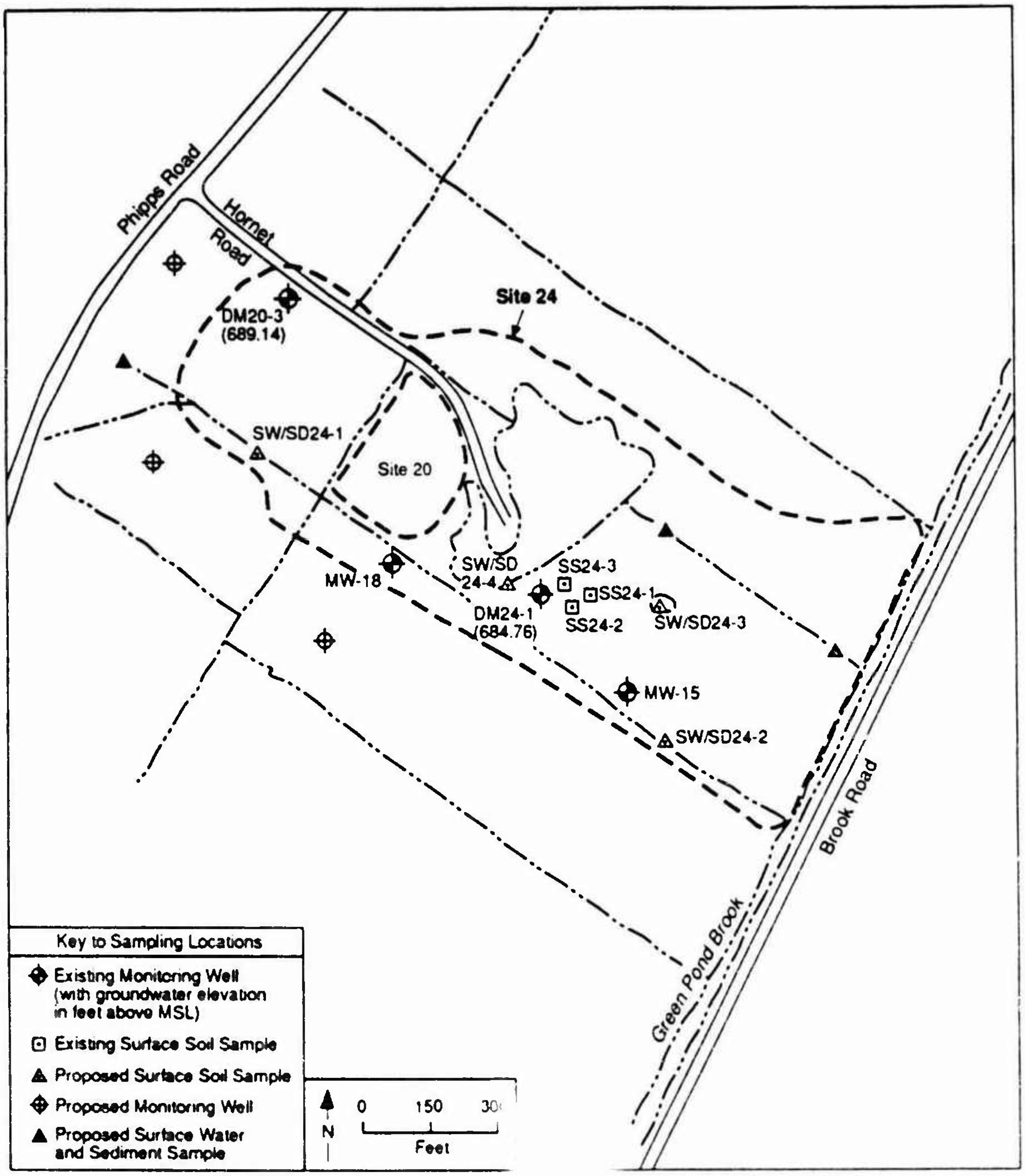

FIGURE 3.2 Layout of Site 24, the Sanitary Landfill (Source: Adapted from Dames & Moore 1989)

Soils in this area have been characterized as the Preakness Series. These soils have moderately rapid permeability, a seasonally high water table, and are subject to flooding. The surface area adjacent to Green Pond Brook consists of a dark surface variant of the Preakness sandy loam. It has a black mucky surface layer not found in the typical Preakness sandy loam (Sargent 1988).

Landfilling activities that occurred along the south-central boundary may be causing localized groundwater mounding. This could influence flow in the area to be northward toward the large pond. The available water level data in Table 3.3 support this conclusion. The water levels suggest a central area of landfilling activities that now contains saturated wastes. They also suggest that the mounding may have increased near well MW-18.

3.3.3 Existing Contamination

According to available information, hydrocarbon fuels contamination in this area is likely (Dames & Moore 1989). No specific information regarding the nature and location of the contamination is available; however, it is reported that there was extensive disposal of a variety of wastes in the swampy area just south of the Site.

3.3.3.1 Soil

The results of the Dames & Moore sampling program showed elevated concentrations of arsenic, lead, zinc, and phenol in the surface soil (Table 3.4). The soil at Site 20 contains similar concentrations of metals.

Sediment samples contained elevated values of vinyl chloride, arsenic, lead, chromium, and zinc (Table 3.5). Sediment sampling location SW/SD24-1 represents background, and SW/SD24-2 is downgradient to obtain information about the impact of groundwater and surface water migrating from the Site. Sample SW/SD24-3 is from the small pond, and SW/SD24-4 is from the large pond. All of the sampling locations, particularly the background location, contained elevated values for metals, volatiles, or both. These elevated contaminant levels may be further evidence of local mounding.

Since results from the background location showed contamination, this location does not address the impact of groundwater on the ditch.

3.3.3.2 Water

In 1981, groundwater samples from well MW-18 contained elevated values of tetrahydrofuran and carbon disulfide. Well MW-15 samples contained tetrachloroethylene, 1,1,1-trichloroethane, tetrahydrofuran, and carbon disulfide.

In 1983, groundwater samples from well MW-18 contained 20 ppb vinyl chloride and samples from MW-15 contained lead (14 ppb) and selenium (57 ppb).

TABLE 3.3 Water Level Data for Wells at Site 24

Well	Date of Measurement	Depth to Water (ft)
DM20-1	April 1988	0.87
DM20-2	April 1988	0.46
DM20-3	April 1988	2.16
DM24-1	April 1988	0.54
MW-18	April 1988	2.90
MW-18	1981	4.38
MW-15	1981	4.80

Source: Dames & Moore 1989.

TABLE 3.4 Selected Analytical Results for Surface Soil Samples 1-3 from Site 24[a]

Contaminant	Sample Depth (ft)	Concentration in Sample (ppm)		
		1	2	3
Arsenic	4.9	7.03	2.73	7.12
Beryllium	4.9	1.27	1.39	1.09
Cadmium	4.9	6.50	0.182	0.496
Chromium	4.9	8.80	4.10	4.70
Lead	4.9	65.0	3.10	100
Zinc	4.9	49.1	-	216
Cyanide	4.9	-	3.20	-
Methylene chlorine	0.5	0.054	0.054	0.054
Phenolics	0.5	-	0.891	13.0

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Dames & Moore 1989.

TABLE 3.5 Selected Analytical Results (ppm) for Sediment Samples 1-4 from Site 24[a]

Contaminant	Stream Sample (No. 1)	Ditch Sample (No. 2)	Pond Samples 3	Pond Samples 4
Arsenic	-	6.78	5.08	-
Cadmium	0.680	0.810	0.650	1.50
Chromium	10.0	8.60	5.10	110
Copper	50.0	-	22.7	-
Lead	54.0	14.0	8.90	120
Zinc	87.8	-	-	-
Vinyl chloride	170	-	-	-

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Dames & Moore 1989.

Water samples collected from monitoring wells in 1988 did not contain significant levels of contamination. Well MW-15 contained methylene chloride (5.0 ppb) and zinc (29.1 ppb), and MW-18 contained 5.0 ppb methylene chloride. It is possible that methylene chloride is the result of lab contamination; however, the presence of vinyl chloride must be addressed. Since the monitoring wells in this area are not detecting the same volatiles found in the drainage ditch, their presence may be the result of isolated disposal at that location or it may be due to the fact that the well screens are below the water table. The sample collection method may also alter the results. Well DM20-3 (installed in 1988) is upgradient to obtain background information for the area of Sites 20 and 24. Similarly, the depth to water is about 5 ft, and the well screen is from 10 to 20 ft. Samples from this well contained only traces of phenol (4.82 ppb) and methylene chloride (4.0 ppb).

Figure 3.2 shows the locations of the four surface water samples. Surface water location SW/SD24-1 represents an upgradient location to provide background information. Location SW/SD24-2 is downgradient to assess any impact from potentially contaminated groundwater or surface water from the Site. Sample SW/SD24-3 is from the small pond, and SW/SD24-4 is from the large pond. Samples from all locations had only traces of volatile organic compounds (Table 3.6).

TABLE 3.6 Selected Analytical Results (ppm) for Surface Water Samples 1-4 from Site 24[a]

Contaminant[b]	Stream Sample (No. 1)	Ditch Sample (No. 2)	Pond Samples 3	Pond Samples 4
Cyanide	-	-	-	-
Methylene chloride	8.00	30.0	-	10.0
Phenolics	-	-	6.19	-
Vinyl chloride	60.0	-	-	-
Zinc	-	78.1	-	-

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

[b]Samples were also tested for arsenic, beryllium, chromium, copper, lead, and nickel; none was detected in significant concentrations.

Source: Dames & Moore 1989.

3.3.4 Proposed RI Plan

Based on the recent sampling results at Sites 20 and 24, further Site definition is needed. Further investigation should determine the gradient and the presence of groundwater mounding.

3.3.4.1 Phase I

The installation of new monitoring wells is recommended based on the following factors:

- The screens of monitoring wells DM20-3, MW-15, and MW-18 range from 6 to 20 ft. Past sampling of wells MW-15 and MW-18 showed some degree of contamination. Since the screening intervals are all below the shallow water table, the chemical data from these wells may not be representative.

- MW-15 is adjacent to an area that has undergone landfilling. If the soils are disturbed, the hydrology is altered.

- DM24-1 may be in an area that is influenced by the pond and the wetlands, or by mounding.

Figure 3.2 shows suggested locations for three new monitoring wells located outside of the outlined study area. The placement should be far enough from the landfill and the swampy area so the well screens can straddle the water table. The exact well placement should depend on the depth to water and best field judgment. This screen placement will also allow sampling to detect the presence of any floating product.

Information indicates that ordnance waste may have been placed in this fill. Many of the shells at PTA contained depleted uranium. Therefore, in addition to taking water levels, samples should be analyzed for TCL compounds, explosives, and uranium.

Monitoring well DM20-3 may be eliminated as a background well due to groundwater mounding; it is receiving contamination from the Site.

Two sediment and two surface water samples should be obtained from the southern drainage ditch farther upgradient, outside the boundary of the study area. Two sediment and two surface water samples should also be obtained from the northern drainage ditch. This is important because it connects the large pond to Green Pond Brook. Tentative sampling locations are shown in Fig. 3.2. The location should be between the pond and brook. Samples should be analyzed for TCL parameters, explosives, uranium, and TCLP leachability (sediment samples only).

3.3.4.2 Phase II

The results of the Phase I investigation should be used to determine the need for further investigation.

4 AREA C: SOUTHERN BOUNDARY, EAST OF GREEN POND BROOK

4.1 INTRODUCTION

Area C contains six Sites located close to the southern boundary of the Arsenal. The potential for migration of contaminants off the Arsenal exists at these Sites. The Sites consist of a pyrotechnic demonstration area, two landfills, a dredge pile, baseball fields, and a waste burial area.

4.2 SITE 19 — PYROTECHNIC DEMONSTRATION AREA

4.2.1 Site History

Site 19 is located in the southern portion of PTA, at the junction of Shinkle Road and Green Pond Brook. Figure 4.1 provides details of the Site. This 4-acre area is no longer in use. Structures on the Site include an abandoned observation tower, a test cage, a stockpile of treated telephone poles, and miscellaneous metal debris.

4.2.2 Geology and Hydrology

According to the overall Arsenal characterization, the bedrock formation directly underlying this Site is the Leithsville Formation.

Information regarding Site-specific soil classification was not available; however, generally the soils in the low-lying areas south of First Street are classified as Adrian Muck. This soil is a nearly level, very poorly drained organic soil that is underlain by sandy deposits. Permeability in the sandy deposits is rapid, and the water table is usually close the surface (Sargent 1988).

4.2.3 Existing Contamination

4.2.3.1 Soil

The results of recent (1988) surface soil and sediment sampling indicate no significantly elevated concentrations. Table 4.1 contains selected data from the sampling points indicated in Fig. 4.1 (Dames & Moore 1989).

4.2.3.2 Water

Three new groundwater monitoring wells were installed in 1988, as shown in Fig. 4.1. The wells were sampled for explosives, volatile organic compounds, nitrate, nitrite, and chromium. See Table 4.2 for selected analytic results (Dames & Moore 1989).

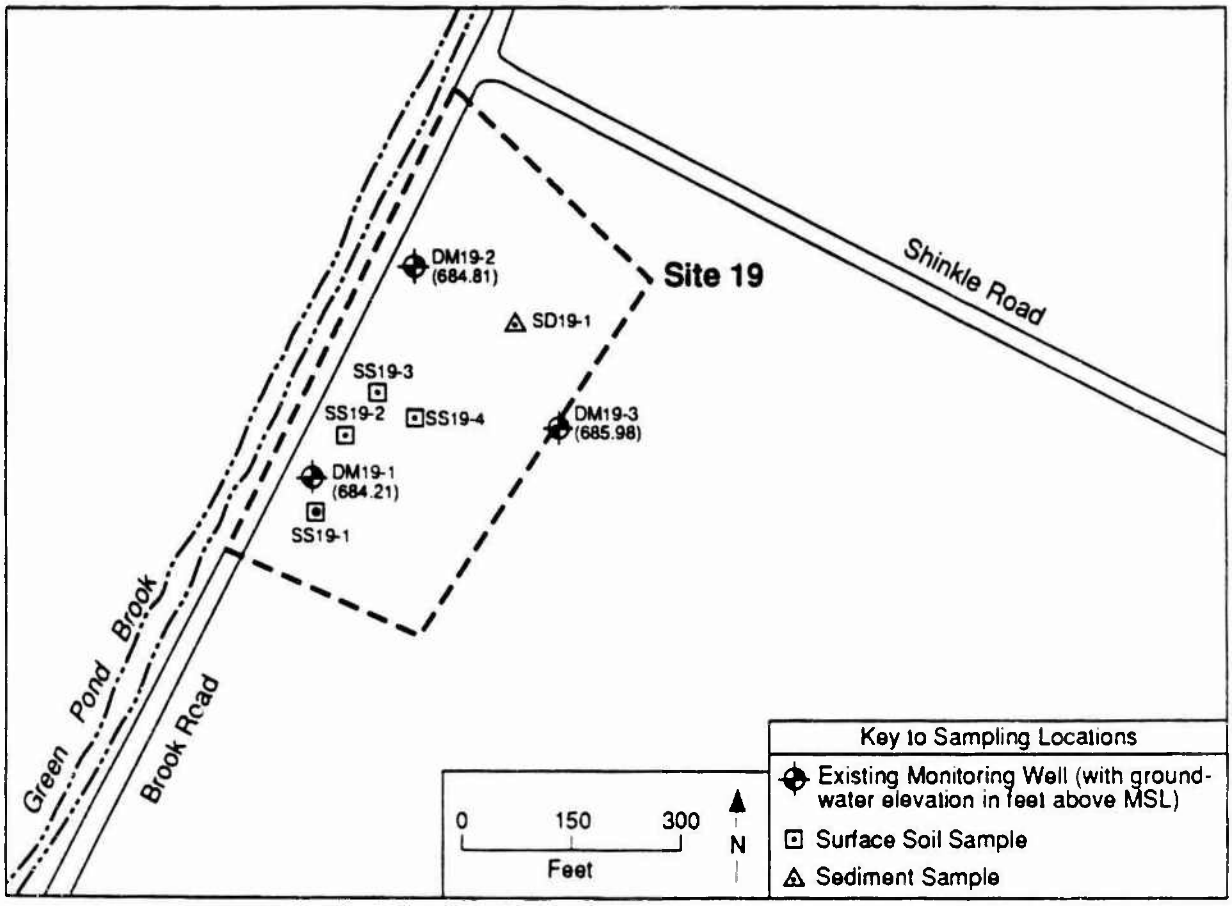

FIGURE 4.1 Layout of Site 19, the Pyrotechnic Demonstration Area (Source: Adapted from Dames & Moore 1989)

4.2.4 Proposed RI Plan

Based on the placement of the samples and the concentrations reported, the evidence for contamination is low at this time. Due to the proximity of Green Pond Brook, past activities, and the shallow water table, quarterly sampling of monitoring wells DM19-1, DM19-2, and DM19-3 for two quarters for TCL volatiles and TCL metals is recommended.

4.3 SITE 23 — POST FARM LANDFILL

4.3.1 Site History

Site 23 is one of the three former landfills at PTA. It is located off Old Post Road in the vicinity of Bldg. 1150. The Site is about 150 ft from the southeastern PTA boundary (see Fig. 4.2).

TABLE 4.1 Selected Analytical Results for Surface Soil and Ditch Sediment Samples from Site 19[a]

Contaminant	Sample Depth (ft)	Concentration in Sample (ppm)				
		Soil				Ditch Sediment
		1	2	3	4	
Barium	4.9	64.1	26.6	26.5	26.3	77.5
Chromium	4.9	9.40	7.60	8.10	9.60	16.0
Methylene chloride	0.5	0.236	0.033	0.032	0.022	0.035
Nitroglycerin	0.5					2.21
Toluene	0.5	0.012	-	-	-	
Trichlorofluoromethane	0.5	0.007	-	-	-	

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Dames & Moore 1989.

TABLE 4.2 Selected Analytical Results for Groundwater Samples from Site 19[a]

Contaminant	Concentration in Well Sample (μg/L)		
	19-1	19-2	19-3
Barium	38.4	126	108
Chromium	-	5.87	12.7
Nickel	-	16.7	13.0
Nitrate	461	306	480
Nitrite	-	-	52.0
Methylene chloride	5.00	5.00	6.00
Trichloroethane	3.79	-	-
1,1-Dichloroethane	1.00	-	-

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Dames & Moore 1989.

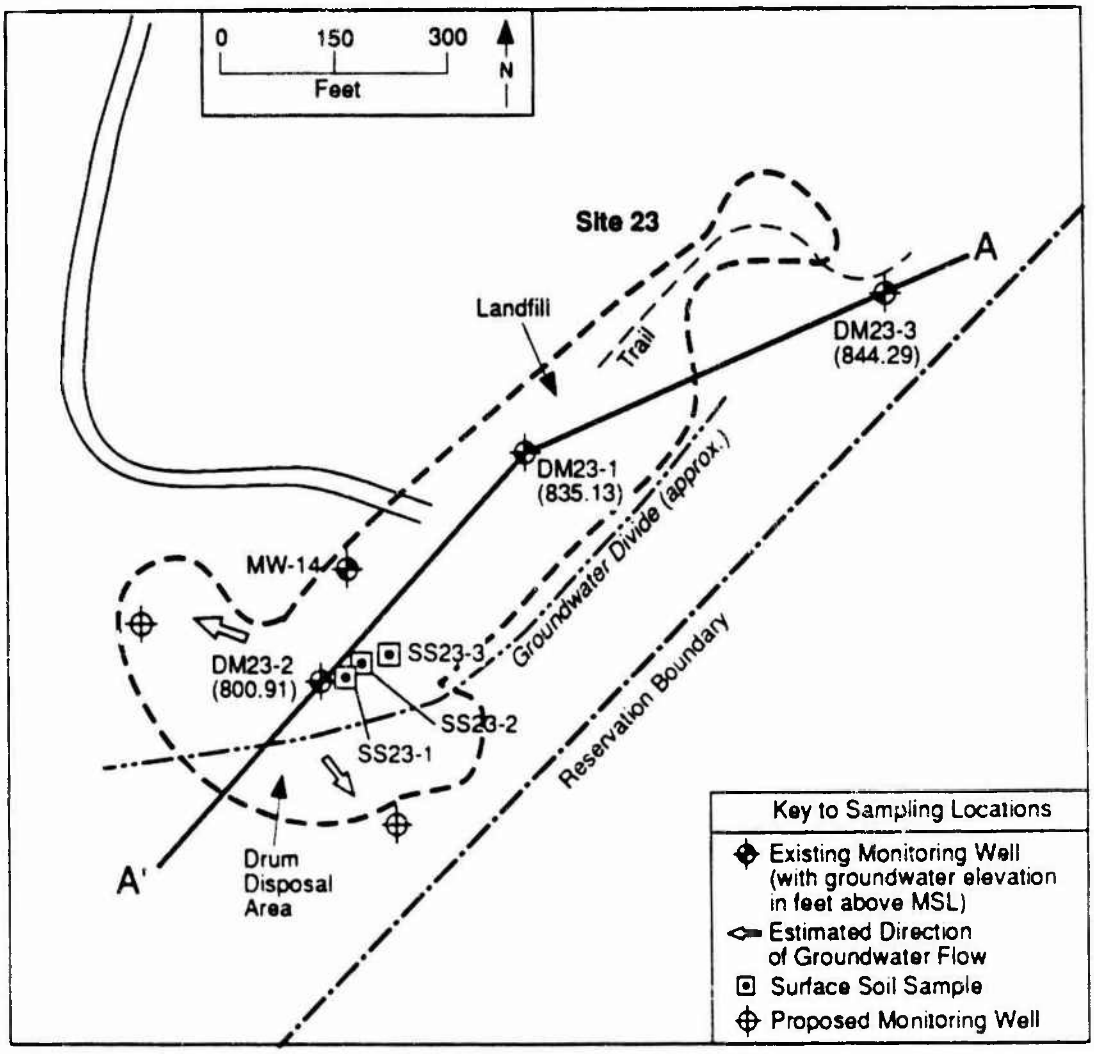

FIGURE 4.2 Layout of Site 23, the Post Farm Landfill (Source: Adapted from Dames & Moore 1989)

The Site occupies an area of about 2 acres and has been used for disposal of nonhazardous wastes, such as clean fill, and vegetative matter, such as trees and brush. However, it was also indicated that the Site could have received a variety of industrial wastes. A detailed aerial photographic study covering the period 1940 to 1984 (Sitton 1989) indicates that the Site was not yet active by December 1940. Therefore, it is quite unlikely that the Site was used for disposal of debris from the 1926 explosion.

Four small excavations were identified in April 1951 and one large one at the center of the Site in May 1957. Filling activities and probable refuse were visible at the excavations in aerial photographs taken from 1957 to 1974. Covering and revegetating of excavations were also evident. The Site appears to be covered, and fill activities ceased in 1979 (Simpson 1986).

There was a pit in the south portion of the Site. In the 1960s, the pit received fly ash from coal burning, paint stripping wastes, phenols, and spent explosive-laden hydraulic oils in containers or as free liquid. The pit was subsequently covered with soils obtained from the middle of the Site.

During a recent Site inspection, a number of drums were found scattered in the wooded area southwest of the southern tip of the landfill. Most of these drums are partially buried. It is not certain whether the drums are empty or contain materials of environmental concern.

Site 23 potentially could have received all kinds of wastes generated at PTA from the 1940s to late 1970. Major pollutants of concern include, but are not limited to, volatile organic compounds (VOCs), semivolatiles, explosives, propellants, heavy metals, polychlorinated biphenyls (PCBs), pesticides, radioactive material, acids, and fuzes.

4.3.2 Geology and Hydrology

Site 23 is located on the top of a ridge in the hills at the eastern boundary of PTA. The topography in the vicinity of the Site is moderately steep, sloping toward the southeast. The surface soils, classified as Rockaway, are deep, moderately permeable, and well-drained upland soils. The subsoils are commonly gravelly loam or gravelly sandy loam. The lower part of the subsoil is a dense, firm fragipan. Water tends to move laterally over the fragipan (Wingfield 1976).

Precambrian gneiss underlies the study area. Up to 7.6 m (25 ft) of glacial till overlies the gneiss. Figure 4.3 is a geologic cross-section of Site 23, as interpreted from soil borings drilled in the study area (Dames & Moore 1988).

The depth to the water table varies from 4.5 m (15 ft) at the center portion (well DM23-1) to 11 m (36 ft) at the northeastern (well DM23-3) and southwestern (well DM23-2) edges.

Because Site 23 is located almost on a ridge top, the area could represent a groundwater divide. The groundwater flow regime in the vicinity of the Site is difficult to assess. General groundwater flow in the area appears to be in a southwesterly direction to the plant boundary, based on the water level data obtained for the three DM wells in April 1988. Locally, particularly at the center and southern portions of the landfill, groundwater could flow west toward Green Pond Brook. The groundwater may flow in an easterly direction across the plant boundary near the southern tip of the landfill. Additional monitoring wells are needed to ascertain the groundwater flow regime in the area.

4.3.3 Existing Contamination

4.3.3.1 Soil

In April 1988, Dames & Moore (1989) collected three surface soil samples from the southwestern portion of the landfill. The sample locations (see Fig. 4.2) were

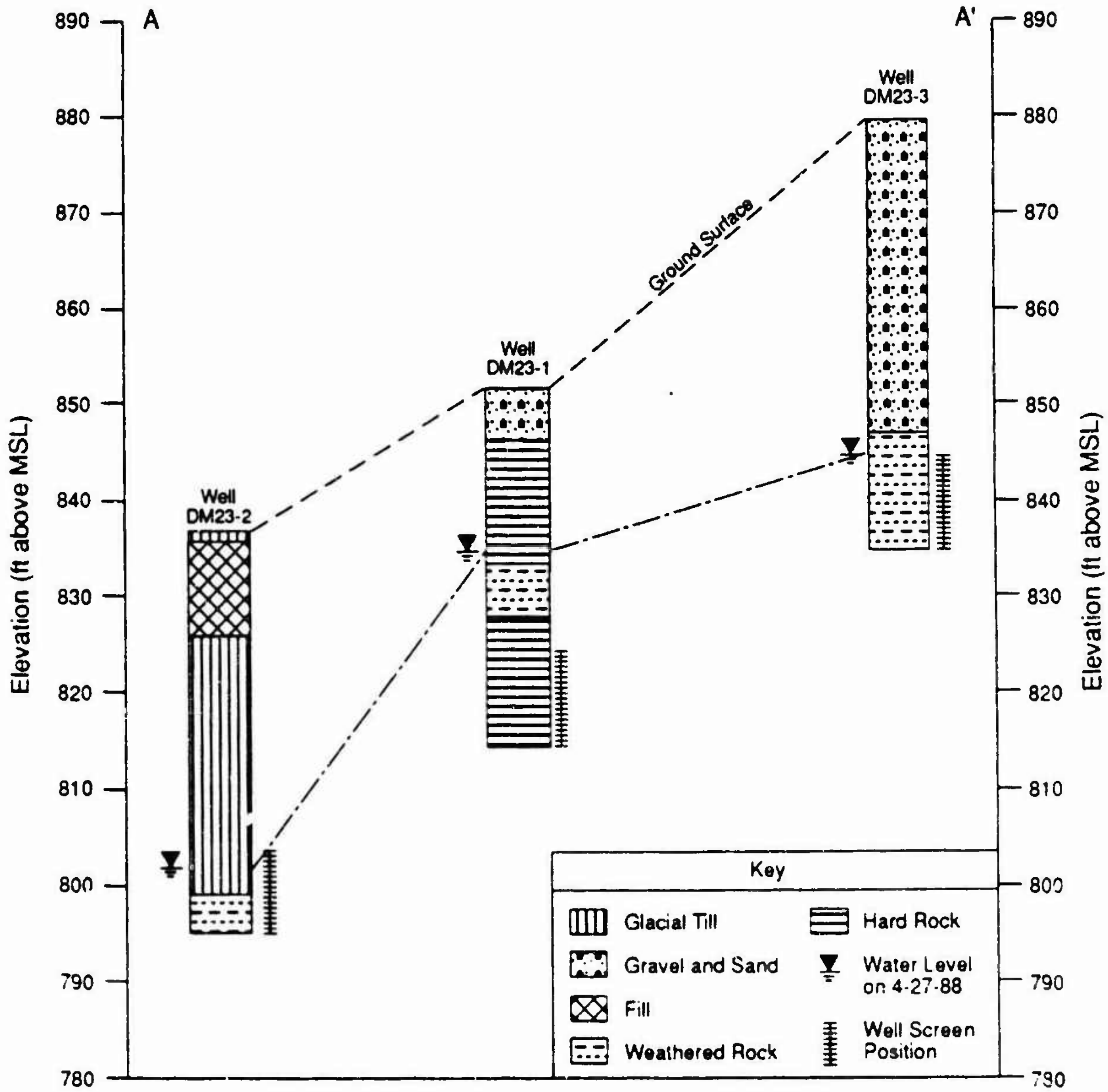

FIGURE 4.3 Geologic Cross-Section A-A' at Site 23 (Source: Based on Dames & Moore 1988)

chosen because surface debris and fly ash were present in these areas. The soil samples were analyzed for phenolics and 13 heavy metals. The results, which are summarized in Table 4.3, indicate that copper and lead were present at concentrations somewhat higher than regional background concentrations. The elevated metal concentrations could be attributed to coal ash disposed of in the area where the soil samples were collected.

4.3.2.2 Groundwater

Site 23 is presently monitored by a network consisting of four wells: DM23-1, DM23-2, DM23-3, and MW-14. The locations of these wells are shown in Fig. 4.2. Well

TABLE 4.3 Selected Analytical Results for Soil Samples from Site 22 (ppm)[a]

Parameter	SS23-1	SS23-2	SS23-3
Silver	2.5	BDL	3.9
Arsenic	5.3	13.0	8.9
Cadmium	0.8	1.5	6.6
Chromium	7.4	14.0	22.0
Lead	28.0	100.0	130.0
Barium	32.8	65.1	66.5
Copper	120.0	560.0	46.0
Phenolics	BDL	BDL	19.0

[a]BDL means below detection limit. Table lists only those metals detected in one or more samples.

Source: Dames & Moore 1989.

DM23-3 was intended to be the upgradient well and the rest the downgradient wells. The construction data for these wells are shown in Table 4.4. All except well MW-14 were drilled into the bedrock. Screens in wells DM23-2 and DM23-3 intercept the water table.

Well MW-14 is located to the southwest of the site near Old Post Road. It was installed in March 1981. The well is 32 ft deep and screened between a depth of 11 and 31 ft. The static level observed in early 1981 was 25 ft deep. The well was sampled three times between 1981 and 1983. Phenol and methylene chloride were detected once, at 7 and 1 µg/L, respectively. Other purgeable organics were not detected. Heavy metals were measured for the sample collected in 1983. Lead and chromium were found at 43 and 3 µg/L, respectively (Sargent et al. 1986). The well was not sampled in 1988 because of a low water level.

Dames & Moore sampled wells DM23-1, DM23-2, and DM23-3 in April 1988 and analyzed the samples for heavy metals and phenols. The analytical results are summarized in Table 4.5. An elevated cadmium concentration (30 µg/L) at DM23-2 could be attributed to the fly ash disposal in the general area of the well. Phenolics were measured at 3.2 µg/L in the upgradient well DM23-3 (in 1988) and at 7 µg/L at MW-14 (in 1983). Both phenol values were substantially below the New Jersey drinking water guideline of 3,500 µg/L.

TABLE 4.4 Well Data for Site 23

Parameter	Well MW-14[a]	Dames & Moore Wells[b]		
		DM23-1	DM23-2	DM23-3
Date drilled	3/9/81	2/19/88	2/11/88	2/24/88
Water surface elevation (ft)	825.30	835.13	800.91	844.29
Total depth (ft)		39	43	45
Ground surface elevation (ft)	850.0	851.0	836.9	878.9
Top of casing elevation (ft)		853.15	839.26	880.52
Screen depth (ft)				
Top	11	27	33	35
Bottom	31	37	43	45
Geologic unit	Stratified drift	Bedrock	Sand, gravel and boulders	Till and bedrock

[a]Source: Sargent et al. 1986.

[b]Source: Dames & Moore 1989. For the Dames & Moore wells, the casing diameter is 4 in. and the screen type is PVC. Water levels in DM wells were measured on 4/27/88.

4.3.4 Proposed RI Plan

4.3.4.1 Phase I

The 1988 groundwater data do not appear to indicate major contamination from Site 23. However, the groundwater data for well MW-14, taken in 1983, and surface soil data discussed above indicate the possibility of contamination. The Site is located right next to the PTA boundary and the groundwater divide. It is recommended that two additional monitoring wells be installed. The locations of these proposed wells are shown in Fig. 4.2. The exact locations should be determined by field inspection. These wells are needed to monitor the groundwater on the southern and western sides of the south portion of the landfill. The suggested new well to the west of the south tip of the landfill would monitor the impact of the drums in the wooded area. The well to the south of the

TABLE 4.5 Selected Analytical Results for Groundwater from Wells at Site 23 (μg/L)[a]

Parameter	DM23-3	DM23-1	MW-14[b]	DM23-2	Det. Limit
Mercury	BDL	BDL	-	BDL	0.72
Arsenic	BDL	BDL	BDL	BDL	4.70
Cadmium	0.66	0.37	BDL	30.0	0.35
Chromium	BDL	BDL	3	BDL	3.30
Lead	BDL	BDL	43	BDL	15.0
Copper	4.9	3.4	15	9.2	2.50
Manganese	282	7.7	-	500	3.30
Phenolics	3.2	BDL	7.0	BDL	2.50
Cyanide	3.23	BDL	BDL	BDL	4.50

[a]BDL means below detection level and a hyphen means data not available.

[b]Measured in March 1983; purgeable organics were not detected.

Sources: Dames & Moore 1989 for DM wells; Sargent et al. 1986 for MW-14.

landfill would provide data to determine whether contaminant migration occurred toward the installation boundary. Because of potential groundwater level fluctuations, as indicated by well MW-14, screens 6 m (20 ft) long may be needed for these wells. To detect the impact at its worst, these screens should intercept the surface of the water table.

It is also recommended that existing and new wells be used for assessing the groundwater flow regime in the study area. Aquifer slug tests should be conducted for the two new wells and two existing wells (DM23-1 and DM23-2). In addition, static water level measurements should be carried out for all wells on a quarterly basis for one year.

New and existing wells should continue to be sampled. The samples from these wells should be analyzed for all TCL volatiles, TCL semivolatiles, TCL metals, explosives, propellants, pesticides, PCBs, nitrite, nitrate, gross alpha, gross beta, and macroparameters.

Additionally, the drums located in the wooded area west of the southwestern portion of the landfill should be sampled. All drums should be opened. For those drums that are found containing wastes, a sample should be collected from each drum and a sample of the soils near each drum. For those drums that are empty, a soil sample from the bottom of the drum should be collected. All drum content and soil samples should be determined at a site inspection. These samples should be analyzed for TCL volatiles, TCL semivolatiles, TCL metals, pesticides, PCBs, explosives, and propellants. If the drum contents are determined to be hazardous and the surrounding soils contaminated, the drums and contaminated soils should be removed and properly disposed of.

4.3.4.2 Phase II

The monitoring plan for Site 23 should be reviewed and continued if warranted by the new data on groundwater flow and quality. Plans for additional soil sampling and monitoring wells and for remedial action may be proposed.

4.4 SITE 25 — SANITARY LANDFILL (NEAR THE DREDGE DISPOSAL PILE)

4.4.1 Site History

Site 25 is one of three former landfills at PTA. It is located about 370 m (1,200 ft) south of the Site 24 landfill and adjacent to the extreme southwest PTA boundary. A Site map is given in Fig. 4.4.

Wastes disposed of in this landfill reportedly include rubbish, industrial wastes, shells, and sewage treatment sludge. Aerial photographs (Sitton 1989) indicate that the Site was not present in 1940; thus, the Site could not have been used to dispose of unexploded ordnance (UXO) from the 1926 explosion. Excavated areas appeared in the 1951 aerial photographs. Possible containers, drums, pits, debris, and active fills were visible in later photographs taken between 1957 and the mid-1970s. The entire Site appeared to be covered by 1979 (Sitton 1989). The landfill encompasses about 3.2 ha (8 acres), although the location of its northern boundary is uncertain. In addition, the central part of the landfill (about 0.4 ha [1 acre]) coincides with Site 26 (dredge disposal pile), which is discussed in Sec. 4.5.

Site 25 potentially could have received all kinds of wastes produced at PTA from the 1940s through late 1970s. Major pollutants of concern include VOCs, semivolatiles, explosives, propellants, heavy metals, PCBs, pesticides, acids, bases, and radioactive materials.

4.4.2 Geology and Hydrology

Site 25 is located close to the southern portion of the glaciated valley. The area is drained by a number of small brooks and drainage ditches, in addition to Green Pond Brook, which flows from the west to the southeast of the landfill. Soils in the area are classified in the Adrian Series. Adrian Muck is a near-level, very poorly drained organic soil that is underlain by sandy deposits at a depth of 41-130 cm (16-50 in.). Permeability is high in these soils, and the water table is close to the surface most of the time. These soils have a tendency to flood from stream overflow (Wingfield 1976).

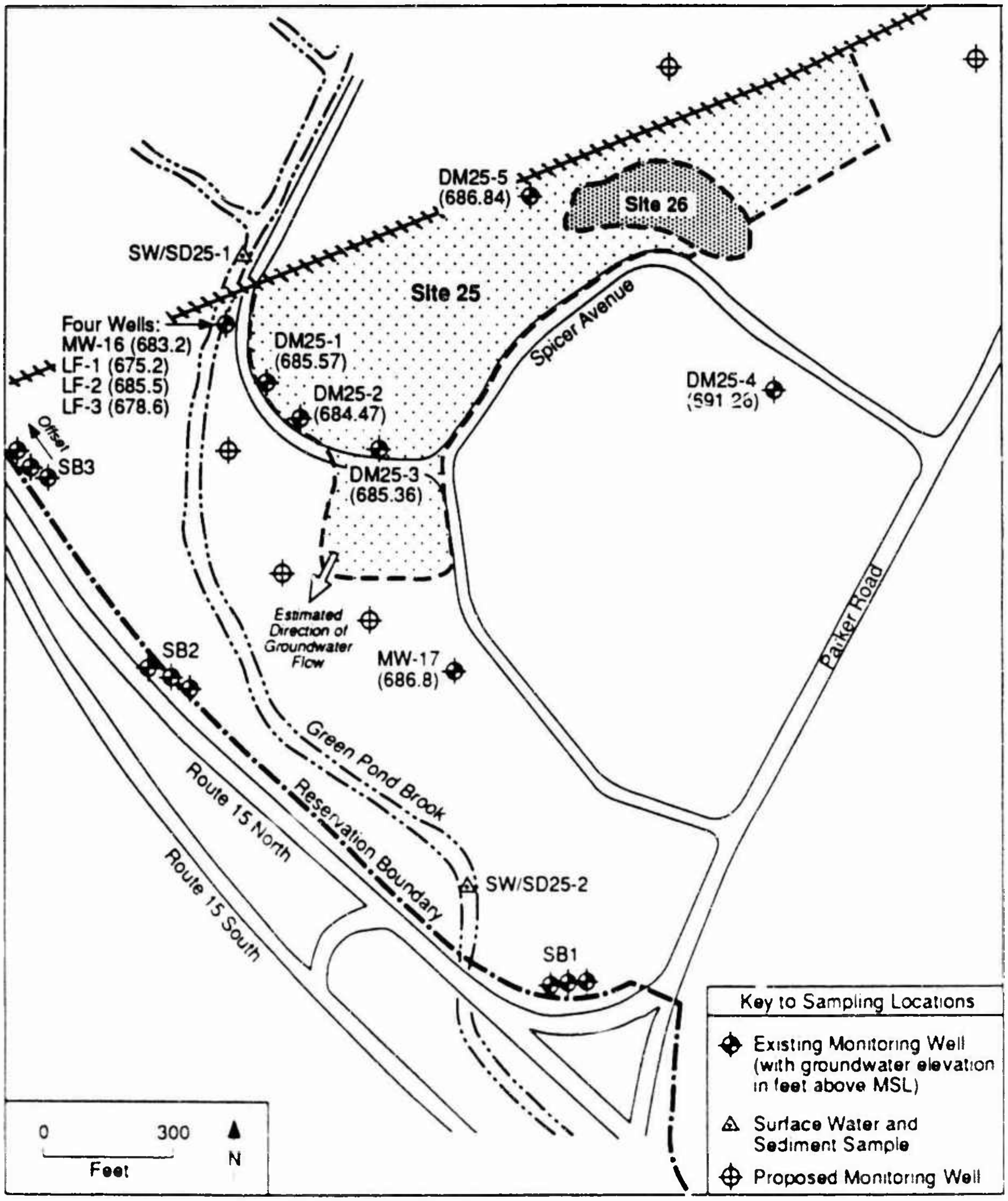

FIGURE 4.4 Layout of Site 25, the Sanitary Landfill (Source: Adapted from Dames & Moore 1989)

The bedrock in this area is a Precambrian gneiss unconformably overlain by the Leithsville Formation of Cambrian age (Harte et al. 1986).

The lithologic and gamma-ray logs and grain-size histogram for LF wells are shown in Fig. 4.5. These show the presence of 55 m (180 ft) of alternating layers of sand or sand and gravel; silt and clay overlie the weathered bedrock (Harte et al. 1986).

Three major aquifers -- the water table or unconfined stratified, the confined stratified, and the bedrock aquifers -- have been identified in the central part of the valley. The limited well log data indicate that this could also be the case in this part of PTA. The water-table aquifer generally is within 10 ft of the ground surface, extending to a depth of about 40 ft. This aquifer is separated from the confined aquifer by a confining unit of sand, silt, and clay about 25 ft thick. The confined aquifer is about 150 ft thick. The weathered bedrock forms a confining unit that separates the confined aquifer from the bedrock aquifer.

The results of recent water level measurements for area wells are shown in Fig. 4.4. It appears that groundwater flow in the water table is toward Green Pond Brook. The water level data for the deep wells (LF-1, -2, and -3) suggest the possibility of a downward vertical hydraulic gradient at this Site. Because of data limitations, the directions of vertical and horizontal water flow in the confined and bedrock aquifers remain to be defined.

4.4.3 Existing Contamination

4.4.3.1 Soil

There are no data on soil contamination at Site 25.

4.4.3.2 Surface Water

Surface water and sediment samples were collected from two locations on Green Pond Brook in April 1988 under the Dames & Moore program. The two sampling locations (see Fig. 4.4) include one upstream (SW/SD25-1) and one downstream (SW/SD25-2) of Site 25. These samples were analyzed for metals, volatile organics, and explosive compounds. The results are listed in Table 4.6.

Varying levels of metals are present in sediment samples, such as mercury (up to 0.42 ppm), arsenic (up to 4.5 ppm), cadmium (up to 5.5 ppm), chromium (up to 33 ppm), lead (up to 62 ppm), and copper (up to 52 ppm). Volatile organics or explosive compounds were either undetected or below detection limits. Beryllium concentrations at sampling location SD25-2, and copper, lead, and possibly mercury concentrations at sampling locations SD25-1 and -2, indicate low levels of contamination. Organics detected at SD25-2 are mostly PAHs, which appear to be related to fly ash. Most volatile organics or

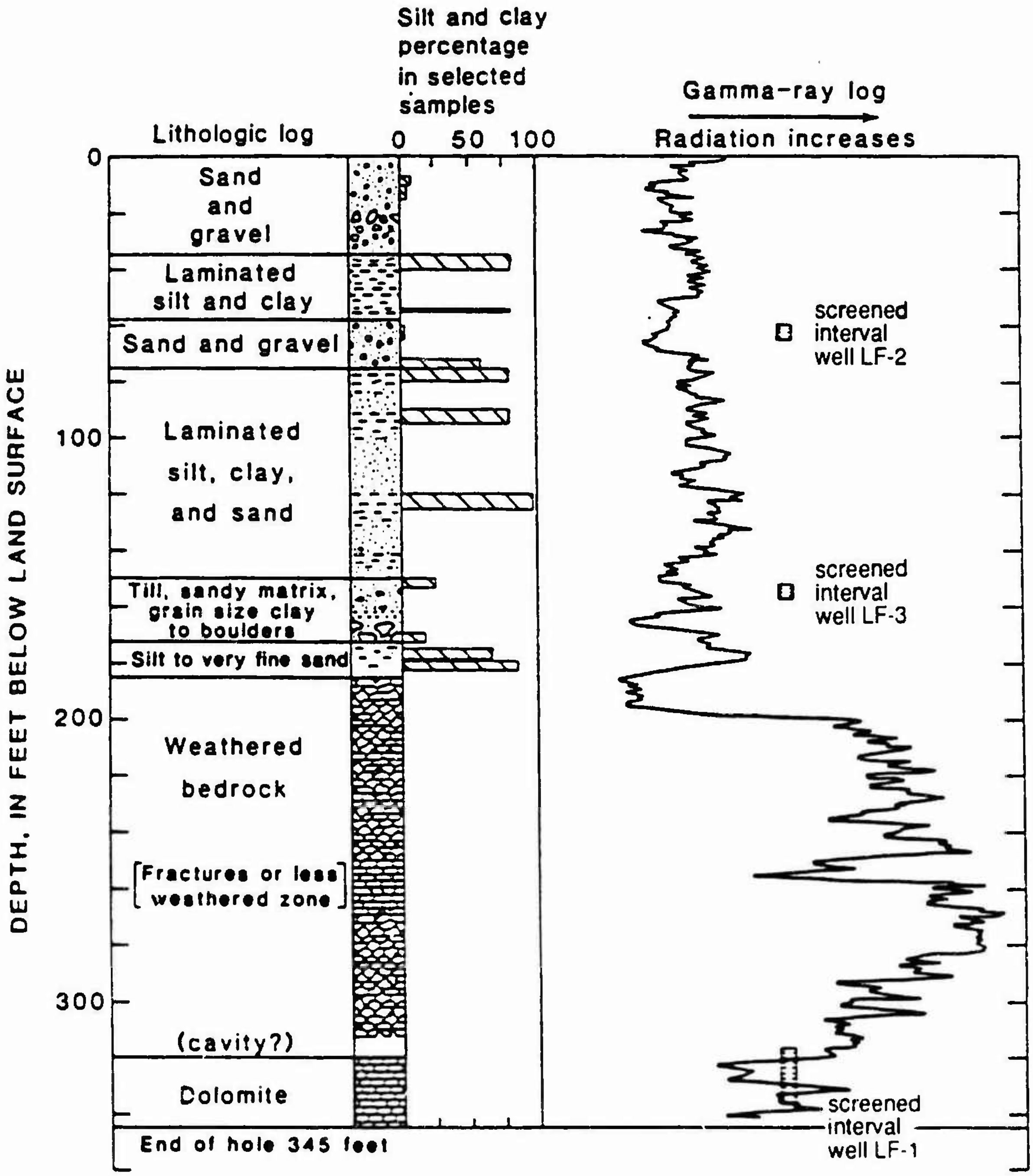

FIGURE 4.5 Lithologic and Gamma-Ray Logs for Wells at Site 25 (Source: Harte et al. 1986)

TABLE 4.6 Analytical Results for Sediment and Surface Water Samples from Green Pond Brook near Site 25[a,b]

Parameter	Sediment Samples (µg/g)		Surface Water Samples (µg/L)		MCLG (µg/L)
	SD25-1	SD25-2	SW25-1	SW25-2	
Metals					
Mercury	0.34	0.42	-	-	3
Arsenic	4.0	4.5	BDL	BDL	60
Beryllium	BDL	BDL	BDL	14.5	130
Cadmium	5.5	3.8	BDL	BDL	5
Chromium	33.0	29.0	BDL	BDL	120
Lead	35.0	62.0	BDL	BDL	20
Barium	51.4	38.0	28.4	28.4	1,500
Copper	52.1	42.3	6.8	4.3	1,300
Semivolatiles					
Di-n-butyl phthalate	0.528	0.607	BDL	BDL	-
bis(2-Ethylhexyl) phthalate	0.528	0.607	BDL	BDL	-
Benzo (g,h,i) perylene	BDL	0.911	BDL	BDL	-
Chrysene	BDL	1.52	BDL	BDL	-
Indeno (1,2,3-c,d) pyrene	BDL	1.21	BDL	BDL	-
Pyrene	BDL	0.759	BDL	BDL	-
Benzo (b) fluoranthene	BDL	3.04	BDL	BDL	-
Benzo (a) pyrene	BDL	1.52	BDL	BDL	-
Fluoranthene	BDL	1.52	BDL	BDL	-
Dibenzo (a,h) anthracene	BDL	0.455	BDL	BDL	-

[a]BDL means below detection level. Analytic results were BDL for silver, selenium, cyanide, tetrachloroethylene, trichloroethylene, 1,1,1-trichloroethane, and explosives.

[b]Samples were collected on April 13, 1988.

Source: Dames & Moore 1989.

explosives were not detected, except for methylene chloride, which was found at both sampling locations at low levels. The presence of this compound is most likely an artifact of laboratory procedures.

The data in Table 4.6 show that surface water samples from the two locations are not contaminated, despite the presence of some contamination in sediments.

4.4.3.3 Groundwater

The groundwater in the vicinity of Site 25 has been monitored since 1981. There are 10 existing wells, and their construction data are given in Table 4.7. Wells DM25-1 through -5 were installed between December 1987 and January 1988. Wells LF-1 through -3 were installed in late 1982, and wells 16 and 17 in March 1981. Well LF-1 is about 337 ft deep and screened in the bedrock aquifer. Wells LF-2 and -3 are 65 and 157 ft deep, respectively; both are screened in the confined aquifer. All other wells are water table wells and screened at 9-20 ft.

The Dames & Moore wells were sampled once, in April 1988. The other wells have been sampled since the early 1980s and also in April 1988. Table 4.8 provides the groundwater quality data obtained in 1988 under the Dames & Moore program. Table 4.9 lists the range of concentrations observed for selected contaminants from 1981 to 1984 for wells established before 1987.

Well DM25-4 (a water table well) is located about 400 ft southeast of the landfill. It was intended to assess background water quality. The one-time data obtained in 1988 show a low pH (3.81) and manganese at 89.4 µg/L, which exceeds its maximum containment level (MCL) of 50 µg/L. Bis-2-ethylhexyl phthalate (B2EHP) was detected at 1,000 ppb.

Well DM25-5, a water table well adjacent to and downgradient of the sludge pile, was contaminated with a myriad of organics, including chlorobenzene (40 µg/L), 1,4-dichlorobenzene (14DCLB, 80 µg/L), and phenols (4.17 µg/L). Its pH was measured at 3.72. Heavy metals, including barium (182 µg/L), cadmium (0.4 µg/L), iron (70.000 µg/L), manganese (1,000 µg/L), nickel (4.56 µg/L), and zinc (110 µg/L) were detected. The values for manganese and iron are above the state secondary groundwater standards, and the value for 14DCLB is above the MCL.

Wells DM25-1, DM25-2, DM25-3, MW-16, and MW-17 are all water table wells located south of the landfill and intended to monitor the impact of the landfill. Among these wells, the three Dames & Moore wells and MW-16 are at the apparent southern edge of the landfill. Under the 1988 sampling program, one or more explosive compounds (2,4-DNT, HMX, and 135-TNB) were detected in these wells except for well MW-16. Heavy metals, phenols, and VOCs are, again except for well MW-16, generally at levels higher than those found in upgradient well DM25-4. Iron or manganese, or both, are at the high levels typically found in the region's groundwater. Well MW-16 is situated right next to the brook; dilution by brook water may explain why lower contamination levels were observed at this well instead of the other three wells at the landfill boundary. Between 1981 and 1985, however, well samples were found to contain chromium (up to 25 ppb), lead (up to 622 ppb), arsenic (up to 16 ppb), tetrachloroethane (up to 5 ppb), TCE

TABLE 4.7 Construction Data for Wells near Sites 25 and 26

Parameter	Dames & Moore Wells[a]				
	DM25-1	DM25-2	DM25-3	DM25-4	DM25-5
Date drilled	12/22/87	12/22/87	12/23/87	12/24/88	1/7/88
Water surface elevation (ft)[b]	685.57	684.47	685.36	691.26	686.84
Total depth (ft)	20	20	20	21.5	19.6
Ground surface elevation (ft)	692.8	692.8	693.5	695.4	691.9
Top of casing elevation (ft)	694.79	694.99	695.37	697.43	694.16
Screen depth, top (ft)	10	10	9.85	9.5	9.5
Screen depth, bottom (ft)	20	20	19.85	19.5	19.5
Geologic unit	Glacial till	Glacial till	Glacial till	Glacial till	Glacial till

	MW Wells[c]		Landfill Wells[d]		
	MW-16	MW-17	LF-1	LF-2	LF-3
Date drilled	3/9/81	3/9/81	11/1/82	12/7/82	12/14/82
Water surface elevation (ft)[b]	683.2	686.8	675.2	685.5	678.6
Total depth (ft)	-	-	-	-	-
Ground surface elevation (ft)	692.6	691.3	692.8	693.3	693.1
Top of casing elevation (ft)	694.8	693.3	-	-	-
Screen depth, top (ft)	9	7	317	60	152
Screen depth, bottom (ft)	19	19	337	65	157
Geologic unit	Stratified drift	Stratified drift	Leithsville Formation	Stratified drift	Stratified drift

[a]Source: Dames & Moore 1989. For the DM wells, casing diameter is 4 in., screen type is PVC, and soil sampling method was split spoon.

[b]Measured in April 1988.

[c]Source: Sargent et al. 1986.

[d]Source: Harte et al. 1986.

TABLE 4.8 Analytical Results for Groundwater Collected from Wells near Site 25 in April 1988 (µg/L)[a]

Analyte	DM25-1	DM25-2	DM25-3	DM25-4	DM25-5
Explosives					
2,4-Dinitrotoluene	BDL	BDL	0.343	BDL	BDL
HMX	BDL	17.4	BDL	BDL	BDL
1,3,5-Trinitrobenzene	0.964	BDL	BDL	BDL	BDL
Metals					
Arsenic	BDL	7.73	BDL	BDL	BDL
Barium	184	136	98.0	BDL	182
Cadmium	0.410	BDL	BDL	BDL	0.410
Chromium (total)	5.54	BDL	4.11	BDL	BDL
Copper	BDL	BDL	BDL	3.03	BDL
Iron	4,700	55.3	52.5	BDL	70,000
Manganese	1,100	960	1,100	89.4	1,000
Nickel	BDL	10.4	BDL	BDL	4.56
Zinc	32.6	BDL	BDL	BDL	110
Anions					
Nitrate	BDL	BDL	1,000	2,600	BDL
Nitrite	116	62.5	110	BDL	56.1
Sulfate	1,190	BDL	11,900	27,000	5,190
Phenols (total)	14.9	8.22	16.7	BDL	41.7
Volatile Organics					
Benzene	BDL	BDL	1	BDL	BDL
Chlorobenzene	10	BDL	10	BDL	40
Chloromethane	BDL	BDL	2	BDL	BDL
1,2-Dichlorobenzene	BDL	BDL	1	BDL	BDL
1,3-Dichlorobenzene	BDL	BDL	2	BDL	BDL
1,4-Dichlorobenzene	70	BDL	60	BDL	80
trans-1,2-Dichloroethene	BDL	4.31	BDL	BDL	BDL
Ethylbenzene	BDL	5	3	BDL	BDL
Methylene chloride	6	20	BDL	10	8
Toluene	BDL	BDL	1	BDL	BDL
Vinyl chloride	BDL	BDL	1	BDL	BDL
Xylenes (total)	49	BDL	4	BDL	BDL
Semivolatile Organics					
Bis(2-ethylhexyl)phthalate	BDL	BDL	30	1,000	BDL
Di-n-Octyl phthalate	BDL	100	BDL	BDL	BDL
pH	6.08	6.61	6.46	3.81	3.72

TABLE 4.8 (Cont'd)

Analyte	LF-1	LF-2	LF-3	MW-16	MW-17
Explosives					
2,4-Dinitrotoluene	BDL	BDL	BDL	BDL	BDL
HMX	BDL	BDL	BDL	BDL	BDL
1,3,5-Trinitrobenzene	BDL	BDL	BDL	BDL	BDL
Metals					
Arsenic	BDL	BDL	BDL	BDL	BDL
Barium	327	50.4	104	31.6	BDL
Cadmium	0.391	BDL	0.506	0.533	BDL
Chromium (total)	BDL	BDL	BDL	BDL	BDL
Copper	4.71	BDL	2.73	BDL	BDL
Iron	1,800	436	74.3	6,500	82.6
Manganese	450	148	8.00	680	14.0
Nickel	BDL	BDL	BDL	BDL	BDL
Zinc	71.4	30.5	BDL	BDL	BDL
Anions					
Nitrate	338	573	368	103	232
Nitrite	BDL	BDL	BDL	51.9	BDL
Sulfate	7,140	29,000	1,830	24,000	21,000
Phenols (total)	BDL	BDL	BDL	BDL	BDL
Volatile Organics					
Benzene	BDL	BDL	BDL	BDL	BDL
Chlorobenzene	BDL	BDL	BDL	BDL	BDL
Chloromethane	BDL	BDL	BDL	BDL	BDL
1,2-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL
1,3-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL
1,4-Dichlorobenzene	BDL	BDL	BDL	BDL	BDL
trans-1,2-Dichloroethene	BDL	BDL	BDL	BDL	BDL
Ethylbenzene	BDL	BDL	BDL	BDL	BDL
Methylene chloride	BDL	6	6	6	5
Toluene	BDL	BDL	BDL	BDL	BDL
Vinyl chloride	BDL	BDL	BDL	BDL	BDL
Xylenes (total)	BDL	BDL	BDL	BDL	BDL
Semivolatile Organics					
Bis(2-ethylhexyl)phthalate	BDL	b	b	BDL	BDL
Di-n-Octyl phthalate	BDL	b	b	BDL	BDL
pH	6.95	6.50	6.50	6.84	5.15

[a]BDL means below detection limit. Underscored concentrations exceed the applicable drinking water standard or guideline.

[b]Data were rejected.

Source: Dames & Moore 1989.

TABLE 4.9 Analytical Results for Groundwater Collected from Wells near Site 25 during 1981-1984 (µg/L)[a]

Parameter	MW-16		MW-17		LF-1		LF-2		LF-3	
	Range	% ADL[b]	Range	% ADL	Range	% ADL	Range	% ADL	Range	% ADL
Cadmium	BDL	0	BDL-24	14	BDL-2	33	BDL-11	33	BDL-1	20
Chromium	BDL-25	50	BDL-6	14	BDL-7	17	BDL	0	BDL-4	17
Lead	BDL-622	60	BDL-120	14	BDL-210	60	BDL-51	67	BDL-35	40
Selenium	BDL	0	BDL	0	BDL-25	20	BDL-25	33	BDL-29	20
Arsenic	BDL-16	33	BDL	0	BDL	0	BDL-1	33	BDL-3	20
Chloroform	ND	0	ND-16	25	ND-3.7	11	ND	0	ND	0
Tetrachloroethylene	ND-5	17	ND-3	25	ND-BDL	0	ND	0	ND-BDL	0
Trichloroethylene	ND-22	17	ND-21	38	ND-BDL	0	ND-3.2	40	ND-BDL	0
1,1,1-trichloroethene	ND-2	15	ND-4	22	ND-BDL	0	ND-BDL	0	ND-BDL	0
Toluene	ND-22	36	ND	0	ND	0	ND	0	ND	0

[a]BDL means below detection limit, and ND means not detected.

[b]Percentage of samples with concentrations above detection limit.

Source: Sargent et al. 1986.

(up to 22 ppb), and toluene (up to 25 ppb). Values of lead and trichloroethylene (TCE) for this well exceeded their MCLs.

Deep wells LF-1, LF-2, and LF-3 are located near well MW-16. Heavy metals were detected in samples prior to 1987, including lead (up to 210 ppb for LF-1, 51 ppb for LF-2, and 35 ppb for LF-3) and selenium (up to 25 ppb for LF-1 and -2 and 29 ppb for LF-3). These compounds exceeded their MCLs. Cadmium, chromium, and arsenic were detected, but at levels lower than their MCLs. The 1988 Dames & Moore samples from these wells showed no significant levels of contamination. No explosive compounds or organics were detected. The metal concentrations were generally lower than their respective MCLs, except for those for iron and manganese, which are typically high in this region.

Well MW-17, also a water table well, is located southeast of and somewhat out of the groundwater migration path from the landfill. The 1988 data showed no significant contamination at this well. However, data for the 1981-85 period showed sporadic concentrations of cadmium (24 ppb), lead (120 ppb), chloroform (up to 4 ppb), TCE (up to 4.4 ppb), and 1,1-dichloroethane (11DCE) (8 ppb). Among these compounds, the levels of lead, cadmium, and TCE exceeded their respective MCLs. Explosive compounds were below detection limits.

The available data apparently indicate that the shallow, unconfined groundwater at the site is contaminated to a limited degree with VOCs and some explosives. It appears that heavy metals are not present in these wells at levels to cause major concern, at least based on the 1988 data.

The zone of contamination can be roughly defined by wells DM25-3 to the south, MW-16 to the north, and DM25-5 to the northeast. The contaminants appear to be derived from the Site's landfill. However, some other upgradient sources, such as Site 26 (dredge pile), Site 34 (burning ground), and the areas near the railroad tracks and between Sites 26 and 34, which have not been characterized, may also be sources of the contamination observed in the wells located in Site 25.

The deep aquifers do not appear to be contaminated, as evidenced by the 1988 data collected for the LF wells. Further sampling, however, is needed to verify this conclusion.

4.4.4 Proposed RI Plan

4.4.4.1 Phase I

The monitoring at stations SW25-1 and SW25-2 on Green Pond Brook should be continued. Monitoring at these stations would provide data on the water quality of the brook before it exits the installation. In addition to Site 25, numerous other sites are situated upstream and adjacent to the brook. A wide range of analytical parameters is needed because of the potentially varied and unknown nature of contamination at these sites. The surface water and sediment samples should be analyzed for all TCL parameters, explosives, herbicides, nitrite, nitrate, gross alpha, gross beta, macroparameters, and TCLP leachability (sediment samples only).

It is essential to monitor the groundwater plume, if any, before it reaches the Site boundary. Three well clusters were installed in May 1988 near Site 25 and close to the southwest boundary of the facility. The locations of well clusters SB1 and SB2 are shown in Fig. 4.4. The third cluster is located about 190 ft northwest of well cluster SB2 and near the Phipps Road entrance to the PTA facility. The deepest well in each of these clusters was drilled to bedrock. These new wells should provide data to improve definition and projection of the contaminant plume in the area.

These well clusters, especially SB2, are well situated to monitor potential off-post migration of contaminated groundwater from Site 25. However, additional water table wells should be installed between Site 25 and the PTA boundary to assist in assessing the extent of contamination before the plume reaches the boundary. The three proposed wells are to be tentatively located south of a line formed by wells DM25-1, DM25-2, DM25-3, and MW-16 and north of the brook. These wells are shown in Fig. 4.4.

Two additional upgradient water table wells are also recommended to improve assessment of groundwater flow regimes and definition of groundwater quality in the upgradient area. One of these two wells should be located between the brook and the northern tip of the dredge pile (see Fig. 4.4). This well would monitor any contaminant contribution from the railroad tracks and potential upgradient sources, including any at Site 34 and in the area between Sites 25 and 34. The other water table well should be located northeast of the Site to detect potential contamination from the direction upgradient of the landfill.

The dredge pile will be undergoing additional sampling before closure. The detailed sampling plan is discussed in Sec. 4.5. Additional analysis of dredgings would help to assess the effect of the pile on groundwater contamination.

All existing wells -- 10 wells in the vicinity of Site 25 (including DM25-1, DM25-2, DM25-3, DM25-4, DM25-5, MW-16, MW-19, LF-1, LF-2, and LF-3) and 9 wells at 3 well clusters recently installed at the installation boundary (including SB1, SB2, and SB3) -- and the 5 proposed new water table wells (24 wells altogether) should be sampled for two quarters. Samples from these well should be analyzed for all TCL parameters (with the exception of PCBs and pesticides), nitrite, nitrate, gross alpha, gross beta, and macroparameters.

Many "unknown" compounds were reported for the groundwater samples taken in the area wells under the Dames & Moore program (Dames & Moore 1989). These compounds should be identified and their significance assessed.

In addition to water quality data, static water levels in all monitoring wells should be measured monthly for one year to determine the groundwater flow direction in the different aquifers. Aquifer slug tests are suggested for three wells (DM25-3, DM-25-5, and LF-1) to help provide needed hydrogeological information.

Wells located outside of PTA in the Rockaway River Basin are drawing from an unconsolidated Quaternary aquifer that has been designated a sole or principal source of drinking water for that area. It is currently unknown if the confined glacial aquifer at PTA is hydraulically interconnected to the Quarternary aquifer of the Rockaway River Basin area. The Wisconsin terminal moraine is reportedly located outside the southwest boundary of the facility (Harte et al. 1986), and little is known about the groundwater flow regime in that area. If these aquifers are interconnected, contaminants in the groundwater near the PTA boundary could create a hazard to the public who receive their drinking water from this unconsolidated aquifer in the Rockaway River Basin area. Studies are currently underway to help determine this. If the results of the ongoing studies fail to resolve the question on the hydraulic connection between these aquifers, additional studies are required.

4.4.4.2 Phase II

The surface water and groundwater sampling results from the area should be reviewed at the completion of the respective Phase I programs to assess the extent and trend of contamination, to revise the monitoring program, and, if necessary, to plan for remedial action.

4.5 SITE 26 — DREDGE DISPOSAL PILE

4.5.1 Site History

Site 26 is in the southwestern portion of PTA, coincident with the northeast portion of Site 25. A map of the Site is shown in Fig. 4.6. The dredge pile covers less than 1 acre, and at some locations it is about 15 ft high . The estimated quantity of dredgings is 12,000 yd^3. The material disposed of on this Site was dredged from Green Pond Brook in 1982 to maintain proper flow conditions and to provide storage for fire-fighting pools. The disposal area is unlined (Gaven 1986).

Green Pond Brook has received waste streams from most operations at PTA, including sewage and industrial wastewater discharges, runoff, and contaminated groundwater plumes. Consequently, the sediments in the brook and the dredged material disposed of at the Site likely contain a wide variety of contaminants. Metals, explosives, semivolatiles, and VOCs are of major concern because wastewater discharges from numerous industrial operations and spills on the PTA facility frequently contain these contaminants. PCBs, pesticides, and herbicides are also of concern, as they have been used at PTA over the years.

Site 26 is to be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

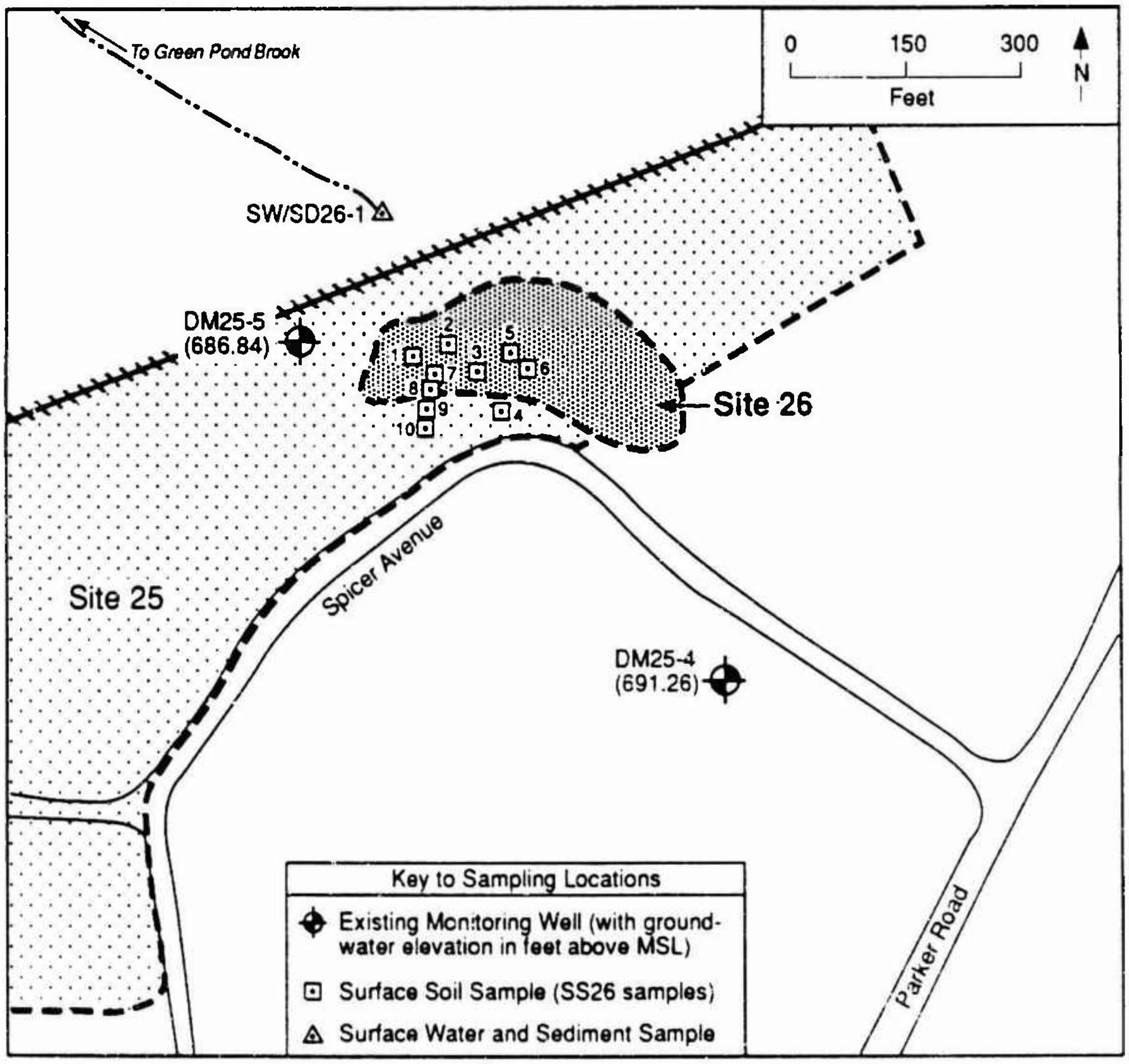

FIGURE 4.6 Layout of Site 26, the Dredge Disposal Pile (Source: Adapted from Dames & Moore 1989)

4.5.2 Geology and Hydrology

The geological and hydrological characteristics of the Site are similar to those of Site 25 (see Sec. 4.4.2).

4.5.3 Existing Contamination

4.5.3.1 Soil

In 1984, two composite samples were collected from the dredge pile: one from the south portion and the other from the north portion. The samples were analyzed for metals, oil and grease, and phenol. The results indicate the presence of arsenic

(3.7-4 ppm), cadmium (5.3-8.3 ppm), chromium (31-49 ppm), cyanide (0.3-0.5 ppm), lead (12-17 ppm), mercury (0.13-0.21 ppm), silver (1.12-1.48 ppm), and oil and grease (138-174 ppm) (ICM 1984).

Under the Dames & Moore program, a total of 10 soil samples were taken at Site 26 in April 1988. Of these, six (SS26-1 through SS26-6, see Fig. 4.6) were collected from the dredge pile at six different locations at depths from 3 to 5 ft. These samples were intended to characterize portions of the pile that may have originated from different dredging locations and to determine the average chemical composition of the dredgings.

The remainder of the soil samples (SS26-7 through SS26-10) were collected along a line perpendicular to the southern face of the dredge pile, at intervals of 5 ft, starting 5 ft from its base (see Fig. 4.6). The purpose of these samples was to assess the extent to which the dredge material may have extended beyond the visible limit of the pile.

The 10 soil samples were analyzed for 14 metals. The results are summarized in Table 4.10. No explosive-related compounds were detected. Metals were detected in most samples, with the concentrations of arsenic ranging from 3 to 11 ppm, cadmium from 5.4 to 26 ppm, chromium from 13 to 56 ppm, lead from 12 to 200 ppm, and barium from 32 to 120 ppm. With the exception of sampling location SS26-1, mercury was found in the samples at less than 1 ppm. Seven samples, including six from on the pile and one from off the pile, contained silver ranging from 1.6 to 8.2 ppm. Copper ranged from below its detection limit to 350 ppm. Among the metals analyzed, the lead, copper, and cadmium concentrations were most indicative of contamination in one or more samples.

The four samples taken from the area outside the visible boundary of the dredge pile show that they are almost as contaminated as those from the pile, indicating that the surface soils beyond the pile may be contaminated for at least 20 ft. The contamination of surface soil could be caused by windblown soil, surface runoff, or spillage during disposal operations.

4.5.3.2 Surface Water

To determine if Site 26 is affecting surface water quality, Dames & Moore collected in April 1988 one surface water and one sediment sample (SW/SD26-1) from the head of the drainage located about 100 ft west of the Site. These samples were also analyzed for metals and explosives. The results are listed in Table 4.11. Explosive compounds were not detected. Many metals that are present in the soil samples from the dredge pile were also measured in the sediment and surface water samples. Lead was measured in surface water at 41.3 μg/L, which exceeds the proposed 20-μg/L MCLG. The high metal concentrations of sediment and water samples from the ditch may be attributable to the dredge pile, although the ditch also receives runoff from Site 25 and the railroad tracks.

TABLE 4.10 Selected Analytical Results for Soil Samples from Site 26 (μg/g)[a]

Sample	Hg	Ag	As	Cd	Cr	Pb	Ba	Cu
SS26-1	BDL	3.0	4.1	9.9	23.0	12.0	32.5	18.6
SS26-2	0.2	8.2	4.8	7.0	24.0	23.0	33.4	25.4
SS26-3	0.4	2.7	4.2	26.0	46.0	51.0	54.0	78.0
SS26-4	0.7	2.9	7.7	17.0	34.0	110.0	100.0	350.0
SS26-5	0.6	4.4	11.0	11.0	13.0	200.0	120.0	12.0
SS26-6	0.6	1.6	6.5	26.0	56.0	27.0	48.8	BDL
SS26-7	0.5	1.6	5.4	11.0	33.0	31.0	42.0	46.6
SS26-8	0.3	BDL	9.5	5.4	19.0	28.0	40.0	24.2
SS26-9	0.5	BDL	3.0	10.0	26.0	21.0	41.7	BDL
SS26-10	0.8	BDL	6.4	9.0	27.0	51.0	63.5	300.0

[a]BDL means below detection limit. The table lists only those analytes detected in one or more samples. Analytic results for all explosives were BDL.

Source: Dames & Moore 1989.

TABLE 4.11 Analytical Results for Surface Water and Sediment Samples from the Site 26 Area[a]

Parameter	MCLG (μg/L)	Surface Water (μg/L)	Sediment (μg/g)
Arsenic	50	10.3	7.8
Cadmium	5	2.2	0.63
Chromium	120	15.9	7.3
Lead	20	41.3	33.0
Barium	1,500	61.8	35.2
Copper	1,300	45.7	33.3
Iron	-	17,000	NA

[a]NA means not analyzed. Analytic results for explosives were below detection limit.

Source: Dames & Moore 1989.

4.5.3.3 Groundwater

The general area of Sites 25 and 26 is currently monitored by a network consisting of 10 wells. The location, construction data, and sampling data for these wells are presented in Sec. 4.4.3.

Well DM25-5 was intended to detect downgradient contamination of Site 26. Well DM25-4 was to serve as an upgradient well for Site 26 as well as Site 25. A one-time sample from water table well DM25-5 had a pH of 3.72 and was contaminated with many organics, including chlorobenzene (40 µg/L) and dichlorobenzene (80 µg/L). Detected concentration of dichlorobenzene exceeds the MCL. Iron (70,000 µg/L) and manganese (1,000 µg/L) were detected at levels exceeding the state secondary ground water standards (Section 3). Explosive-related compounds were not detected.

The upgradient well DM25-4, also a water table well, appears to be less contaminated. However, the water had a low pH (3.81), and bis(2-ethylhexyl) phthalate was detected at 1,000 µg/L (see Table 4.8).

The available groundwater data are limited, making it difficult to determine whether the materials in the dredge pile are leaching into the groundwater. The groundwater quality data for well DM25-5 are not distinctively different from those from the downgradient wells, such as DM25-1, DM25-2 and DM25-3. The location of these wells and the direction of local groundwater flow show that all these wells can be affected by a combination of several waste disposal areas, including Site 25, Site 26, Site 34, and the area between Site 25 and Site 34. The nature of these effects has not been characterized.

4.5.4 Closure Plan

Site 26 may undergo RCRA closure if it is determined that the pile contains hazardous waste; NJDEP has received a closure plan. The revised closure plan includes the following actions (Foster Wheeler 1988c; Solecki 1989a). Sampling and analysis will be carried out to determine whether the dredge pile material is hazardous. Ten dredge composite samples will be collected, using random sampling methods. Six samples will be analyzed for extraction procedure (EP) toxicity for all parameters, reactivity (including reactive cyanide and sulfide), total petroleum hydrocarbons (TPH), and PCBs. Four samples will be retained as spare samples.

If the results show the concentration of TPH above 1%, then the sample will be tested for the EPA priority pollutants and identifications of the largest 40 additional peaks (Foster Wheeler 1988c). Analyses for VOCs are not included in the closure sampling plan as they are not expected in the dredge pile due to the pile's long history (6 years) and natural effects of rain and wind. Analysis for other organics and explosives was not proposed because previous analysis indicated no significant concentrations in the dredge pile. Analysis for PCBs was included, even though PCBs were not detected in previous analysis, as it has been specifically requested by NJDEP (Foster Wheeler 1988c).

If the dredge material is determined by NJDEP to be hazardous, the dredge pile will be closed by removing the dredge material for disposal, but not before ammunition has been sifted out.

Following removal, natural soil samples will be collected to a depth of 0.15 m (6 in.) to verify that removal of contaminated material is complete. The number of soil samples will be determined by NJDEP and the Army Armament Research, Development, and Engineering Center (ARDEC) when the analytical results for the pile samples are available. The soil samples will be analyzed for priority pollutant metals, VOCs, TPH, and EP toxicity for metals (if necessary), pesticides, and herbicides. Soil found to be EP toxic will be excavated. Two grab samples of wash water used for equipment decontamination will be collected and analyzed for priority pollutant metals.

If the dredge pile is determined to not be hazardous, all dredge pile material will be sifted to remove ammunition, which will then be disposed of under Army regulations. The dredge pile will be bulldozed so that the Site will be ready for future use.

4.5.5 Proposed RI Plan

The proposed sampling plan will be carried out independently of implementation of the closure plan. Monitoring of the existing wells in the area should continue. The monitoring of wells at this site should be coordinated with that for Site 25.

Additional RI work should be planned as new data become available or if closure is not possible.

4.6 SITE 163 — BASEBALL FIELDS

4.6.1 Site History

The Site includes two baseball fields located near the main entrance of PTA and at the intersection of Klanderman Lane and Spicer Avenue (Fig. 4.7). The fields were reportedly used as a burning ground. During interviews, PTA personnel also reported that dredging material from Green Pond Brook has been placed on the field. Also, for 3 years, unknown material was reportedly placed into pits below the ball fields. It is not known if this disposal occurred at these fields, the Little League baseball field (Site 176), or both.

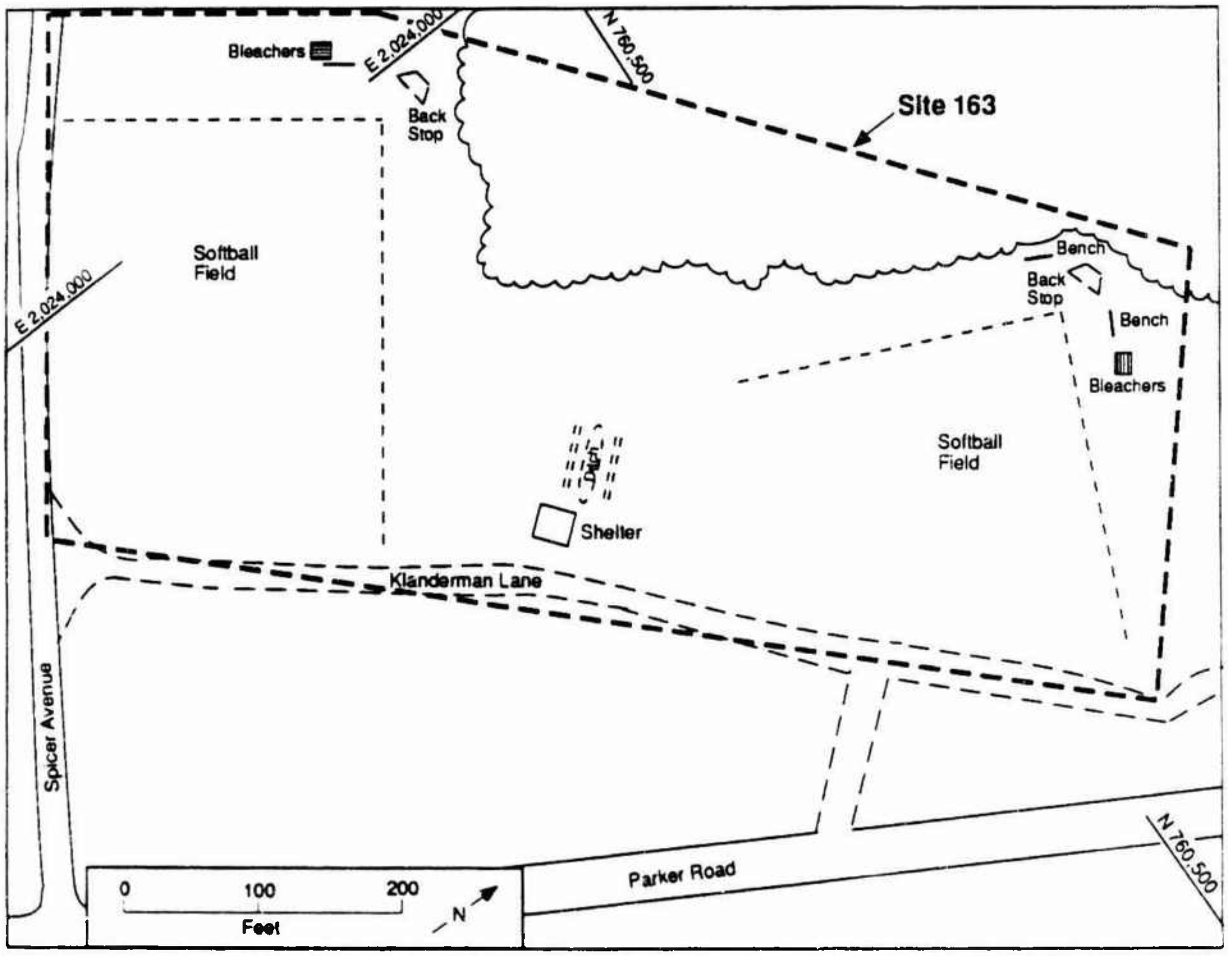

FIGURE 4.7 Layout of Site 163, the Baseball Fields (Source: Adapted from USACE 1984b)

4.6.2 Geology and Hydrology

The Site is located on a flat plain in the main valley. Green Pond Brook flows around the Site about 300 m (1,000 ft) away. Based on records from a nearby well (DM25-4), the Site is underlain by a sequence of medium sand, silt, and fine sand of fluvial and lacustrine origin (Dames & Moore 1989). The thickness of the sediment is estimated to be 45 m (150 ft) (Lacombe et al. 1986). Bedrock under the sediment is Leithsville dolomite.

When well DM25-4 was drilled in December 1987, groundwater was encountered at a depth of 1.6 m (5 ft). Based on data for wells at Site 25 (located a few hundred feet west of the Site), groundwater may flow locally in a western direction, toward Green Pond Brook (Dames & Moore 1989).

4.6.3 Existing Contamination

A groundwater sample taken from downgradient well DM25-4 at a depth of 29 m (95 ft) in April 1988 contained manganese at 89.4 µg/L and B2EHP at 1,000 µg/L (Table 4.8). Also, the one-time water sample had a low pH, 3.81.

4.6.4 Proposed RI Plan

4.6.4.1 Phase I

The proposed monitoring wells for Site 25 would provide information on the groundwater flow direction and the water quality at this Site. Therefore, no separate groundwater monitoring program is proposed here for Site 163.

A geophysical survey should be conducted to locate contaminated areas and the reported pits below the baseball fields.

If areas of geophysical anomalies are located, a soil boring should be drilled in each, and soil samples should be taken from the top, depth of the pit bottom or anomaly, and bottom of each boring. The samples should be analyzed for furans, dioxins, PCBs, cyanide, TCL volatiles, TCL semivolatiles, TCL metals, propellants, and explosives.

4.6.4.2 Phase II

Additional monitoring wells and groundwater and soil samples may be required depending on the Phase I results.

4.7 SITE 180 — WASTE BURIAL AREA NEAR SITES 19 AND 34

4.7.1 Site History

This area is located near the southern PTA boundary, east of the lower burning ground (Site 34), and south of the pyrotechnic demonstration area (Site 19). Although the exact size and location of the Site are not known, it covers some or all of the swampy area adjacent to Site 34. Figure 4.8 shows the Site layout.

4.7.2 Geology and Hydrology

This area of PTA is reclaimed marsh or swamp land. It is underlain by unconsolidated glacial deposits of the Pleistocene Age, ranging in size from clay to boulders. The bedrock below the glacial deposits is Kitatinny Limestone (Bayha 1985).

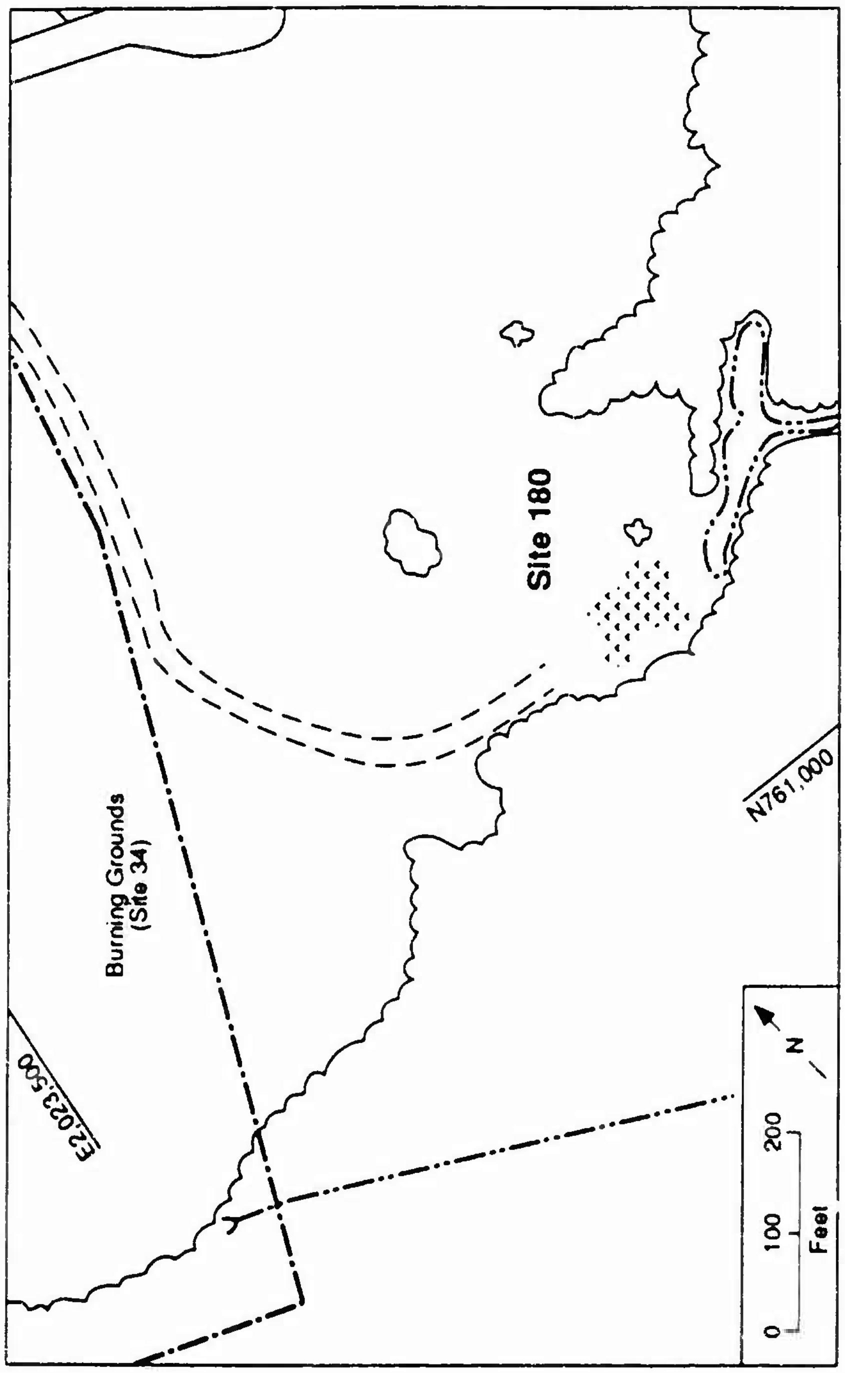

FIGURE 4.8 Layout of Site 180 (Source: Adapted from USACE 1984b)

No information regarding Site-specific soil classification was available. Generally the soils in this area are classified as the Carlisle Muck Series. The Carlisle Muck is a deep, nearly level, poorly drained, organic soil formed in low swampy areas. It may be high in peat content, consisting of the remains of sphagnum moss. The depth to the water table in these soils ranges from 1.1 to 2.0 m (3.7 to 6.6 ft). The soils are compressible under load (Bayha 1985; Sargent 1988).

4.7.3 Existing Contamination

During interviews, PTA personnel reported that several means were used to dispose of a variety of items. These methods were excavation of a large pit to contain these items, or allowing the items to sink into the swampy areas. Items included railroad ties, telephone poles, concrete, and a railroad car.

As described in Sec. 2.2, wastes from a variety of sources were sent to the lower burning ground. The proximity of Site 180 may have made it a convenient alternative for disposal of items that were either not destroyed by burning or did not require burning.

4.7.4 Proposed RI Plan

4.7.4.1 Phase I

All activities for this area should be coordinated with those recommended for Site 34. In order to assess the potential for contamination resulting from operations, a phased investigation is recommended. The current condition of the Site should be established by inspecting all areas for visible contamination and signs of disposal activities. If possible, a geophysical investigation should be carried out to discover buried items and delineate the areas of concern.

If warranted by visible staining or the presence of disturbed areas, one soil sample should be collected from each stained area. One surface water and sediment sample should be collected from three locations within the wetland area. The sampling locations should be determined by field inspection.

If the disposal area can be delineated, a grid should be established. Soil and sediment samples should be collected at 15-m (50-ft) intervals from a depth of 0.6 m (2 ft) using a hand auger. If the disposal area cannot be found, 10 soil samples should be collected at random from a depth of 0.6 m (2 ft) across the Site 180 area. All samples should be analyzed for all TCL parameters except dioxin.

4.7.4.2 Phase II

If contaminant concentrations in the soil samples are elevated, it will be necessary to determine the extent of contamination. One soil boring should be drilled in each contaminated area, and samples should be collected from each boring. All samples should be analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install monitoring wells. Any well installation should be closely coordinated with those scheduled for Sites 19 and 34. Groundwater samples should be analyzed for parameters present at elevated concentrations in the soil boring samples.

5 AREA D: CENTRAL MANUFACTURING VALLEY

5.1 INTRODUCTION

Area D contains 14 Sites located in the south central part of the Arsenal. For some of the Sites, such as those associated with Bldgs. 24 and 31, there is documented contamination of the soil and groundwater. Other Sites with less potential for contamination are included in the Area because they are located near these Sites. The groundwater contamination in the Area is the main reason for the listing of Picatinny Arsenal on the National Priorities List (NPL).

5.2 SITES 21 AND 37 — BUILDING 24, PLATING FACILITY AND SURFACE IMPOUNDMENTS

5.2.1 Site History

The plating facility was originally built in 1942 as Bldgs. 24 and 45. It is now referred to as Bldg. 24 (see Fig. 5.1). Since that time, several different operations have been housed there. The Bldg. 45 portion was built as a plating, deburring, and cartridge-case unit. Components were processed in the deburring rooms prior to plating, and the cartridge-case unit was used for reworking used cartridge cases, which were then cleaned and/or plated and sent to be reloaded. The original Bldg. 24 portion was built as a machine shop and shipping facility and later converted to a welding shop (Haven and Emerson 1981).

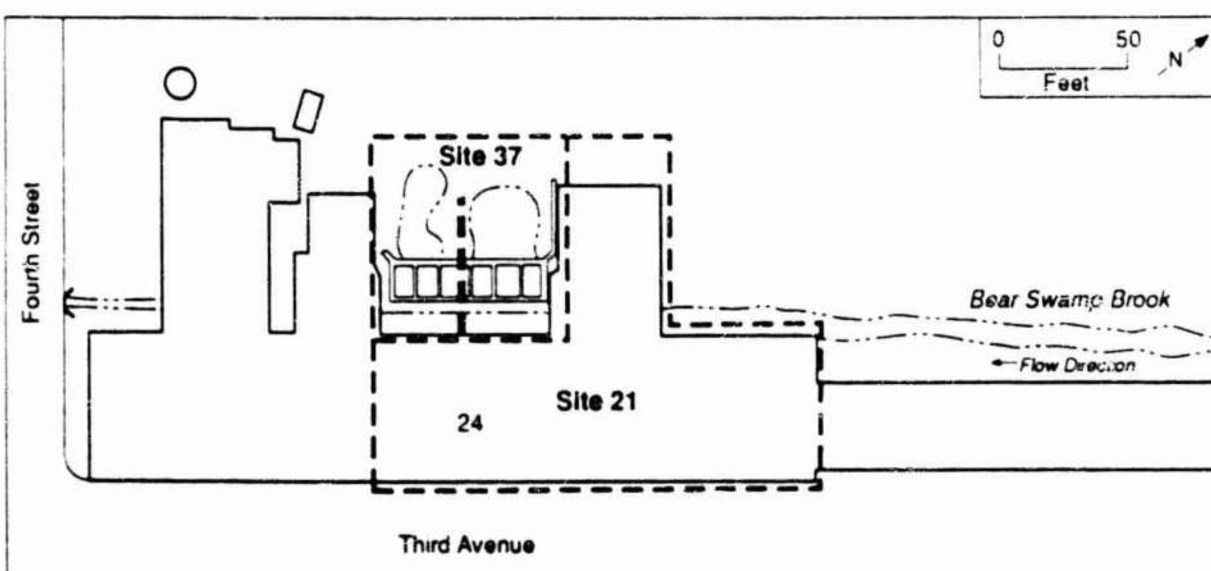

FIGURE 5.1 Layout of Sites 21 and 37, the Building 24 Plating Facility and Surface Impoundments (Source: Adapted from USACE 1984b)

In 1960, the building was gutted and a new plating facility was installed in the southeast section of the building. An industrial waste treatment plant (IWTP) was built adjacent to the plating operation in the southwest section of the building. At that time, two exterior lagoons were constructed on the southwest side of the building. The upper portion of each lagoon was lined with asphalt, the bottom with sand and clay. The asphalt linings were replaced in 1978. The combined volume of the adjoining lagoons was about 55,000 gal. Their approximate dimensions were 20 by 40 ft and 25 by 25 ft; both were 8 ft deep (Haven and Emerson 1981).

Operations in Bldg. 24 included anodizing with chromic and sulfuric acids; cleaning; degreasing; deburring; and plating with chromium, cadmium, copper, tin, and nickel. The building also contained a chemical storage area where chemicals and rinse solutions for the plating operation were kept. The main chemicals used for the plating process were hydrochloric acid, nitric acid, chromic acid, various caustic solutions, black oxide, sodium bisulfite, sodium hydrosulfite, zinc phosphate, and sodium dichromate. Within the chemical storage area, new plating solutions were blended in tanks located over secondary containment pits. Wastes that were generated include spent cyanide and chromic solutions and wastewater from plating and anodizing operations. Operations requiring cyanide were discontinued in 1980, because the necessary ventilation systems were inoperable (Foster Wheeler 1987a). Waste trichloroethylene (TCE) was also generated from washing and degreasing of metal parts prior to plating. In 1983, PTA discontinued the use of TCE and began using trichloroethane (TCA) (Haven and Emerson 1981). Information regarding the disposal of waste degreasing solvents was not available.

Spent solutions flowed by gravity to the IWTP. Several process waste streams were isolated from the lagoon system by discharging into the acid and chrome tanks; these streams included effluent from the chromate treatment tank and effluent from the cyanide destruction process, which was pumped into an alkali reservoir before being routed to the acid and chrome tanks. After treatment, the wastewater was sent to the lagoons where the water percolated into the ground. Chromium was found to be the predominant metal in the effluent that was discharged to the lagoons. Other metals found include aluminum, cadmium, copper, and zinc (Vowinkel et al. 1985).

This method of operation was followed from 1960 until 1981. According to available records, the average daily wastewater discharge during 1979 was about 10,000 gal/d with a maximum of 21,600 gal/d. Records also show that, prior to 1981, about 2,000-3,000 gal of sludge slurry was removed from the lagoons annually and sent off-post to an approved disposal facility (Haven and Emerson 1981; Foster Wheeler 1987a).

In 1981, the unlined lagoons were replaced by two concrete-lined lagoons. During the reconstruction, contaminated soil was removed to a depth of about 10 ft and shipped off-post for disposal as hazardous waste. As was the previous practice, treated effluent was discharged to the lagoons. It then flowed into a trough-like settling tank from which it was discharged, through an overflow weir, to Bear Swamp Brook. Bear Swamp Brook, a small tributary to Green Pond Brook, flows adjacent to the industrialized section of PTA and Bldg. 24 before discharging into Green Pond Brook. Periodically, these lagoons were dredged and the solids were sent to a disposal facility. In 1982, plating operations were discontinued. Until 1985, activities included aluminum cleaning with mild caustic and aluminum anodizing using sulfuric and chromic acids (Haven and Emerson 1981).

In addition to the wastewater lagoons, a primary source of contamination in this area is a dry well, which was constructed in 1961, between the front of the building and Third Street in the area included in Site 21 (Fig. 5.1). The well drained a 3-in. overflow line that served as a relief system in the event of a temperature-driven increase in degreasing fluid levels. The well was an unmortared concrete-block pit (about 4 ft deep) with a concrete slab top. It was surrounded by about 4 in. of gravel and drained to the subsurface. At this location, the water table ranges from 5 to 15 ft below the ground surface (Foster Wheeler 1987a, 1988b). Since there were no reported overflow events that actually drained into the well, contamination has been linked to vapor condensation within the relief line. As TCE vapor condensed, it could have entered the dry well. The well was capped in 1985 (Foster Wheeler 1987a; Sargent 1988). The dry well, which never had interim status, will be closed in accordance with New Jersey hazardous waste regulations.

Groundwater in the vicinity of Bldg. 24 has been monitored since 1981. Between 1981 and 1984, the U.S. Army Environmental Hygiene Agency (USAEHA) conducted several phases of a groundwater quality assessment that found the following: (1) iron and manganese concentrations exceeded secondary drinking water standards in most wells, (2) cadmium concentrations exceeded the primary drinking water standard in two wells, (3) over half of the monitoring wells were found to contain detectable levels of volatile organics, and (4) TCE contamination in the deep cluster wells near the cafeteria and Bldg. 24 indicated vertical movement of contaminants (Vowinkel et al. 1985).

In 1985, the U.S. Geological Survey (USGS) completed a preliminary evaluation of groundwater contamination based entirely on previously collected data. For the study area, the report concludes that (1) a contaminant plume, principally TCE, emanates from Bldg. 24 and follows the general water table gradient over 1,500 ft downgradient from Bldg. 24; (2) concentrations of dissolved solids, sodium, sulfur, cadmium, lead, iron, manganese, cyanide, selenium, and chromium exceed drinking water standards; (3) concentrations of trichloroethylene and tetrachloroethylene exceed New Jersey drinking water guidelines in nearby observation and supply wells; and (4) toluene and benzene found in water samples originate from a source other than Bldg. 24 (Sargent 1988).

5.2.2 Geology and Hydrology

Soils in the area of Bldg. 24 are classified as urban land. They are usually well-drained, deep sandy, gravelly, or stony material of glacial deposits. During development, the soils in the area have been reworked to the extent that the original soil profile may be unrecognizable (Sargent 1988).

Four bedrock units and several unconsolidated units are found in the Arsenal. The general relationships of the bedrock units are based on investigations by Kummel and Weller (1902), Bayley et al. (1914), and Drake (1969). Throughout most of the area, especially in the valley, the bedrock is obscured by deposits of unconsolidated sediments of glacial origin. The stratified drift deposits, composed of interbedded layers of sand, silt, and clay, are formed under different depositional environments. Drift thickness varies from 80 ft near Picatinny Lake to more than 185 ft at the southwestern boundary of the Arsenal. In general, the sediments become finer toward the southwest near Bldg. 24, where varved silts and clays of lacustrine origin are present (Vowinkel et al. 1985).

A boulder bed was encountered while drilling at the cafeteria cluster. Wells 81 and 82 (USATHAMA Nos. 129 and 130, respectively) were thought to be screened at the top of the bedrock surface at about 125 ft. However, the deep well at the cafeteria cluster indicated that wells 129 and 130 were actually above a boulder bed, which is over 40 ft thick in some areas (Vowinkel et al. 1985).

The underlying formations in the area of Bldg. 24 include the Green Pond Conglomerate, the Leithsville Formation, and Precambrian gneiss. Green Pond Conglomerate of Silurian age is the youngest bedrock at the Arsenal. Lithologically, the Green Pond is a very coarse quartzite conglomerate interbedded with the grading upward into quartzite and sandstone. The contact with the Leithsville is not visible but is believed to be separated by a steeply dipping fault called the Green Pond fault. The fault originates between Green Pond and Cooperas Mountains, where the conglomerate lies next to an upthrown block of Precambrian gneiss and extends southwest from Cooperas Mountain to Picatinny Lake (Vowinkel et al. 1985).

The Leithsville Formation is an Early to Middle Cambrian dolomite. The contact with the underlying Hardstone quartzite is gradational both vertically and laterally. The Leithsville underlies the glacial deposits in the valleys and outcrops on the western shore of Picatinny Lake (Vowinkel et al. 1985).

Precambrian gneiss underlies the eastern part of the Arsenal and in this area is divided into three mineralogic rock types: alaskite, hornblende granite, and biotite-quartz-feldspar gneiss, with the hornblende granite predominating (Vowinkel et al. 1985).

A generalized hydrogeologic section across the valley defines three aquifers: an unconfined stratified-drift (water table) aquifer, which is about 35 ft thick; a confined glacial aquifer, which ranges from 20 to 75 ft in thickness; and a bedrock aquifer (Fusillo et al. 1987).

The confined glacial aquifer comprises the sublacustrine sand and gravel, which is separated from the water table by interbedded fine sand, silt, and clay. This layer forms a leaky confining unit of variable thickness and has a vertical conductivity of 0.6 ft/d (Fusillo et al. 1987). Withdrawals from the supply wells located near Bldg. 24 have induced contaminants to move around or through the confining layer resulting in contamination of the glacial aquifer. In addition to this pathway, the screening interval for well 130-obs (adjacent to water supply well 130) was 17.5-125 ft. Since it was screened in both the water table aquifer and the confined glacial aquifer, it may have provided a conduit for the movement of contaminants from the upper to the lower aquifer, particularly during pumping of water supply well 130. Well 130-obs was sealed in 1986 (Sargent 1988).

Groundwater flow within the water table and confined glacial aquifers is essentially horizontal and towards Green Pond Brook at an average velocity of 0.46-1.4 ft/d. Discontinuities in the confining silts and clays modify the flow path. Vertical gradients in the unconsolidated deposits are generally downward on the sides of the valley and upward in the vicinity of the brook. Zones of highest vertical gradients in the bedrock aquifer are near the valley sides where the vertical component of flow is generally upward, reflecting recharge from the hills. The range of measured head differences between the bedrock aquifer and the confined glacial aquifer are small, indicating that there is some limited flow between these aquifers (Vowinkel et al. 1985).

Water levels taken in December 1987 and February 1988 show that the potentiometric surfaces of the confined glacial and bedrock aquifers are similar to the water table aquifer in orientation. The potentiometric surfaces of the water table, confined glacial, and bedrock aquifers are shown in Figs. 5.2, 5.3, and 5.4, respectively (Sargent 1988).

5.2.3 Existing Contamination

Studies conducted between 1981 and 1984 identified several organic contaminants present in the groundwater. The main constituent of the contaminant plume was identified as TCE. Other organics found include tetrachloroethylene, 1,1,1-trichloroethane, the cis and trans isomers of 1,2-dichloroethylene, and phenol (Vowinkel et al. 1985).

During these studies, several inorganic contaminants were detected at what were apparently maximum concentrations. The inorganics include cadmium (61 μg/L), chromium (150 μg/L), lead (97 μg/L), cyanide (43[illegible] μg/L), and copper (409 μg/L). By 1985, most levels had decreased significantly (Vowinkel et al. 1985).

In 1986, USGS began a study of the Bldg. 24 area. Based on the results of past investigations and further characterization, 33 new monitoring wells were installed in or adjacent to areas of known contamination. Well locations were based on the results of a ground-penetrating radar survey and a drive-point sampling program. Following installation, slug tests were performed. The well locations are shown in Fig. 5.5, and the drive-point sampling locations are shown in Fig. 5.6.

Analytic results from the soil and sediment sampling program, the drive-point sampling program, the monitoring well sampling program, and the slug tests will be available when the USGS study is finalized (see Sargent 1988). In this report, only selected draft results will be discussed in order to define Site-specific problems.

5.2.3.1 Soil

The following discussion of soil contamination is based on soil gas samples and stream-bed sediment samples. Soil gas samples were collected from the unsaturated zone in February and March 1988. The locations sampled are shown in Fig. 5.7. TCE

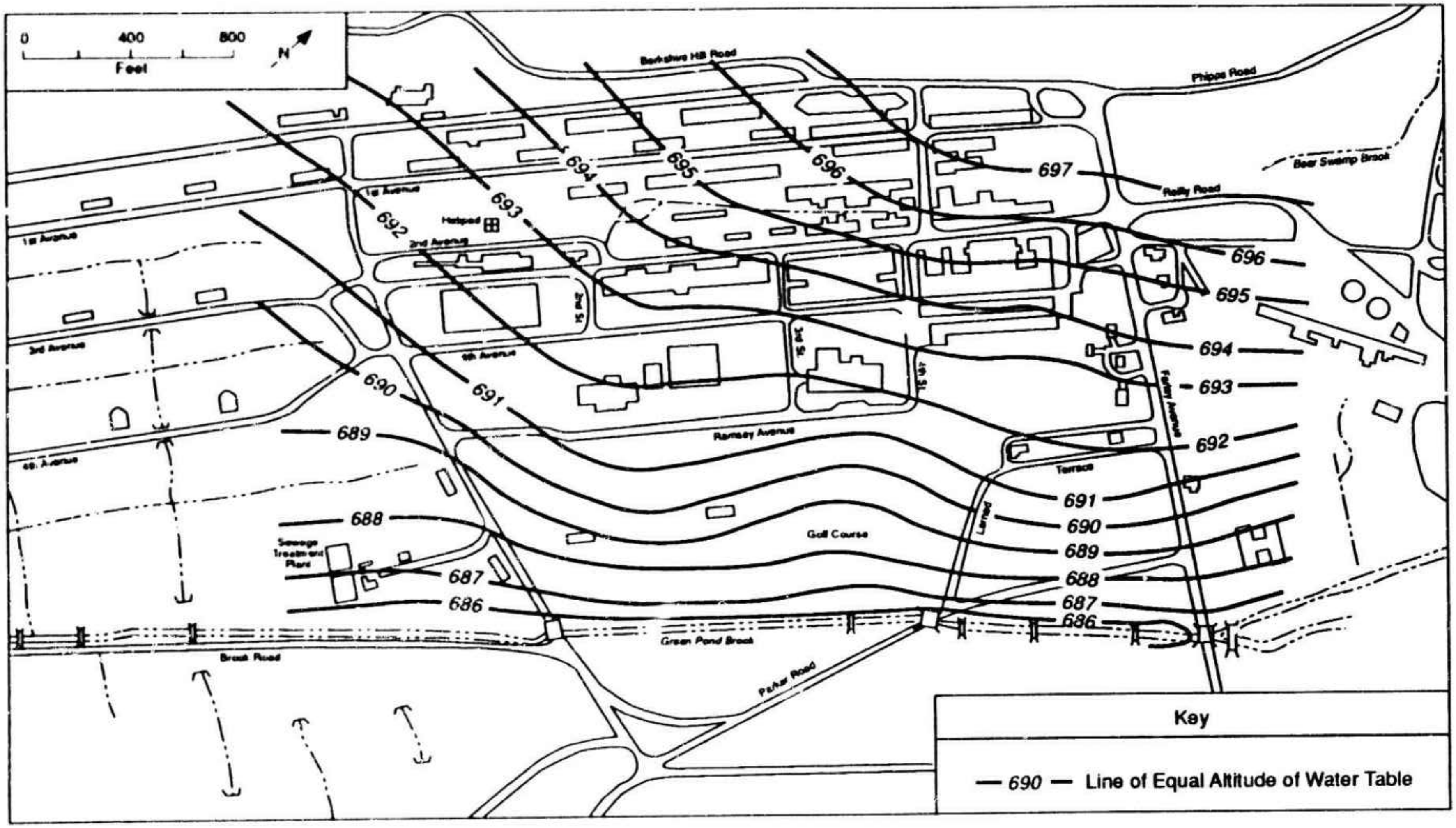

FIGURE 5.2 Potentiometric Surface of Water Table and Direction of Groundwater Flow near Building 24 (Source: Adapted from Sargent 1988)

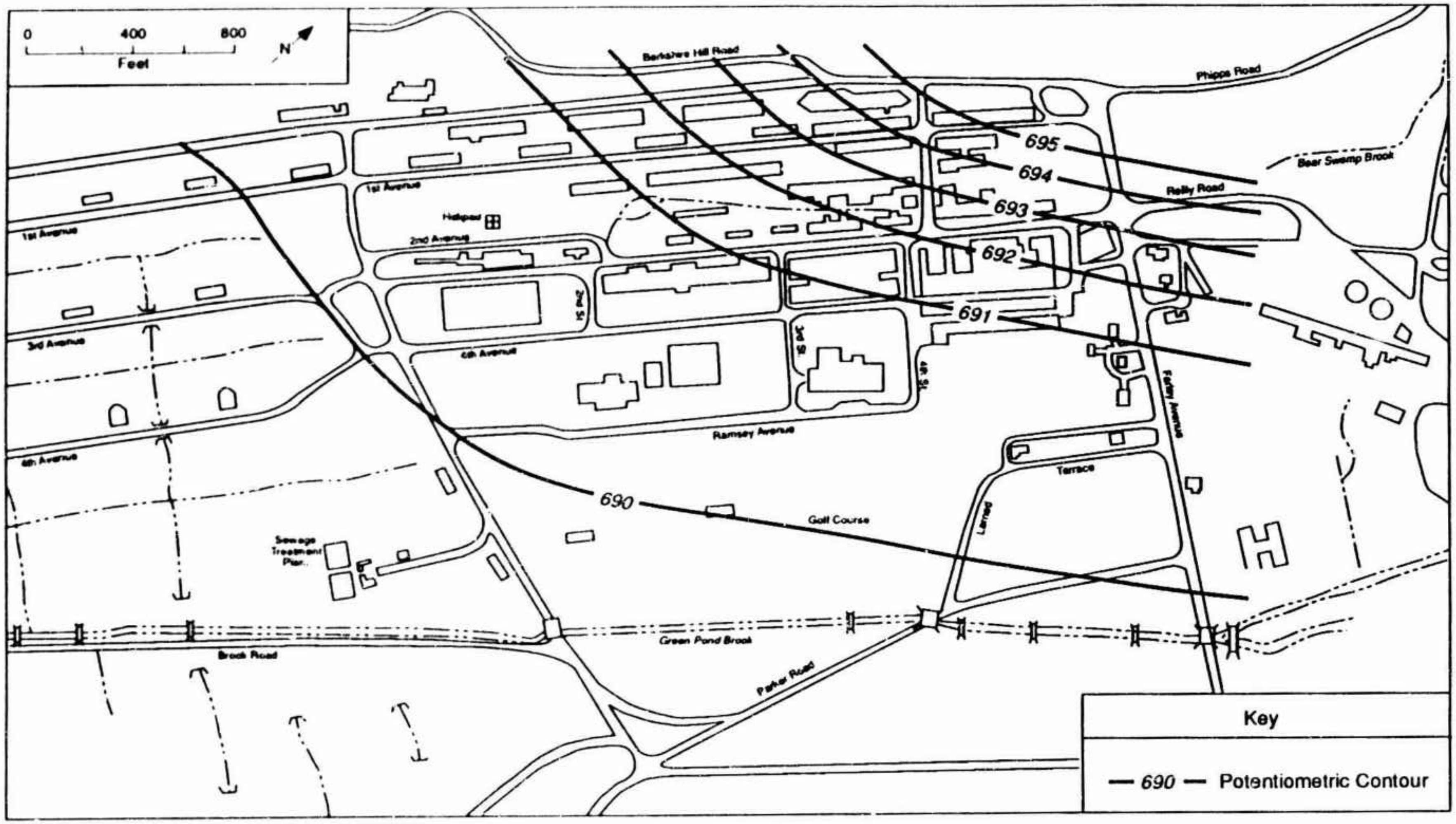

FIGURE 5.3 Potentiometric Surface of Confined Aquifer and Direction of Groundwater Flow near Building 24 (Source: Adapted from Sargent 1988)

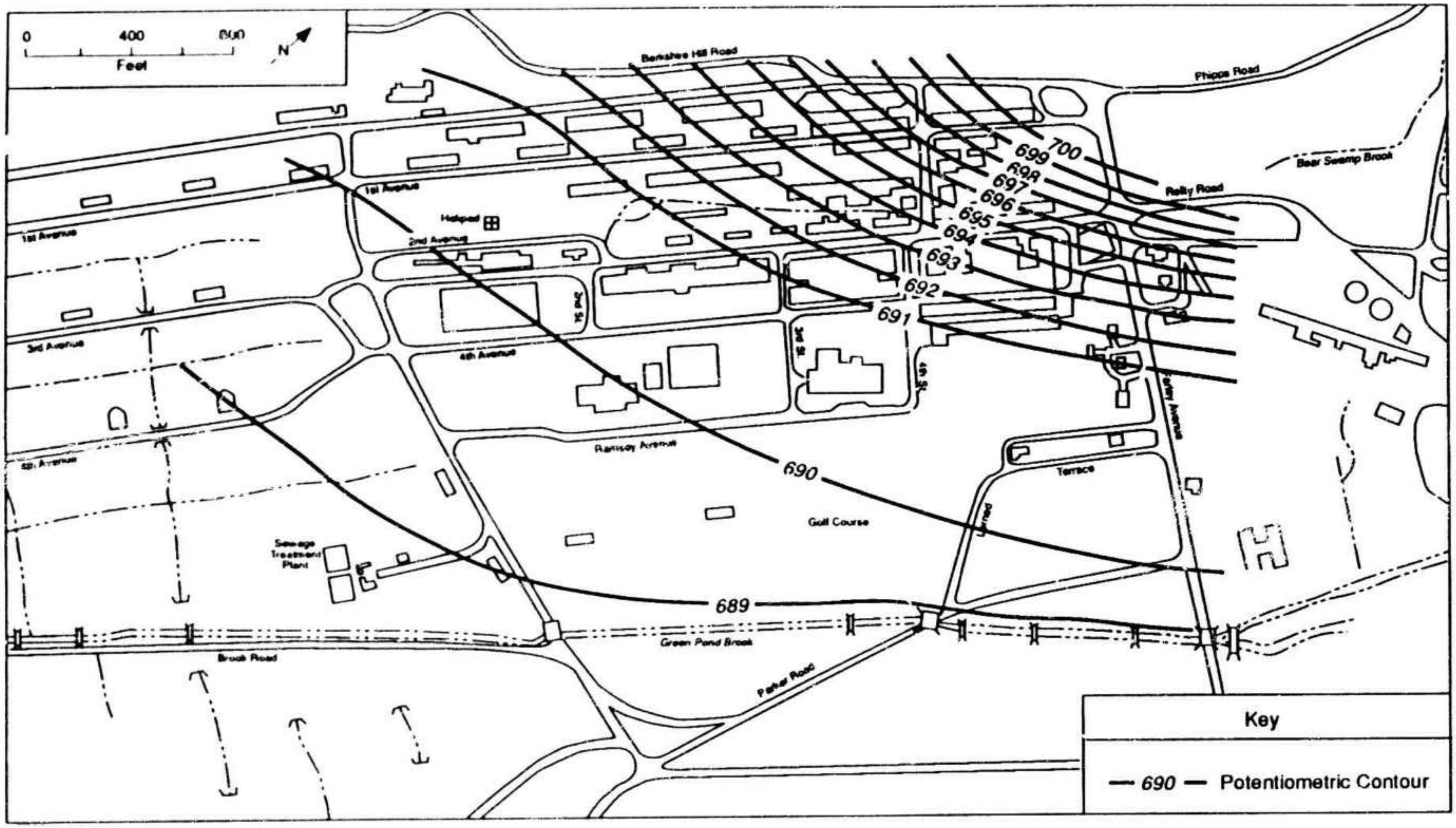

FIGURE 5.4 Potentiometric Surface of Bedrock Aquifer and Direction of Groundwater Flow near Building 24 (Source: Adapted from Sargent 1988)

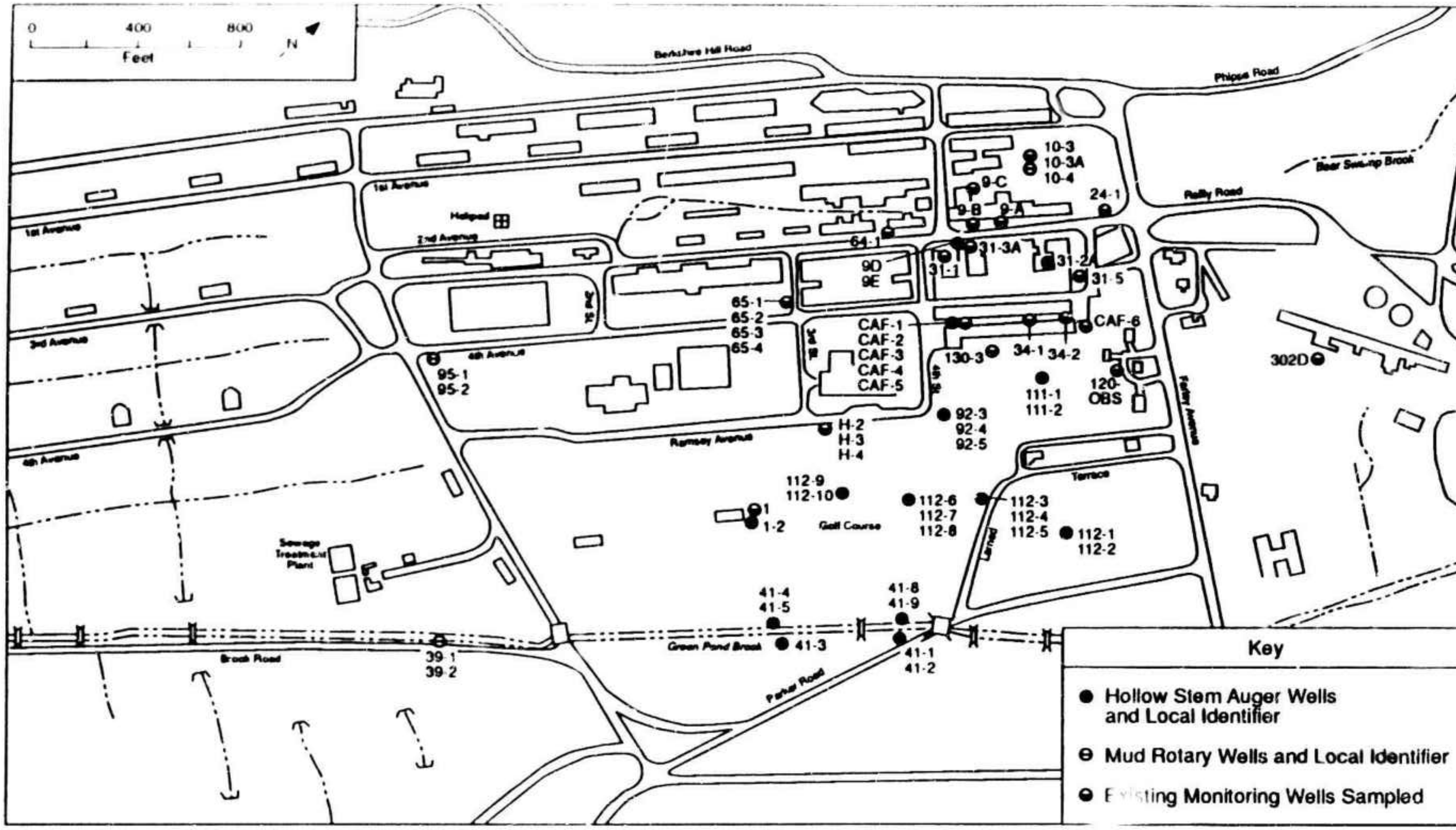

FIGURE 5.5 Locations of USGS Monitoring Wells near Building 24 (wells installed in 1987) (Source: Adapted from Sargent 1988)

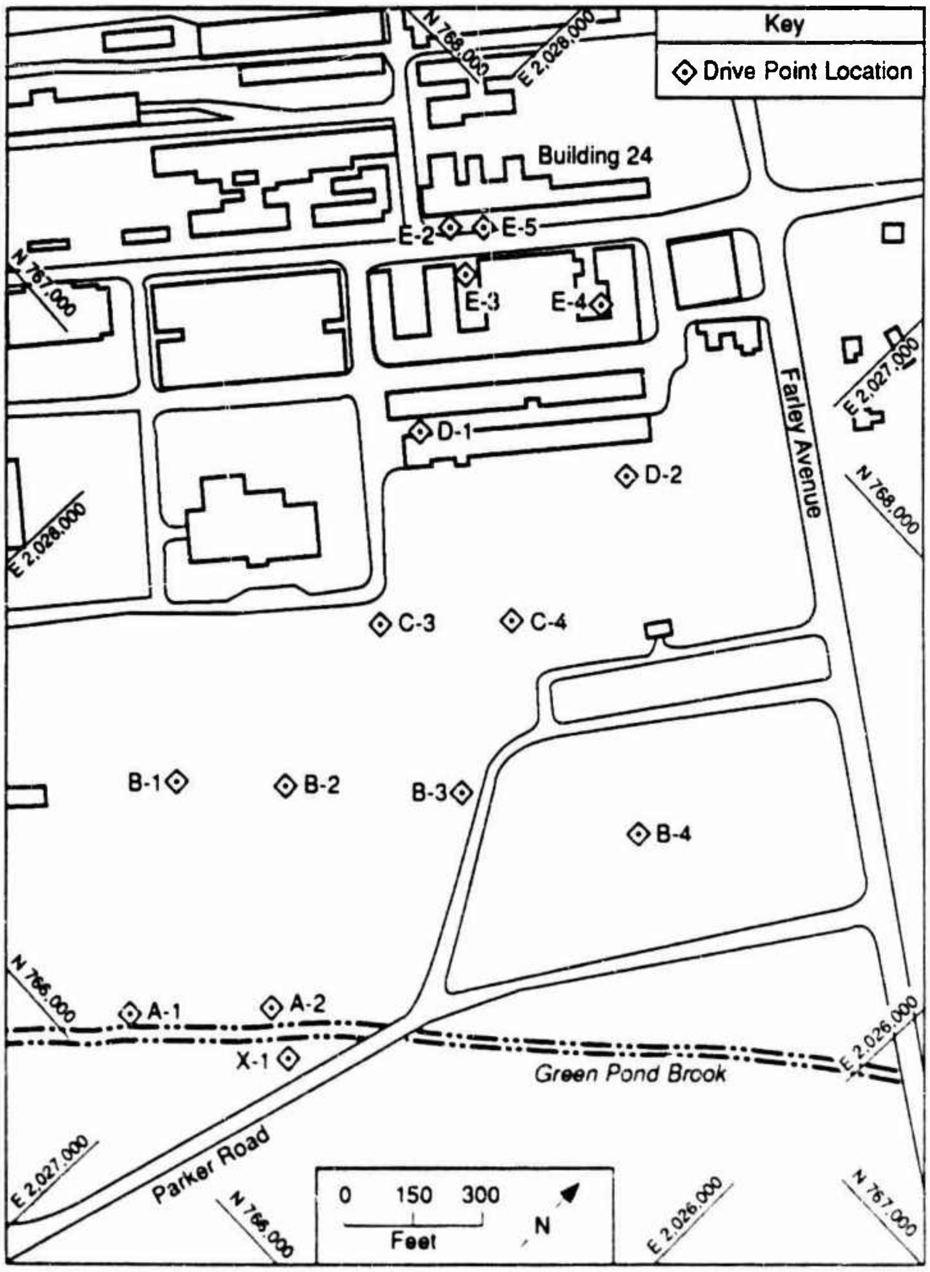

FIGURE 5.6 Locations of Drive-Point Sampling near Building 24 (Source: Adapted from Sargent 1988)

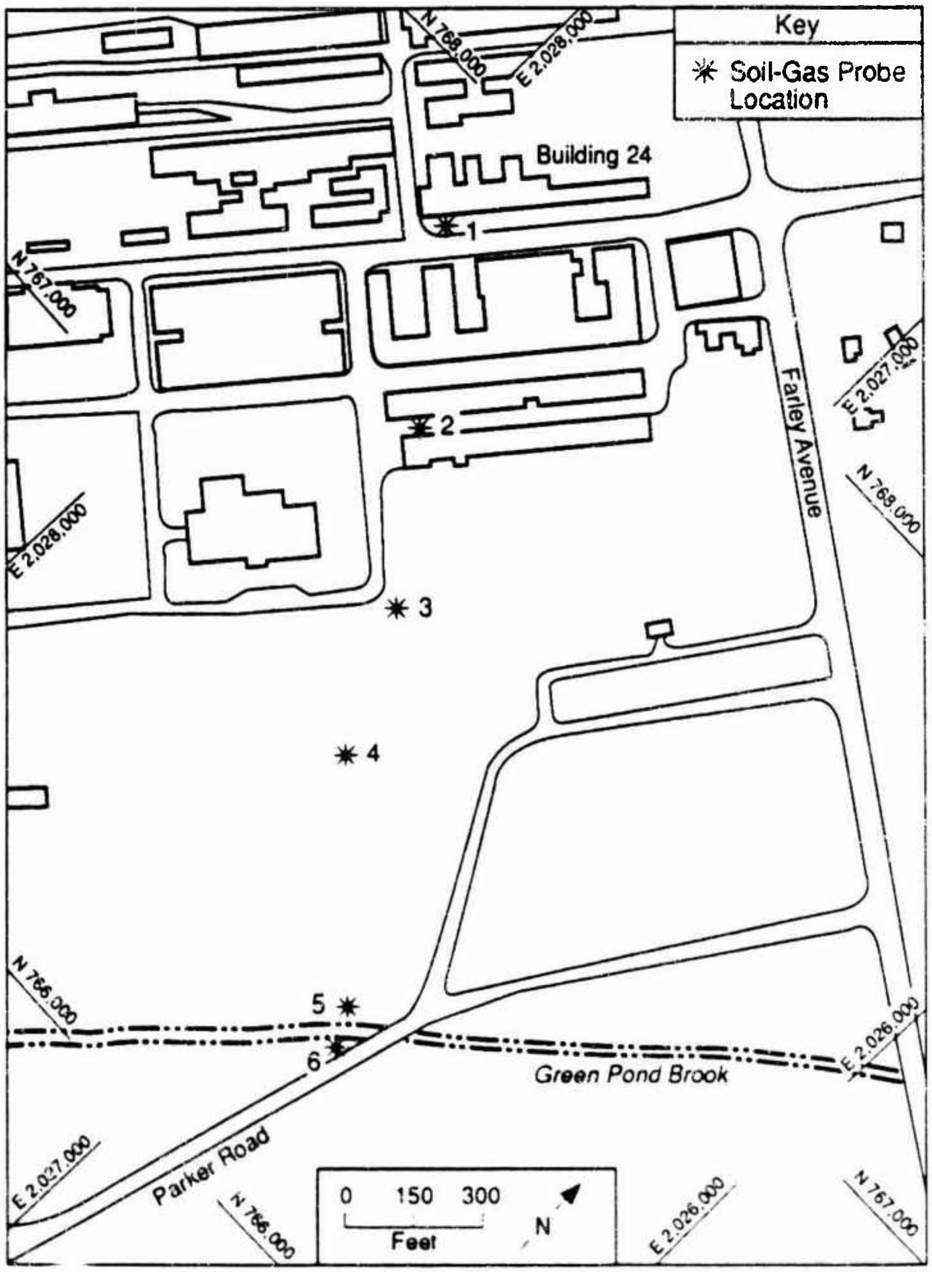

FIGURE 5.7 Locations of Soil Gas Sampling near Building 24 (Source: Adapted from Sargent 1988)

was the predominant contaminant with maximum concentrations (7,300 ng/L) found about 1 ft above the water table near Bldg. 24. In general, as the distance from the top of the water table increased, the TCE concentration decreased. Dichloroethylene and tetrachloroethylene were also detected with maximum concentrations of about 130 ng/L. The maximum concentration of TCE was found at sampling location 1 with concentrations decreasing with distance from the source. At sampling location 6, on the eastern side of the brook, TCE was not detected (Sargent 1988).

Sediment samples were taken from beneath the stream bed as shown in Fig. 5.8. At each location, samples were taken from each side and the middle and analyzed for cis-1,2-dichloroethylene and TCE. Results indicate that only samples from the western side of the stream bed had detectable concentrations of organics. This result agrees closely with the estimates of the extent of the contaminant plume (Sargent 1988).

5.2.3.2 Water

Slug tests were performed on 22 of the 33 monitoring wells to obtain estimates of the hydraulic conductivity in the water table aquifer. The variability in hydraulic properties of the aquifers and confining beds is confirmed by the areal trend in sediment distribution. This trend is reflected by the fact that conductivities at some shallow depths exceeded those obtained at selected deeper wells. Even though the flow path is modified by these irregularities, the groundwater flow in both the water table and confined glacial aquifers is generally toward Green Pond Brook (Sargent 1988).

Drive-Point Sampling Results

Samples taken from 15 drive points at specified depths were analyzed for inorganic and organic compounds and physical properties. A total of 105 samples were taken. Sampling location X-1 (on the eastern side of Green Pond Brook) was chosen to provide background data. Sampling location E-4 was chosen to differentiate between contamination coming from Bldg. 24 and that coming from Bldg. 31 (Sargent 1988).

The results of the inorganic sampling showed elevated levels of sulfate and chloride, which may be the result of using sulfuric acid and hydrochloric acid in the plating process. Other constituents were not elevated significantly from values found at sampling location X-1. Trace metals associated with metal plating activities were not found in high concentrations downgradient. Although iron and manganese were frequently found downgradient at elevated concentrations, these metals may be naturally occurring. Iron concentrations ranged from 3 to 12,000 μg/L, and manganese concentrations ranged from 10 to 1,300 μg/L (Sargent 1988). The New Jersey Secondary Drinking Water Regulations recommend 300 μg/L for iron and 50 μg/L for manganese. Although toxicological significance is not at issue, both iron and manganese can impart an objectionable taste and cause staining and incrustation (USAEHA 1984b).

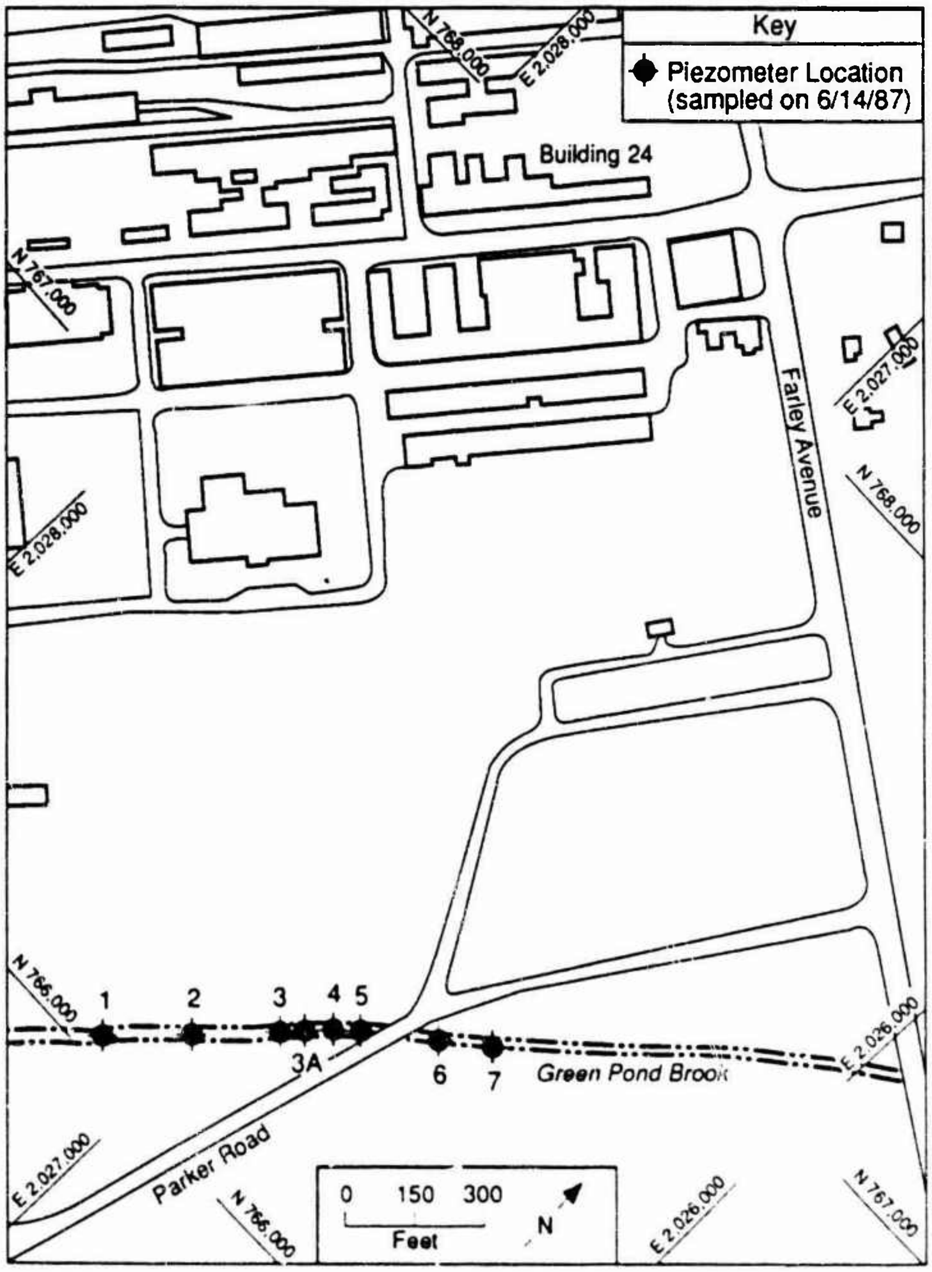

FIGURE 5.8 Locations of Stream Bed Sampling near Building 24 (Source: Adapted from Sargent 1988)

Selenium concentrations did not exceed 10 µg/L in the study area. Arsenic and chromium concentrations exceeded 10 µg/L only at sampling location E-2, immediately adjacent to Bldg. 24. Similarly, the highest concentrations of aluminum (540-680 µg/L) and cadmium (65 µg/L) were found at this location. Strontium, zinc, and lithium were detected in trace concentrations at the majority of sampling locations. Lead was found at location B-1 (190 µg/L); however, it was an isolated detection (Sargent 1988).

The detection limits used for the organic analyses ranged from 0.2 to 100 µg/L based on the dilution factors. Results did not differ significantly from previous investigations. About 15 locations had values at or less than detection limits, 46 locations had concentrations up to 50 µg/L, and 44 locations had concentrations exceeding 50 µg/L. The four contaminants that exceeded 100 µg/L include methane, tetrachloroethylene, TCE, and both isomers of 1,2-dichloroethylene (cis and trans) (Sargent 1988).

The most frequently detected volatile organic was TCE. This compound was also present in the highest concentration (44,000 µg/L) at sampling location E-2. Figure 5.9 depicts cross-sections A-A' and B-B' across the contaminant plume. The plume of volatile organics originates in the Bldg. 24 area and follows the general water table gradient to Green Pond Brook, about 1,600 ft. Near section A-A', the plume is about 20 ft thick with 15-20 ft of relatively uncontaminated ground water above it. The plume is about 400-800 ft wide and the bottom is 50 ft below the surface, at the boundary of the water table aquifer and the confining bed. Concentrations near the center of the plume at B-B' range from 7,000 to 14,000 µg/L. The vertical distribution of TCE at both cross-sections is shown in Fig. 5.10 (Sargent 1988).

Based on the vertical distribution of TCE, USGS mapped the plume at three altitudes, 650, 670, and 690 ft above MSL (Figs. 5.11, 5.12, and 5.13, respectively). The shaded areas reflect the difference between the plume detected in the drive-point samples (1986) and the monitoring well samples (1987). The 1987 data indicate that the plume has moved farther down the valley since the 1986 data (from the drive points) were mapped.

The 650-ft altitude is near the base of the water table aquifer and is estimated to be the bottom of the plume. The center of the plume is not aligned with the Bldg. 24 source (Fig. 5.11). The possibility exists that pumping at production well 130 caused the plume to move toward the well. Since it is no longer pumped, the plume is now moving downgradient from well 130 (Sargent 1988).

At the 670-ft altitude near the center of the plume, and at Green Pond Brook, concentrations of TCE exceeded 1,000 µg/L (Fig. 5.12) (Sargent 1988).

The 690-ft altitude is considered to be the top of the plume. As seen in Fig. 5.13, concentrations exceeding 1,000 µg/L were found at the source, in the center of the plume, and at Green Pond Brook. It is generally believed that contamination has moved downward as it traveled away from the source, and upward near the brook. Since no significant concentrations of TCE were detected at sampling location X-1, it appears that the plume has not passed the brook (Sargent 1988).

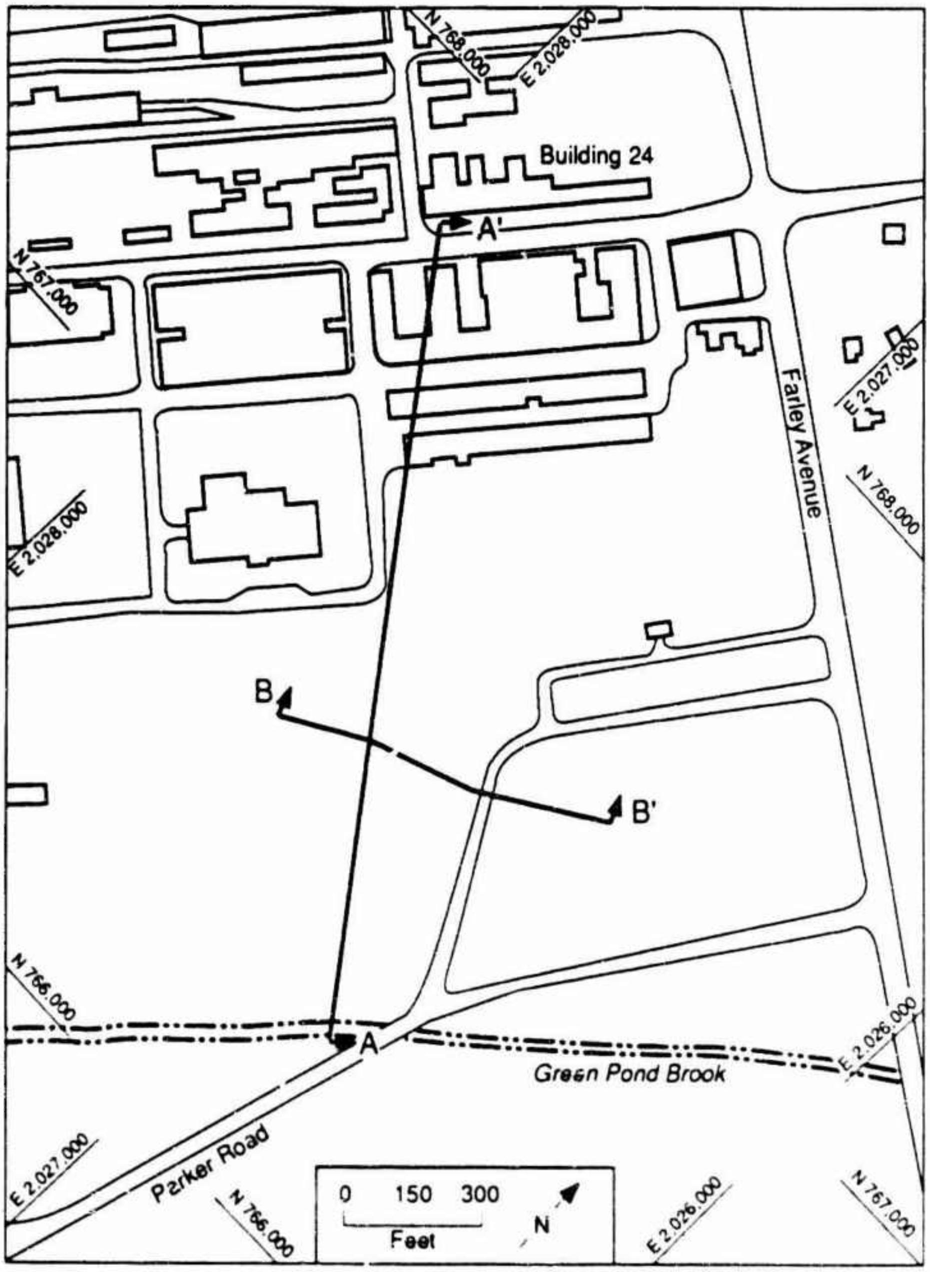

FIGURE 5.9 Locations of Cross-Sections A-A' and B-B' near Building 24 (Source: Adapted from Sargent 1988)

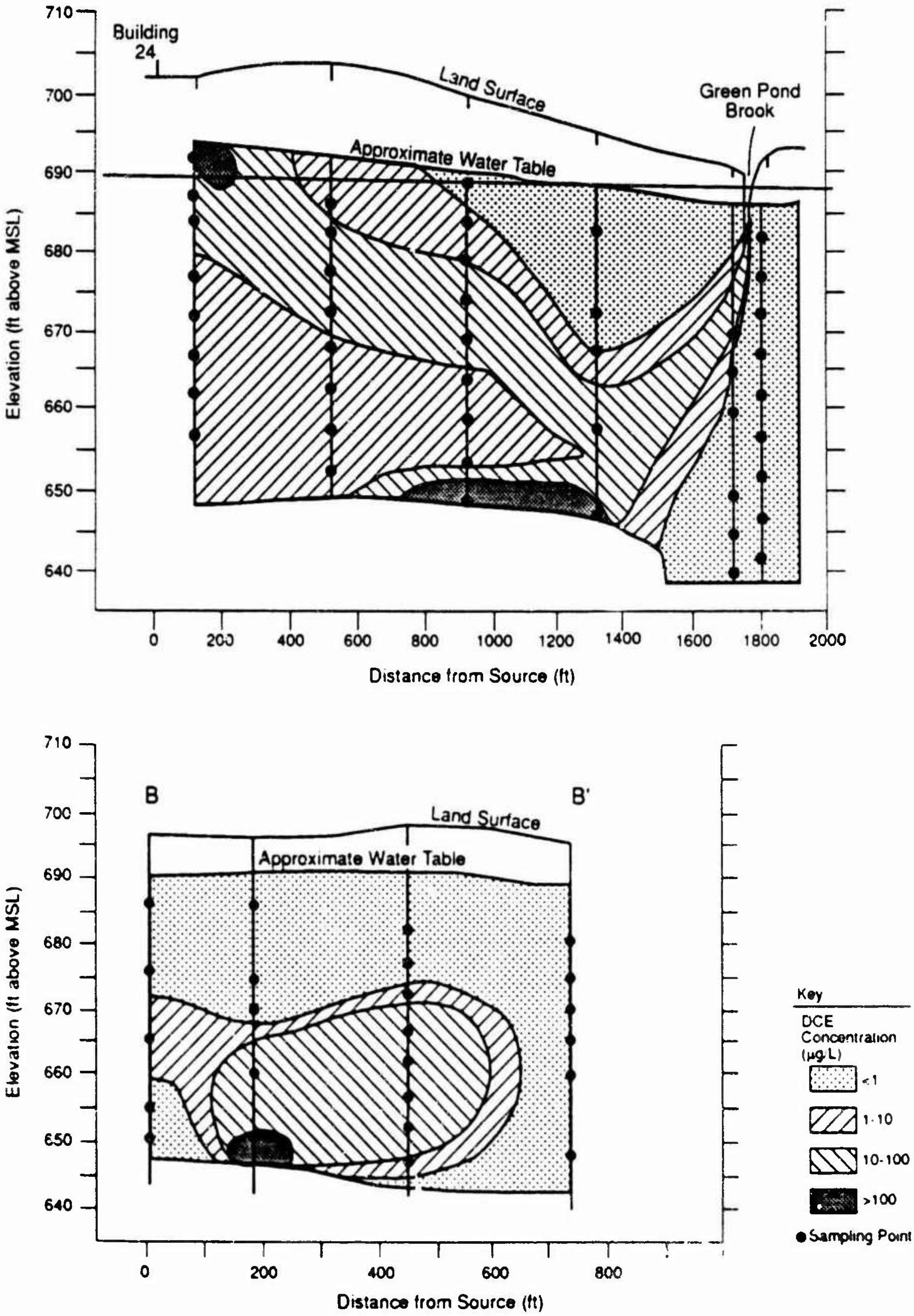

FIGURE 5.10 Vertical Distribution of TCE at Cross-Sections A-A' and B-B' near Building 24 (Source: Adapted from Sargent 1988)

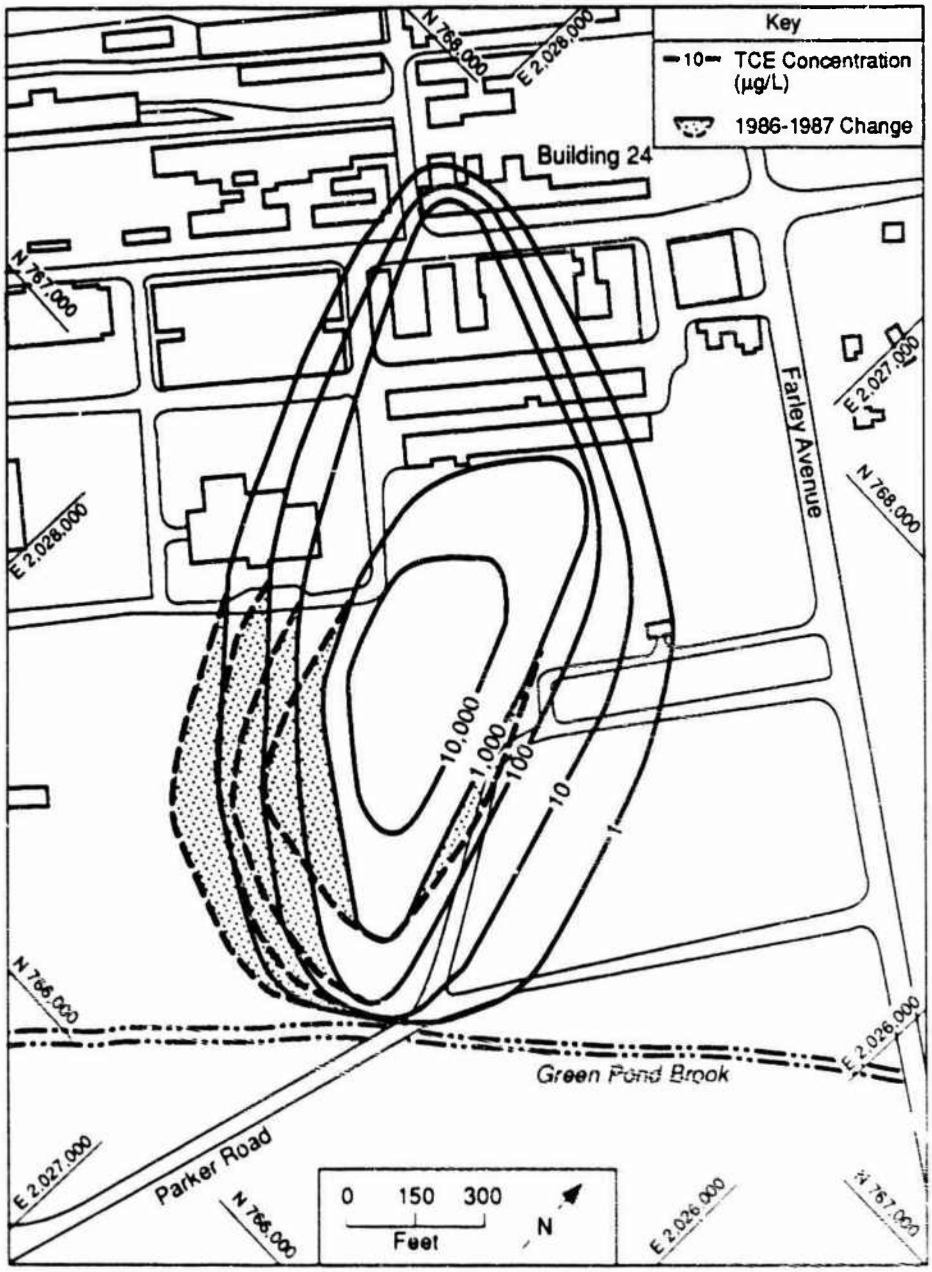

FIGURE 5.11 Comparison of 1986 and 1987 TCE Concentration Data from the Building 24 Contaminant Plume at the 650-ft Altitude (Source: Adapted from Sargent 1988)

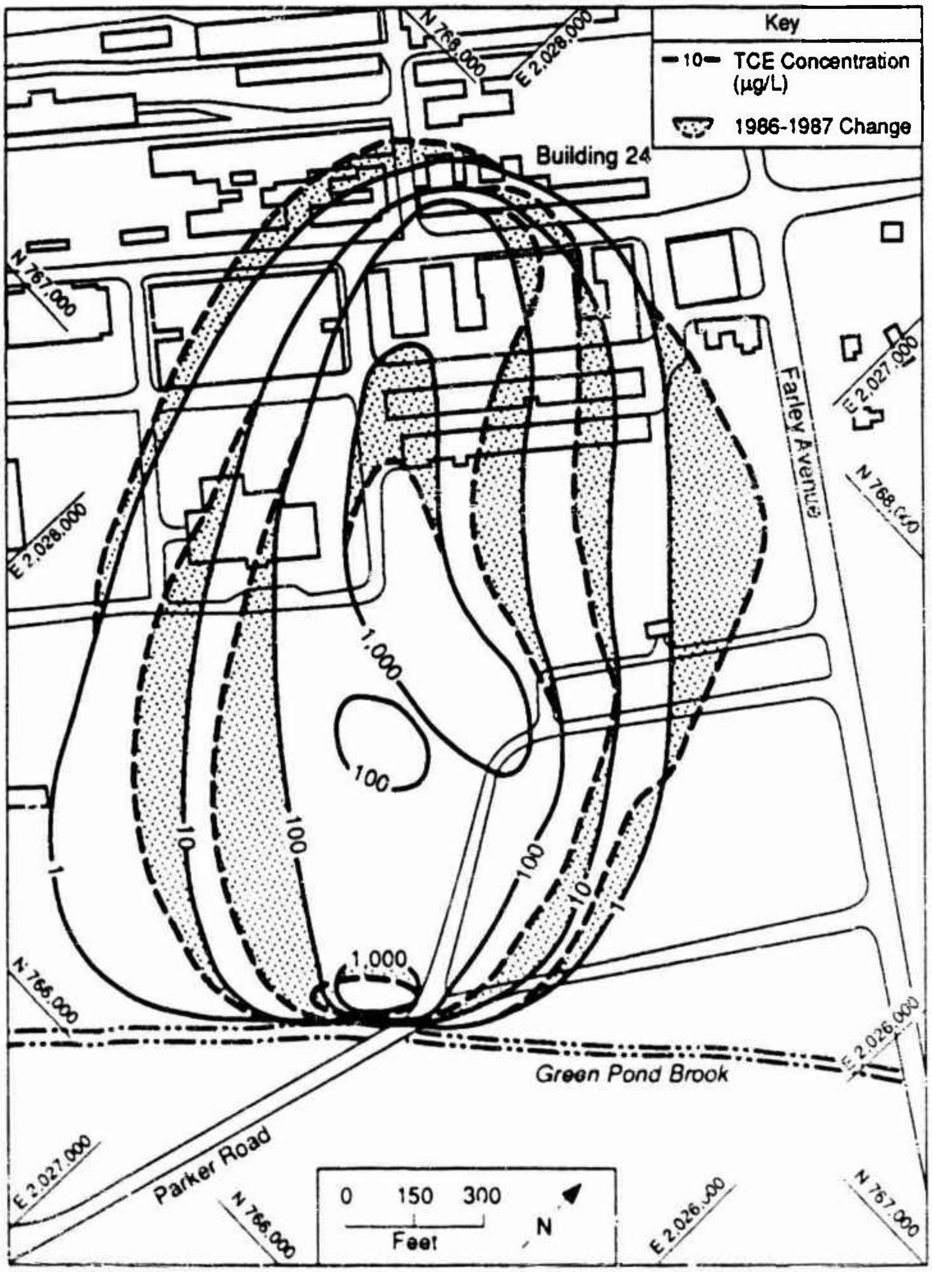

FIGURE 5.12 Comparison of 1986 and 1987 TCE Concentration Data from the Building 24 Contaminant Plume at the 670-ft Altitude (Source: Adapted from Sargent 1988)

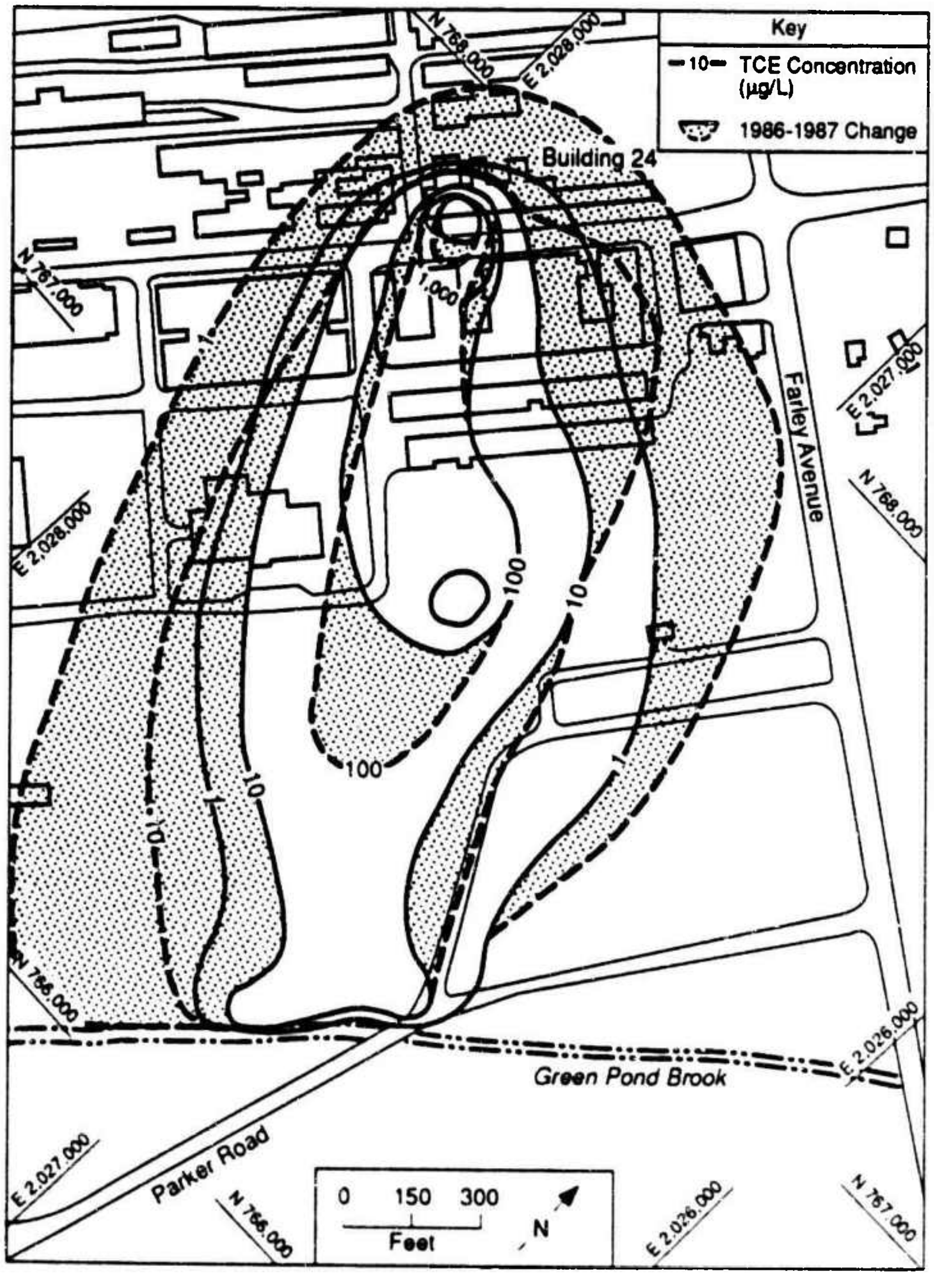

FIGURE 5.13 Comparison of 1986 and 1987 TCE Concentration Data from the Building 24 Contaminant Plume at the 690-ft Altitude (Source: Adapted from Sargent 1988)

The second most significant volatile organic component of the plume is cis-1,2-dichloroethylene. Based on the highest drive-point concentrations, plumes from Bldgs. 24 and 31 have been identified. As mentioned previously, differentiation between sources of contamination in this area is difficult because of the number of buildings and the industrial nature of the operations. Figure 5.14 shows that the vertical distribution of dichloroethylene at cross-sections A-A' and B-B' is very similar to the distribution of TCE. The two primary zones where contamination exceeds 100 µg/L are near the base of the water table aquifer, and at the 20- to 25-ft depth. The degradation products of TCE include cis-1,2-dichloroethylene, dissolved methane, and vinyl chloride. These were detected at most of the sites. Tetrachloroethylene, 1,1,1-trichloroethane, and vinyl chloride were also detected in the zone of contamination (Sargent 1988).

Well Sampling Results

In October and November 1987, groundwater samples were collected from 60 wells. Five wells are screened in the bedrock aquifer, 10 in the confined glacial aquifer, and 45 in the water table aquifer. The bedrock and the glacial aquifers did not show unusually high concentrations of macroparameters or cyanide (Sargent 1988).

Mercury was detected above 2 µg/L in all three of the aquifers. Cadmium concentrations exceeded the primary drinking water standard of 10 µg/L only in the water table aquifer in wells 9-C, 9-D, and 31-1. Based on the well locations, it appears that cadmium has not moved far from the source at Bldg. 24. Similarly, the only concentrations of copper that exceed the secondary drinking water standard (50 µg/L) were near the source at wells 9-B and 9-E (Sargent 1988).

Lead was detected in the water table aquifer at scattered locations, and in the bedrock aquifer concentrations ranged from 19.2 and 36.8 µg/L. Overall, the results indicate that metals have been adsorbed onto clay particles near Bldg. 24 and have not moved significant distances in the groundwater (Sargent 1988).

Volatile organic compounds were detected in all three of the aquifers. Samples from two wells in the bedrock aquifer showed TCE contamination. Detection of 55 µg/L at well 10-3A (upgradient) was an isolated finding, and USGS suggests confirmation sampling. TCE contamination at well 65-1 confirms past sampling efforts. Wells 65-3, CAF-3, and CAF-4, all screened in the confined glacial aquifer, had detectable concentrations of volatile organics. Past sampling of these wells showed TCE contamination; however, the most recent sampling shows the presence of additional constituents. The 1987 results show that, in addition to TCE, there are detectable levels of tetrachloroethylene and cis-1,2-dichloroethylene (Sargent 1988).

TCE concentrations in the water table aquifer were similar in distribution to those of the drive-point samples; however, as shown by the shaded areas in Figs. 5.11, 5.12, and 5.13, the plume detected during the well sampling appears to be farther down the valley (Sargent 1988).

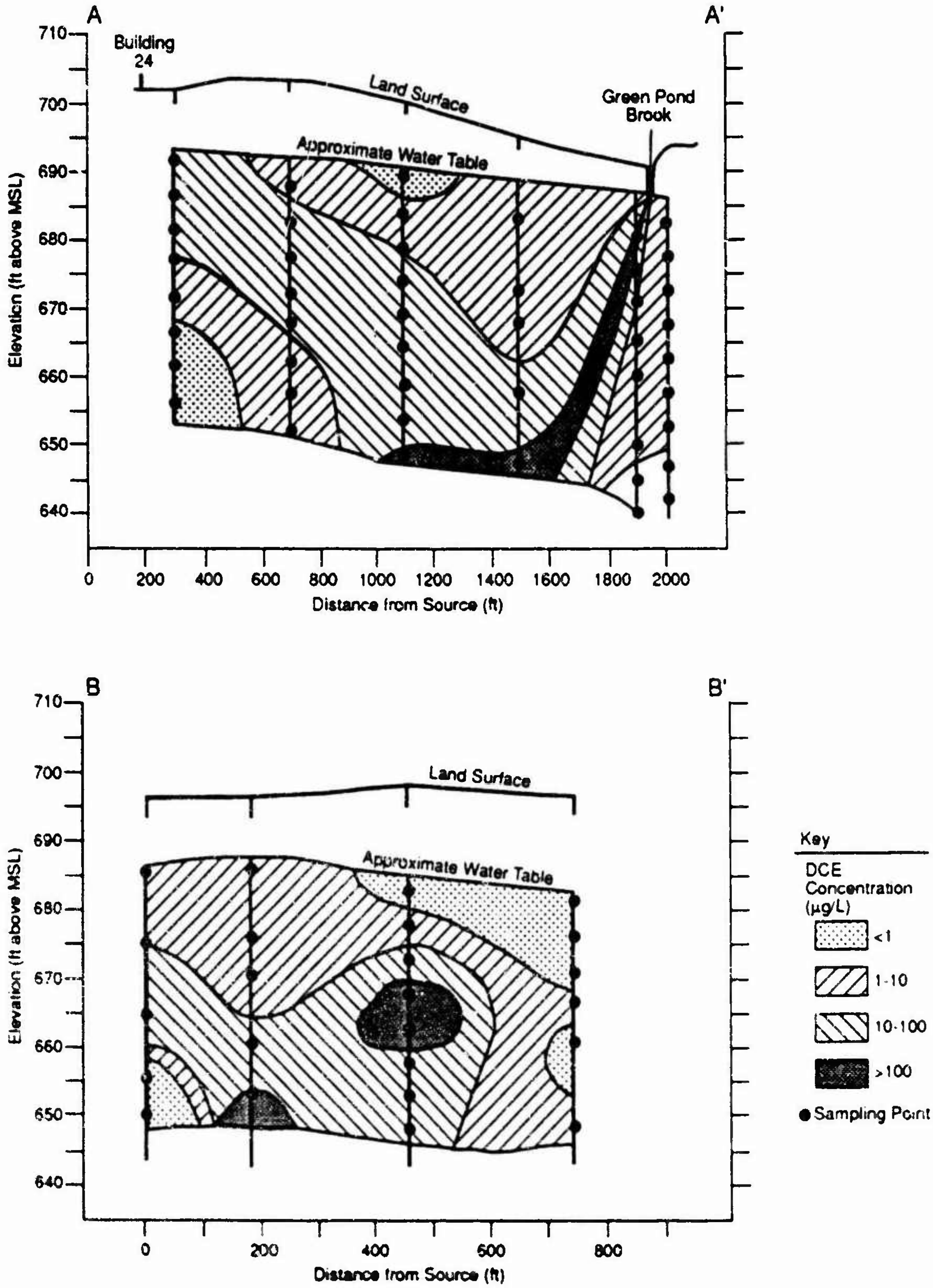

FIGURE 5.14 Vertical Distribution of Dichloroethylene at Cross-Sections A-A' and B-B' near Building 24 (Source: Adapted from Sargent 1988)

Surface Water Sampling Results

During 1986 and 1987, surface water samples were collected from three locations on Green Pond Brook, as shown in Fig. 5.15. Samples were analyzed for volatile organics. Sampling location SQ-1, Green Pond Brook at Farley Avenue, is upstream from the area affected by the plume and is the designated background location. Sampling location SQ-2 is downstream from the point of groundwater discharge into the brook, and SW-3 reflects water quality as it leaves the Arsenal (Sargent 1988).

At sampling location SQ-1, neither TCE nor dichloroethylene was above the detection limit of 3 µg/L. At SQ-2, TCE was detected in five of ten samples (2.5-3.8 µg/L) and dichloroethylene was detected in six of ten samples (2.3-11 µg/L). The increased concentrations can probably be attributed to the inflow of contaminated groundwater from the Bldg. 24 plume. At sampling location SW-3, TCE was not detected

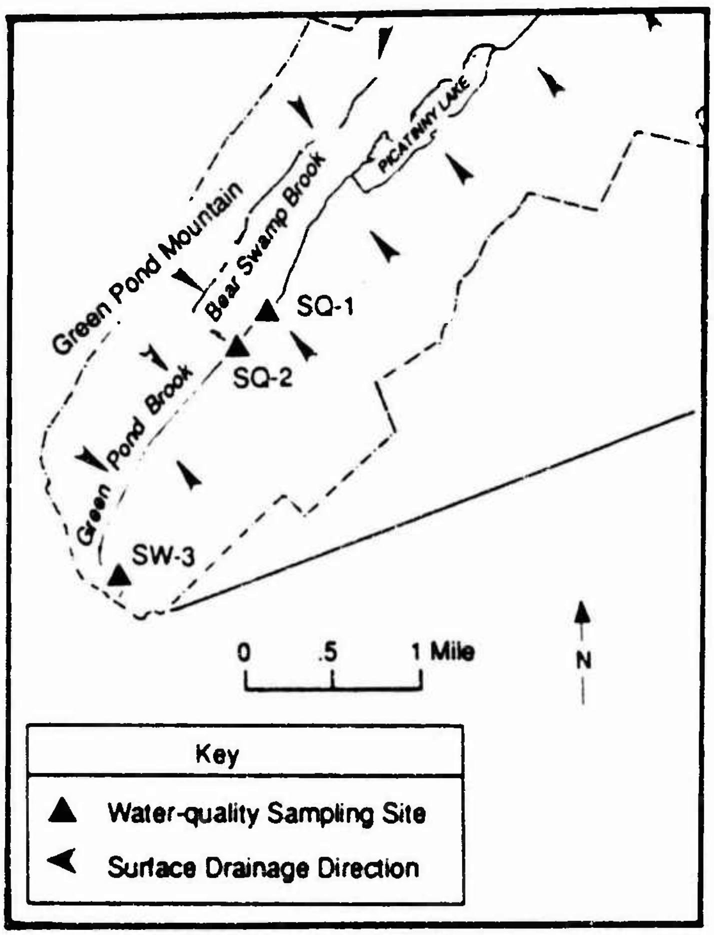

FIGURE 5.15 Locations of Surface Water Sampling at Green Pond Brook (Source: Adapted from Sargent 1988)

above 3 μg/L, and dichloroethylene was detected in two of nine samples (3 and 4.2 μg/L). These levels are probably due to dilution and volatilization, which results from rapid stream flow over many small falls and riffles. Based on these levels, downstream use of the stream water should not be affected by TCE or dichloroethylene (Sargent 1988).

5.2.4 Closure Plan

The RCRA closure plan for the dry well includes sampling to determine the extent of contamination and the procedures for remediation. Upon approval by NJDEP, PTA will close the dry well.

5.2.5 Proposed RI Plan

Some of the information for the evaluation in Sec. 5.2.3 was obtained from a 1987 USGS draft report (Sargent 1988). If significant changes are made to the final report or the final data, the following sampling plan may need revision.

The proposed RI plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, this RI plan should be modified as new data become available.

5.2.5.1 Building 24 Plating Facility (Site 21)

The most significant organic contaminants of concern are trichloroethylene and cis-1,2-dichloroethylene. Cyanide and cadmium are the next most common and significant contaminants of concern.

As required by Section 1424(e) of the Safe Drinking Water Act, the EPA Administrator has published notice in the Federal Register, January 24, 1984, Vol. 49, No. 16: "the U.S. EPA has determined that the Unconsolidated Quaternary Aquifer in the Rockaway River Basin is the sole or principal source of drinking water for the Rockaway River Basin Area, and that the Unconsolidated Quaternary Aquifer, if contaminated, would create a significant hazard to public health." It has also been determined that "the Quaternary deposits represent an aquifer which currently serves as the sole source of drinking water for approximately 90,000 residents; and there are no existing alternative drinking water sources which would provide fifty percent or more of the drinking water to the designated area, nor is there any reasonably available alternative future source capable of supplying the drinking water demands of the Rockaway River Basin Area."

Based on the groundwater model that predicts the rate and direction of movement of the Bldg. 24 contaminant plume, the groundwater is being removed and treated. In addition, the wells installed in 1987 by the USGS in this area should be sampled for two quarters for volatile organic compounds and TCL metals. The water should also be analyzed for radon-220 and -222. Since these are natural contaminants, any water treatment scheme would cause them to be released.

5.2.5.2 Metal Plating Surface Impoundments (Site 37)

Since the lagoons are no longer in use, closure would provide the best level of protection for PTA. A lagoon closure plan has been developed in accordance with New Jersey Administrative Code (NJAC) Title 7, Department of Environmental Protection, Chapter 26, Subchapter 10.6(h), Surface impoundments (Foster Wheeler 1987a). The closure plan includes sampling to determine whether the soil below the lagoons is contaminated and the requisite steps for the ensuing options. Upon approval of the closure plan by the NJDEP, PTA should close the lagoons.

5.3 SITE 29 — BUILDING 31, YARD DRUM STORAGE AREA

5.3.1 Site History

Building 31 was a metal work shop containing various types of equipment including lathes, milling machines, and drill presses. Primarily, these operations produced cutting oils and machine oils, which were collected in 55-gal drums that were stored outside of the building, as shown in Fig. 5.16. Metal shavings coated in cutting oil were also produced. The waste oil was transferred manually to a 10,000-gal underground storage tank (UST) under the drum storage yard. Currently, the UST is empty and is not used, and its removal is planned (Anderson 1988b). The yard is an unpaved gravel area, about 60 by 75 ft. The transfer of waste oil would be compatible with the reported spills in this area. This UST will be closed according to NJDEP regulations because it did not have interim status.

In 1980, a steel 10,000-gal UST was installed adjacent to the northeastern corner of the building, as shown in Fig. 5.16. This tank, which was used to store fuel oil, was removed in 1986 because it was leaking. An unknown volume of the surrounding soil was removed, and confirmation samples were analyzed for petroleum hydrocarbons. The removal was approved by NJDEP (Anderson 1988b).

5.3.2 Geology and Hydrology

This Site is located directly across Third Avenue from Sites 21 and 37. Due to the proximity of these Sites, the geology and hydrology are similar to that presented in Sec. 5.2.

5.3.3 Existing Contamination

The proximity of this Site to the Bldg. 24 metal-plating shop (Site 21) and the metal-plating shop wastewater lagoons (Site 37) makes the differentiation of the exact source of contamination difficult.

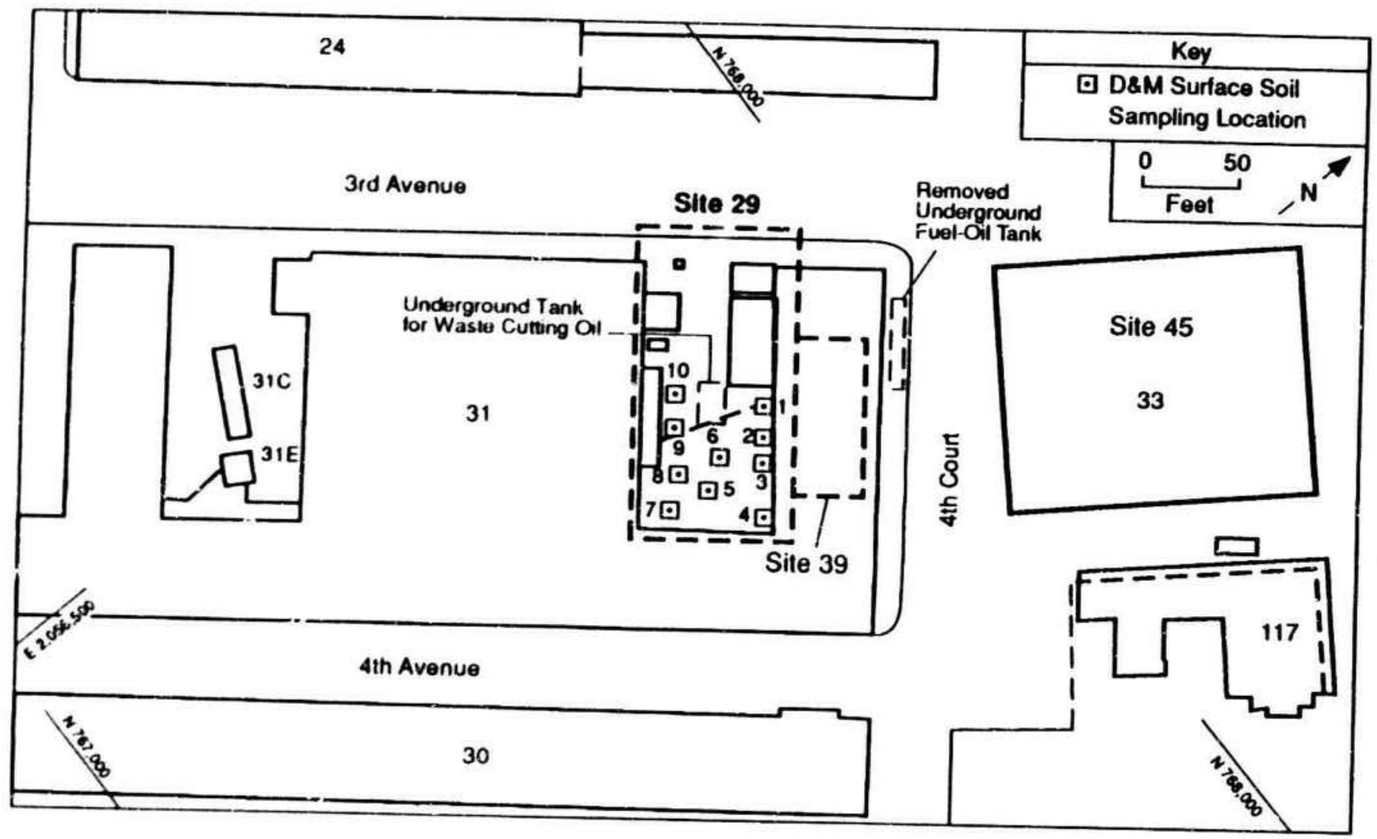

FIGURE 5.16 Layout of Site 29, the Drum Storage Area (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

5.3.3.1 Soil

Soil contamination in the Bldg. 31 area has been attributed to spills, leaking 55-gal drums, and a leaking UST. In the spring of 1984, visible contamination was discovered in the drum storage yard. An asphalt pad that covered a small portion of the yard was removed in October 1984. The area beneath the pad was found to be visibly contaminated, indicating that spills had occurred prior to its installation. In June 1986, about 60 yd^3 of topsoil was excavated and sent off-site for disposal (Gaven 1986; Anderson 1988a).

Soil in the drum storage yard was sampled by Dames & Moore in 1988 (Dames & Moore 1989). A summary of the sampling results is presented in Table 5.1. Sampling locations are shown in Fig. 5.16. Samples taken to a depth of about 5 ft indicate elevated concentrations of chromium, cadmium, lead, and zinc. The organics detected were not elevated significantly; however, they were found most frequently in two locations (sampling points 5 and 6). This may indicate the location of an activity that acted as a source for the local contamination, or it may have been the location for storing excavated topsoil prior to disposal.

5.3.3.2 Water

Building 31 has been identified as one of the sources of a plume of contamination discussed in Sec. 5.2.3. The location of drive point sample E-4 (see Fig. 5.6) was selected to gain information about possible contamination coming from the oil storage activities at the Site. Chloride concentrations were found to be equivalent to the drinking water standard (250 mg/L). Table 5.2 contains data for drive-point location E-4.

Vinyl chloride, methane, and cis-1,2-dichloroethylene are degradation products of TCE and were detected at most sampling locations in the area. It is possible that these contaminants are from the Bldg. 24 source.

Cis-1,2-dichloroethylene is the second most abundant volatile organic found in drive point samples. Based on the distribution of this contaminant, two plumes were identified: one from Bldg. 24 and one from Bldg. 31 (see Fig. 5.17).

Vowinkel et al. (1985) discuss contamination of well 129 with toluene, benzene, and phenolic compounds. Since these are not significant to Bldg. 24 operations, they may have originated from Bldg. 31. Other than discovering contaminants exclusively identified with Site operations, distinguishing sources in this area is difficult.

The results of recent monitoring well sampling are discussed in Sec. 5.2.2. Essentially the same groundwater results apply to Site 29, since it is downgradient from Sites 21 and 37.

TABLE 5.1 Selected Analytical Results for Surface Soil Samples 1-10 from Site 29[a]

Contaminant	Sample Depth (ft)	Concentration in Sample (ppm)									
		1	2	3	4	5	6	7	8	9	10
Arsenic	4.9	13.0	11.0	9.50	8.49	8.73	8.50	4.57	8.38	4.83	4.99
Barium	0.5	67.1	58.1	96.8	>100	62.5	64.3	57.9	>100	67.6	64.8
Beryllium	0.5	2.89	0.993	0.668	0.579	0.691	0.791	0.892	0.701	0.965	1.20
Cadmium	4.9	5.70	6.40	14.0	>0.500	13.0	7.20	1.10	27.0	0.500	7.20
Chromium	4.9	130	22.0	66.0	130	140	950	19.0	150	91.0	36.0
Copper	0.5	>50.0	270	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0	>50.0
Lead	4.9	47.0	12.0	150	510	380	270	12.0	270	75.0	28.0
Mercury	4.9	-	-	0.235	0.592	0.214	-	-	0.452	-	0.206
Nickel	0.5	18.5	13.5	>20.0	>20.0	22.5	>20.0	14.8	>20.0	24.3	18.8
Zinc	0.5	73.8	59.5	362	400	207	265	47.2	313	256	160
Acenaphthene	0.5	-	-	-	-	1.10	0.337	-	-	-	-
Benzo(a)anthracene	0.5	-	-	-	-	3.29	0.674	0.224	-	0.088	-
Benzo(a)fluoranthene	0.5	-	-	-	-	4.38	1.01	0.335	-	-	2.26
Benzo(a)pyrene	0.5	-	-	-	-	2.19	0.562	-	-	-	1.13
Benzo(g,h,i)perylene	0.5	-	-	-	-	2.19	0.337	-	-	-	0.679
Benzo(k)fluoranthene	0.5	-	-	-	-	5.48	1.12	-	-	-	-
Butylbenzyl phthalate	0.5	-	-	-	-	2.19	0.225	-	-	-	-
Chrysene	0.5	-	-	-	-	3.29	0.674	-	0.443	-	1.13
trans-1,2-Dichloroethene	0.5	-	0.016	0.016	-	0.016	-	0.016	-	-	-
Fluoranthene	0.5	-	-	-	-	6.58	1.12	0.335	-	-	1.13
Indeno(1,2,3-cd)pyrene	0.5	-	-	-	-	2.19	0.337	-	-	-	0.905
Methylene chloride	0.5	-	-	0.045	0.046	0.044	-	-	-	-	-
Naphthalene	0.5	-	-	-	-	0.438	0.899	-	-	-	-
Phenanthrene	0.5	-	-	-	-	7.67	1.12	-	-	-	-
Pyrene	0.5	-	-	-	-	4.38	1.01	-	-	-	0.566

[a] A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Dames & Moore 1989.

TABLE 5.2 Analytical Results (ppb) for Samples from Drive-Point E-4 at Site 29[a]

Sample Depth (ft)	Methane	Vinyl Chloride	TCE	cis-1,2-DCE	Chloride
15	-	30.0	2.0	4.0	-
20	410	9.0	2.0	6.0	130
25	-	2.0	9.0	7.0	-
30	1,500	20.0	5.0	6.0	250
35	110	7.0	19.0	11.0	91.0
40	20.0	<1.0	2.0	<1.0	-

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Sargent 1988.

5.3.4 Closure Plan

The 10,000-gal UST under the drum storage yard will undergo RCRA closure. At closure, the tank will be emptied and excavated. All associated piping and other structures will also be removed. After excavation has been completed, confirmation samples will be collected to ensure complete removal and soil borings will be sampled at 2-ft intervals down to a depth of 10 ft at three locations.

Any stained soil in the drum stor ;e yard will be removed, drummed, and disposed of in accordance with applicable regulations. A composite sample of drummed soil will be collected. All soil samples will be analyzed for priority pollutant metals, VOCs, PCBs, and, if necessary, EP toxicity for metals (Solecki 1989a). The need for further remedial action will be based on the results of these analyses.

5.3.5 Proposed RI Plan

Based on the results of the soil samples from this area, it is evident that both organic and inorganic contaminants are present to a depth of at least 5 ft. The proposed action for this Site is to proceed with closure. The results of the soil borings that will be part of closure should be used to determine the extent of the contamination. Any remedial actions for this Site should be closely coordinated with those for Site 21/37.

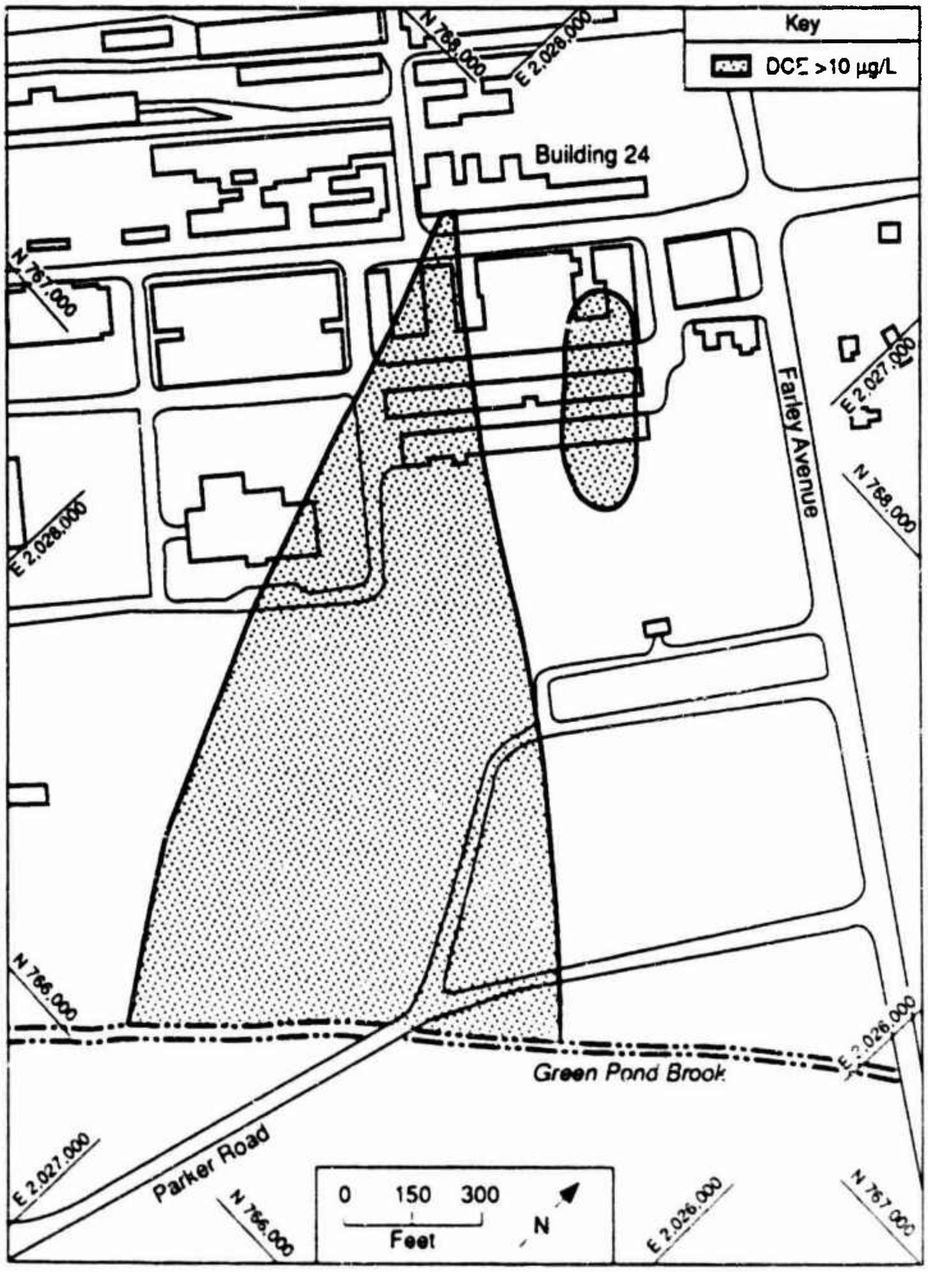

FIGURE 5.17 Generalized Distribution of cis-1,2-Dichloroethylene near Buildings 31 and 24 (Source: Adapted from Sargent 1988)

5.4 SITE 39 — BUILDING 31, VEHICLE MAINTENANCE WASTEWATER TREATMENT PLANT

5.4.1 Site History

A dissolved air flotation treatment unit with a mechanical skimmer is located inside the northern end of Bldg. 31 (see Fig. 5.18). This unit treats oily wastewater that is produced by vehicle maintenance and washing operations in Bldg. 33, directly across Farley Avenue. An in-ground sump is used to collect flow from all floor and roof drains, which is then piped under the street for treatment. After flocculation and treatment with a cationic polymer, suspended particles are skimmed. The skimmed effluent enters a float-treat tank and then flows out to one of the IWTPs located at PTA. The froth and oil skimmed from the surface is sent to a 1,000-gal UST. Dirt and other heavy solids fall to the bottom of the float-treat tank, where a mechanical screw flushes the sediment to the UST. The wastes from the UST are shipped off-post for disposal on a regular basis (Gaven 1986; Foster Wheeler 1987b; Anderson 1988b). Site 39 will be closed in accordance with New Jersey hazardous waste regulations because it did not have interim status.

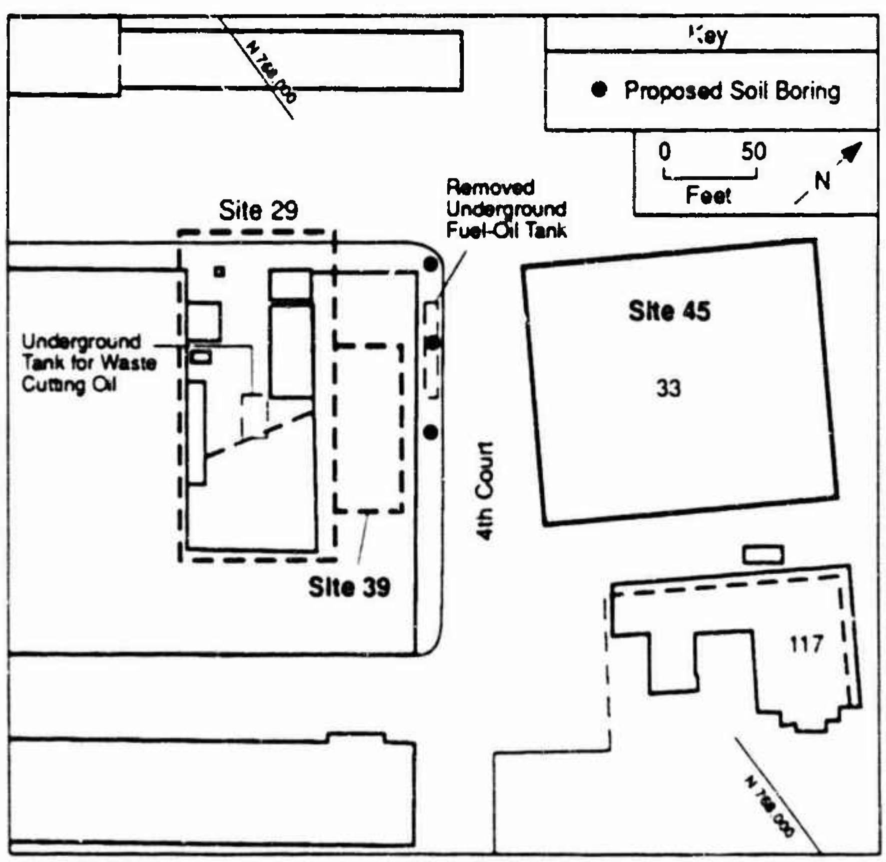

FIGURE 5.18 Layout of Site 39, the Wastewater Treatment Plant at Building 31, and Site 45, Building 33 (Source: Adapted from USACE 1984b)

5.4.2 Geology and Hydrology

Site 39 is located directly across Third Avenue from Sites 21 and 37. Due to the proximity of these Sites, the geology and hydrology are similar to that described in Sec. 5.2.2.

5.4.3 Existing Contamination

Since this Site is located in Wing 1 of Bldg. 31 (Site 29), the associated environmental concerns, namely leaking underground storage tanks and contaminated soil, are similar to those for Site 29. Data regarding soil contamination at Bldg. 31 is discussed in Sec. 5.3.3.1. Building 31 has been identified as one of the sources of a plume of groundwater contamination, which is discussed in detail in Secs. 5.2.3 and 5.3.3.

5.4.4 Closure Plan

The integrity of the 1,000-gal UST was tested in November 1988. The test determined that the tank needed closure. A closure plan for the tank has been submitted to the NJDEP for approval.

5.4.5 Proposed RI Plan

No activities beyond those in the closure plan are proposed.

5.5 SITE 45 — BUILDING 33, 90-DAY WASTE ACCUMULATION AREA

5.5.1 Site History

Building 33 was constructed in 1933 and has always been used as a maintenance shop for military tactical and standard vehicles. Figure 5.18 provides details of the Site. The types of vehicles include cars, trucks, trailers, buses, lift trucks, lifting devices, locomotives, and tactical vehicles. Tactical vehicles include tanks, self-propelled howitzers, personnel carriers, and missile carriers. An autobody shop is located in the southeastern part of the building (Anderson 1988b).

Between 1970 and 1984, used oil was stored in 55-gal drums and periodically taken to the power house (Bldg. 507) to be burned as fuel. In 1984, PTA began disposing of used oil as hazardous waste. The storage room also contained waste radiator coolant, drained battery acid, and cloths containing oil and paint thinner. These items have always been sent off-post for disposal (Anderson 1988b). Site 45 will be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

5.5.2 Geology and Hydrology

This Site is located on Third Avenue across from Sites 21 and 37. Due to the proximity of these Sites, the geology and hydrology are similar to that described in Sec. 5.2.2.

5.5.3 Existing Contamination

Extensive investigations of this part of the Arsenal have focused on the contamination associated with Bldgs. 24 and 31. Since this Site is located directly across Third Avenue and adjacent to Bldg. 31, the environmental concerns are similar.

5.5.3.1 Soil

Soil samples were not collected near this building in recent sampling efforts. Information regarding past sampling events was not available.

5.5.3.2 Water

Due to the proximity of this Site to the Bldg. 24 metal-plating shop and wastewater lagoons (Sites 21 and 37) and the Bldg. 31 operations, differentiation of another source of contamination would be difficult.

5.5.4 Closure Plan

The hazardous waste will be transferred to Bldg. 3100 for storage prior to off-post disposal. The storage area will then be cleaned and sampled to confirm the completeness of cleanup.

5.5.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, this RI plan should be modified as new data become available.

5.5.5.1 Phase I

The Site should be inspected for visible contamination, spills, and leaks. The surface soil should be sampled (at 0- to 6-in. depth intervals) outside the access doors and in any areas with visible contamination. The samples should be analyzed for TCL volatiles and TCL semivolatiles.

5.5.5.2 Phase II

If warranted by the results of the surface soil samples, the contaminated soil should be excavated and disposed of in an appropriate manner. Confirmation sampling should be conducted to ensure that the removal is complete.

5.6 SITE 49 — BUILDINGS 19 AND 19A, 90-DAY WASTE ACCUMULATION AREA

5.6.1 Site History

Buildings 19 and 19A are located between Second and Third Avenues, northwest of Second Street. The Site location is shown in Fig. 6.6 (see Sec. 6.4). Building 19 was constructed in 1918. It is 105 by 30 ft with a concrete foundation, wood floors, corrugated asbestos roofing, and 8-in. hollow tile walls. It was used as a model shop, ordnance facility, and electrical equipment facility, and it is now used as a training facility for high-reliability soldering. Various solvents are used to clean circuit boa prior to soldering. Waste solvents are generated and placed in drums stored in an adjacent shed, Bldg. 19A. Waste solvent is known to have been stored in the shed for periods exceeding 90 days. This shed consists of a concrete foundation with metal siding as walls and roof. It is padlocked at all times except during drum filling and removal (Anderson 1988b).

The maximum inventory of hazardous waste stored in these buildings is two 55-gal metal drums of waste solvent/soldering fluxes and ten 5-gal metal drums of waste solvents (Foster Wheeler 1988b). These quantities are estimated based on the maximum quantity generated during a three-month period.

Buildings 19 and 19A are to be closed in accordance with New Jersey hazardous waste regulations because they never had interim status.

5.6.2 Geology and Hydrology

Due to its proximity, Site 49 should have geological and hydrological characteristics similar to those of Site 22 described in Sec. 6.2.2.

5.6.3 Existing Contamination

There are no data concerning soil, surface, and groundwater contamination at the Site.

5.6.4 Closure Plan

Revised closure plans for Site 49 include transferring hazardous material to Bldg. 3100 for off-post disposal, washing the buildings with detergent, rinsing them with clean water, collecting two wash water samples from each building, and analyzing these samples for priority pollutant metals. Following the wash and rinse step, six chip samples (four from Bldg. 19 and two from Bldg. 19A) will be collected from the locations shown in Fig. 5.19. The chip samples will be analyzed for priority pollutant metals.

If the floor in Bldg. 19A is cracked, the soil sample will be collected through the crack. The soil sample will be taken from a depth of 0.3 m (1 ft) and analyzed for VOCs, priority pollutant metals, and, if necessary, EP toxicity for metals. If the soil is above predetermined concentration limits, further sampling will be done to determine the extent of contamination (Foster Wheeler 1988b, 1989; Solecki 1989a).

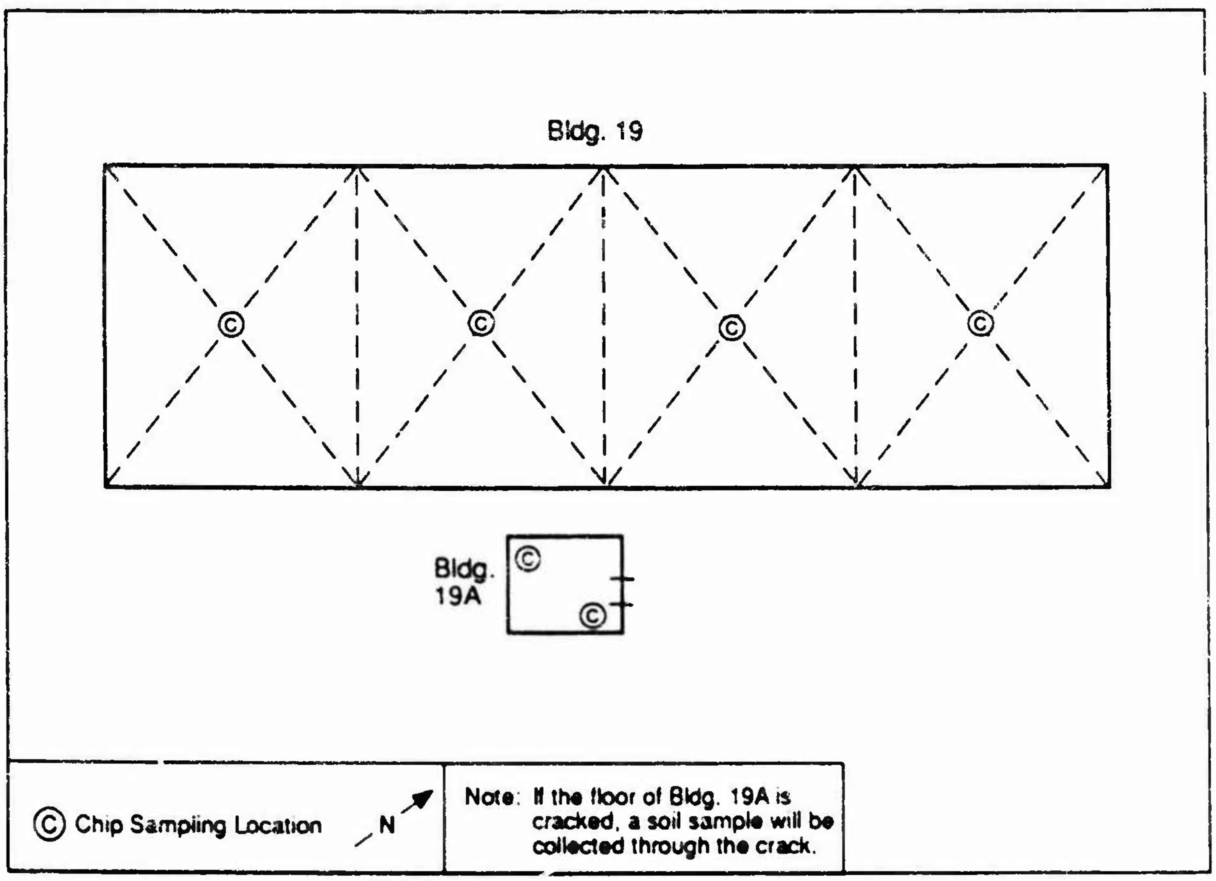

FIGURE 5.19 Closure Plan Sampling for Site 49 (Source: Adapted from Foster Wheeler 1989)

5.6.5 Proposed RI Plan

No additional sampling activities are proposed unless the soils are found to be contaminated. If contamination is found, a surface water and groundwater sampling plan should be developed and implemented.

5.7 SITE 69 — BUILDING 92, SURVEILLANCE LABORATORY

5.7.1 Site History

Building 92, the Predictive Surveillance Laboratory, is in the industrial area of the southwestern portion of PTA. Details of the Site are given in Fig. 5.20. The lab conducted quality assurance testing for surface thickness of painted and anodized coatings. Acid was used to strip coatings from panels. Documentation of waste disposal began in October 1981. Between 1982 and 1985, spent acid was sent to Bldg. 24 for disposal. None was generated during 1986, and, during 1987, it was taken to Bldg. 183 for disposal with other laboratory wastes. The stockpile reliability testing (SRT) area is also located in this building. This area is a controlled clean room where optical disks are cleaned and checked for quality. The only waste produced by the SRT is detergent water, which is discarded in the sink (Foster Wheeler 1988b).

Past operations also discharged waste into a concrete underground storage tank via floor drains and sinks. According to PTA personnel interviewed in 1989, the tank had an outfall into Bear Swamp Brook near Bldg. 95. Building 92 is a designated satellite waste accumulation area; an estimated 5 gal of waste is generated per year (Solecki 1989c).

A closure plan has been prepared for this Site (Foster Wheeler 1988b). Because it did not have interim status, it will be closed in accordance with New Jersey hazardous waste regulations.

5.7.2 Geology and Hydrology

Four bedrock units and several unconsolidated units are found at the Arsenal. Limited information regarding bedrock geology specific to this area is available, so a discussion of the orientation and placement of the units is not presented. The underlying formations in the area of Bldg. 92 include the Green Pond Conglomerate, the Leithsville Formation, and Precambrian gneiss. The specifics of these formations are discussed in Sec. 2 of Volume 1 and Sec. 5.2.2 of this volume. Groundwater in these formations is usually contained in fractures, and well yields are low to moderate. Flow in this area is estimated to be south-southeast toward Green Pond Brook.

Soils in the area of Bldg. 92 are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

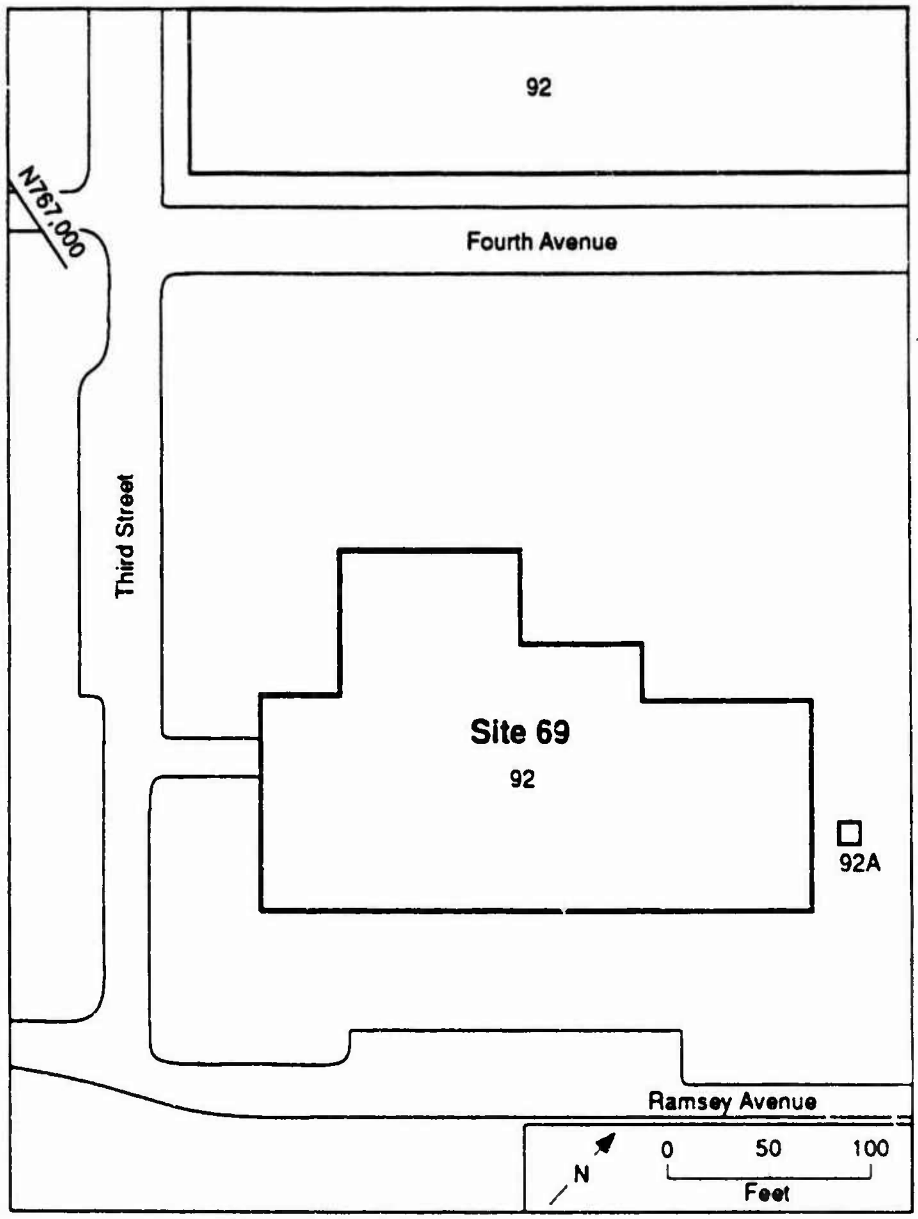

FIGURE 5.20 Layout of Site 69, the Building 92 Surveillance Laboratory (Source: Adapted from USACE 1984b)

5.7.3 Existing Contamination

No previous investigations are reported for this Site. During interviews, PTA personnel reported that sodium cyanide, potassium cyanide, chromium trioxide, acetone, and peroxide may have been discharged to the concrete tank. Analyses of waste oil generated by this operation have shown concentrations of antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium, thallium, and zinc (Solecki 1989c). Since the tank reportedly had an outfall into Bear Swamp Brook near Bldg. 95, the possibility exists that these contaminants were discharged to the brook and swamp.

5.7.4 Closure Plan

Areas included in the closure plan are the laboratory table tops in room 18, a cabinet containing unknown chemicals, and a paint locker storage bin located outside of the building. Activities include removal, sampling, and disposal of stored chemicals; washing with detergent and high pressure water; and collection of chip samples from each area and two rinsate samples. The samples are analyzed for priority pollutant metals.

5.7.5 Proposed RI Plan

In order to address the potential for contamination resulting from Site operations, a phased investigation is recommended. The following RI plan will be carried out independently of the closure sampling plan. If clean closure is not possible, the RI plan will be modified as new information becomes available.

5.7.5.1 Phase I

The current condition of the Site should be assessed by inspecting all areas to locate visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area of stained soil.

In addition to the sampling of visibly contaminated areas, three deeper samples (2 ft) should be collected with a hand auger from around the underground tank, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area, and two surface water and sediment samples should be collected from Bear Swamp Brook at the location of the former outfall from the building.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, TCL metals, nitrate, sulfate, and cyanide.

5.7.5.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. All samples should be analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

5.8 SITE 86 — BUILDING 12, PHOTOPROCESSING FACILITY

5.8.1 Site History

Building 12, which contains a photoprocessing operation, is in the industrial area of the southwestern portion of PTA. Figure 5.21 gives the details of the Site. Since 1977, the operation has converted ARDEC drawings to 35-mm microfilm. The process uses various solutions that are replaced about once per month. The spent solutions are stored temporarily until they are transferred to the Defense Reutilization and Marketing Office (DRMO) for silver recovery. All of the solutions are designated recyclable materials from which precious metals are reclaimed [40 CFR 261.6a(2)(iv)]. Therefore, PTA claims exemption from 90-day accumulation periods for this Site, and it will not undergo closure.

5.8.2 Geology and Hydrology

Four bedrock units and several unconsolidated units are found at PTA. Limited information regarding bedrock geology specific to this area is available, so a discussion of the orientation and placement of the units is not presented. The underlying formations in the area of Bldg. 12 include the Green Pond Conglomerate, the Leithsville Formation, and Precambrian gneiss. The specifics of these formations are discussed in Sec. 2 of Volume 1 and Sec. 5.2.2 of this volume. Groundwater in these formations is usually contained in fractures, and well yields are low to moderate. Flow in this area is estimated to be south-southeast toward Green Pond Brook.

Soils in the area of Bldg. 12 are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

5.8.3 Existing Contamination

No previous investigations are reported for this Site. The types of solutions handled in Bldg. 12 include acetic acid and photoprocessing developer and fixer. Potential contaminants include ammonia-nitrogen and silver. No spills or releases have been reported for this Site.

As noted above, an exemption is claimed from the 90-day accumulation requirements. The substantive requirements that are required include notification of activity, record keeping, and recycling of at least 75% of the material within one calendar year [40 CFR 261.1(c)].

5.8.4 Proposed RI Plan

Because this Site handles only recyclable materials, only limited investigation is recommended to assess the current condition of the Site and the potential impacts

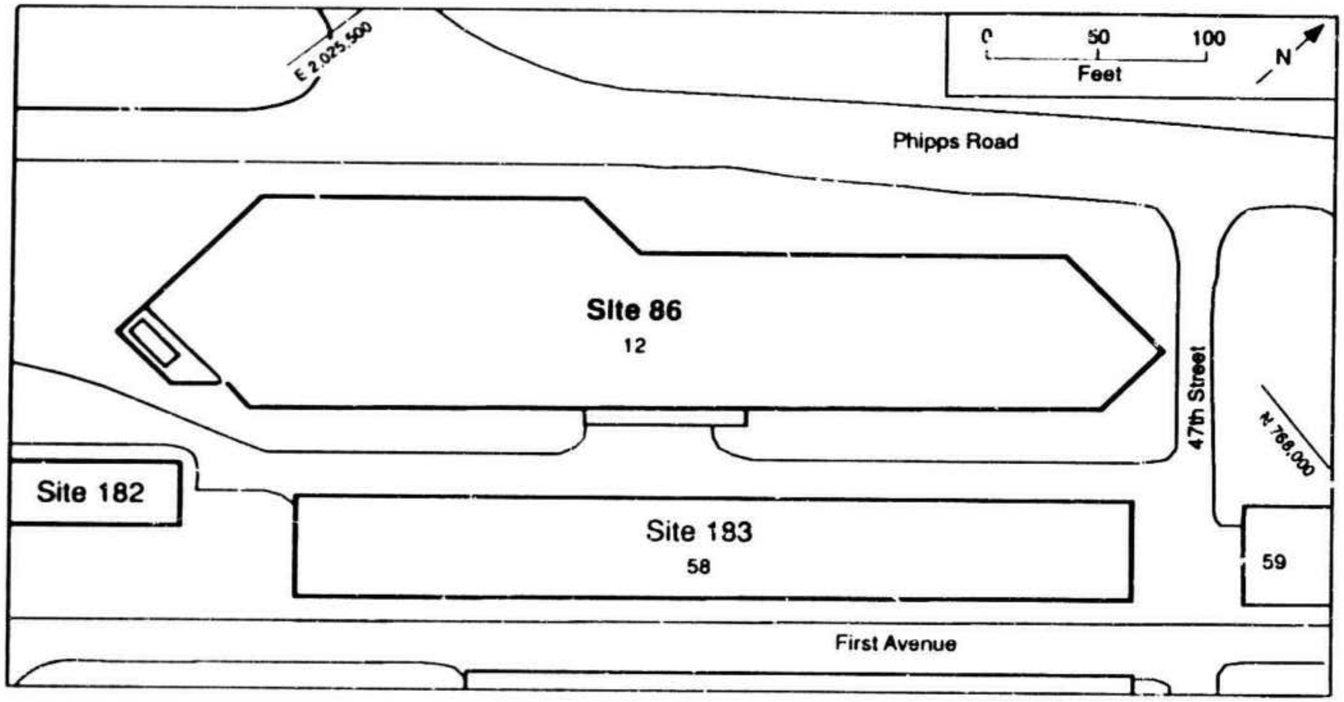

FIGURE 5.21 Layout of Site 86, the Building 12 Photoprocessing Facility (Source: Adapted from USACE 1984b)

resulting from regular operations. The Site should be assessed by inspecting all areas to locate visible contamination, drains, and other migration pathways. If none are found, no further action is recommended for this Site.

The need for further investigation should be determined based on the Site inspection.

5.9 SITE 117 — BUILDING 22, PRECISION MACHINE SHOP

5.9.1 Site History

Building 22 is located south of Farley Avenue adjacent to Bear Swamp Brook in the industrial section of PTA (Fig. 5.22). It was built in 1918 and has been used as a precision machine shop for machining depleted uranium and metals. Reportedly, it was cleaned and is no longer a machine shop.

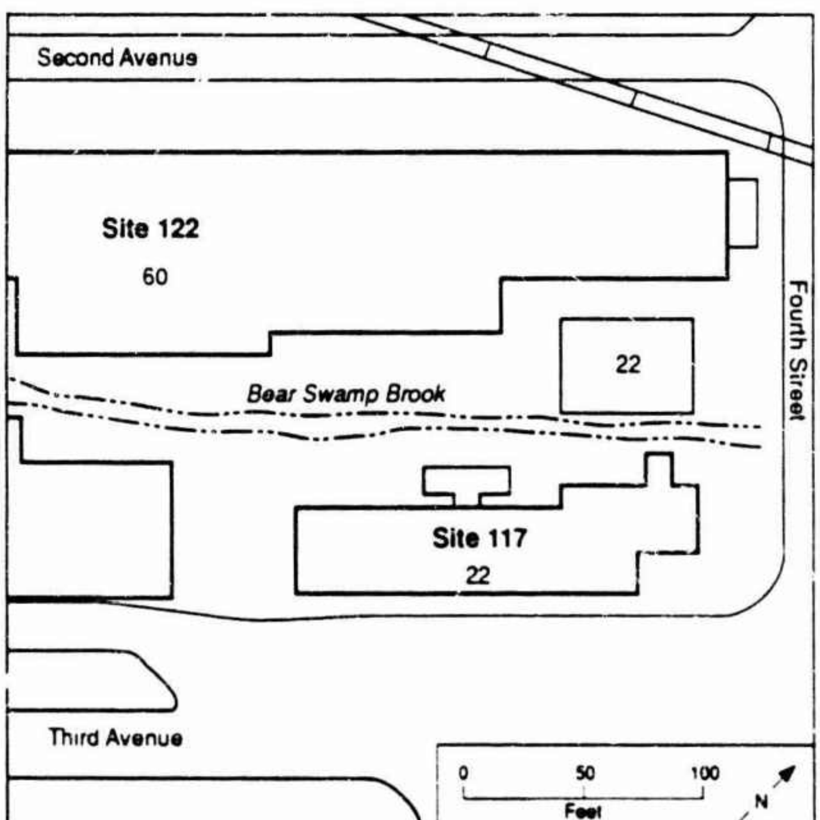

FIGURE 5.22 Layout of Site 117, the Building 22 Precision Machine Shop (Source: Adapted from USACE 1984b)

5.9.2 Geology and Hydrology

Four bedrock units and several unconsolidated units are found at PTA. Limited information regarding bedrock geology specific to this area is available, so a discussion of the orientation and placement of the units is not presented. The underlying formations in the area of Bldg. 22 include Green Pond Conglomerate, Leithsville Formation, and Precambrian gneiss. The specifics of these formations are discussed in Sec. 2 of Volume 1 and Sec. 5.2.2 of this volume. Groundwater in these formations is usually contained in fractures, and well yields are low to moderate. Flow in this area is estimated to be south-southeast toward Green Pond Brook.

Soils in the area of Bldg. 22 are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

5.9.3 Existing Contamination

Information from previous investigations of Bldgs. 24 and 31 has shown that there are several sources of contamination associated with this area (see Secs. 5.2 and 5.4). Potential contaminants from this Site include waste oil, depleted uranium, and metals. During interviews, PTA personnel reported that there may have been oil spills at this Site. The degree to which the building was cleaned after being used for machining is unknown. Since this area is the heart of industrial operations at PTA, there is a moderate to high potential that contaminants have been released to the soil; however, the source of this contamination may be other buildings. Information indicates that the bulk of machining operations were across the street in Bldg. 31. Therefore, this Site is considered to have a low potential for releasing contaminants to groundwater and surface water.

5.9.4 Proposed RI Plan

Activities for this Site should be coordinated with those recommended for Sites 21/37 and 29. In order to address the potential for contamination resulting from site operations, a phased investigation is recommended.

5.9.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area of stained soil.

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area and three surface water and sediment samples should be collected from Bear Swamp Brook (one upstream, one next to the Site, and one downstream).

All soil, surface water, and sediment samples should be analyzed for TCL volatiles, TCL semivolatiles, uranium, and TCL metals.

5.9.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

5.10 SITE 118 — BUILDING 41, PESTICIDE STORAGE AND OIL/WATER SEPARATOR POND

5.10.1 Site History

Building 41 is located at the eastern end of Dunn Avenue in the middle of the golf course in the western part of the PTA (Fig. 5.23). The building occupies an area of 293 m^2 (3,150 ft^2), and it has hollow-tile walls and a corrugated asbestos roof (PTA 1971). The building was used for pesticide storage. PTA personnel reported that the building roof leaked for years. Until 1988, bags of pesticide were opened and leaked onto wooden floors in the building.

About 450 ft west of the building is an oil/water separator pond. The pond, which is located near Bldg. 40, received oily water, which may have included TCE from Bldg. 24, through an underground pipe beneath the golf course. Reportedly, oil floated on the top of the water in the pond, while the water left below was drained southward through an underground pipe to Green Pond Brook. The pond now is inactive.

5.10.2 Geology and Hydrology

The Site is located in Green Pond Brook valley. It is covered by a layer of Quaternary deposits about 46 m (150 ft) thick and overlying Cambrian dolomite (Lacombe et al. 1986). From top to bottom, the deposits are composed of (1) fine- to coarse-grained sands about 9 m (30 ft) thick, (2) a sequence of fine-grained sands and clayey silt, and (3) a layer of sand and gravel occasionally underlain by till (Harte et al. 1986). The top layer is a leaky water-table aquifer. The water table is about 3 m (10 ft) below surface (Vowinkel et al. 1985). Groundwater flows in the aquifer from the north-northwest and discharges to Green Pond Brook, in the south-southwest.

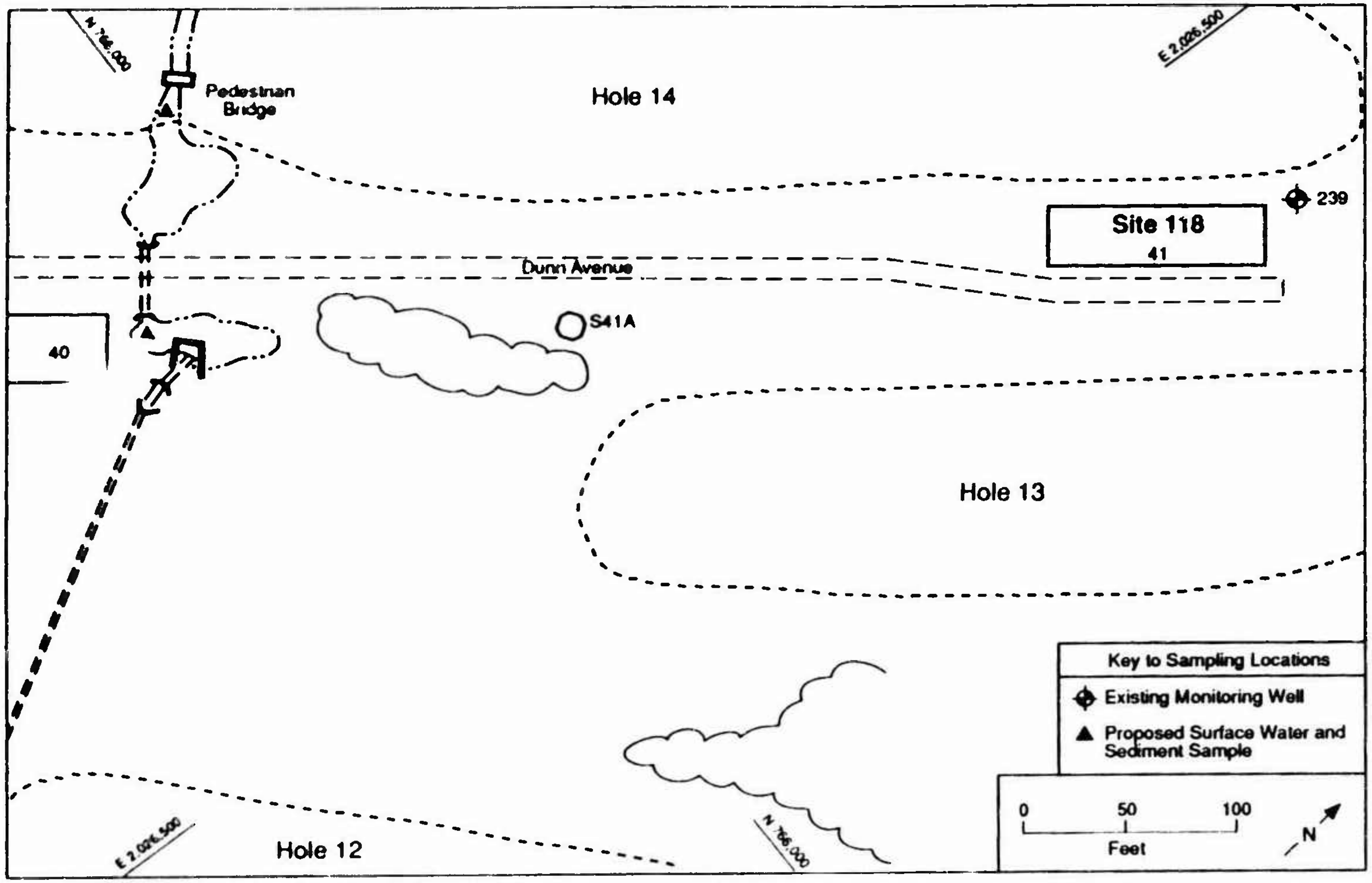

FIGURE 5.23 Layout of Site 118, the Building 41 Pesticide Storage and Oil/Water Separator Pond (Source: Adapted from USACE 1984b)

5.10.3 Existing Contamination

Groundwater samples taken from well 239 at the Site (Table 5.3) show VOC contamination of the water-table aquifer at the eastern end of the Site. The contamination may be part of a contamination plume from Bldg. 24. Table 5.3 summarizes groundwater quality data for selected chemicals from 1982 to 1984 (Vowinkel et al. 1985).

Electromagnetic conductivity measurements (Lacombe et al. 1986) delineate an area with relatively high apparent conductivities at Green Pond Brook immediately downgradient of the oil/water separator. The high conductivity may be contamination-related.

A pesticide risk management study was made in 1988 at PTA (USAEHA 1989). In the study, five soil samples were collected in areas downgradient of Bldg. 41 and were analyzed for pesticides and PCBs. One of the samples had a total pesticide residue concentration of 5.51 mg/kg (Table 5.4), slightly above the USAEHA action level guideline (5 mg/kg).

5.10.4 Proposed RI Plan

5.10.4.1 Phase I

For the oil/water separator pond, two sediment samples, each to a depth of 0.3 m (1 ft), and two surface water samples should be collected. One of the sediment samples and one of the water samples should be taken from the inlet area, and the other two should be taken from the outlet area. One additional sediment sample should be collected from the brook at the outlet of the underground pipe. The samples should be analyzed for TCL volatiles, TCL semivolatiles, cyanide, PCBs, and TCL metals.

5.10.4.2 Phase II

If significant contamination is found in the Phase I samples, additional sediment samples and soil borings may be required to delineate the extent of the contamination. The number and location of the samples and borings depend on the Phase I results. Also, one monitoring well should be installed between the pond and the brook to monitor the groundwater quality.

5.11 SITE 122 — BUILDING 60, SATELLITE WASTE ACCUMULATION AREA

5.11.1 Site History

Building 60 is near Bldg. 22 (Site 117) on the opposite bank of Bear Swamp Brook. Figure 5.24 shows Site details. It was built in 1942 and renovated in 1959. It was used for storing nuclear materials and ordnance. Currently, it is a satellite waste

TABLE 5.3 Analytical Results for Groundwater Collected from Well 239 during 1982-1984

Parameter	No. of Analyses	Concentrations (μg/L) Range	Median
Cadmium	7	<1 - 15	1
Chromium	7	3 - <25	4
Iron	4	<100 - 1,750	115
Manganese	4	77 - 180	142
Sodium	4	60,000 - 116,000	87,400
Lead	6	4 - 27	8.5
Selenium	6	<5 - 15	<5
Cyanide	7	0.9 - <10	<1
Chloride	5	102,000 - 141,000	115,000
Fluoride	5	50 - 221	100
Sulfate	4	17,500 - 51,400	30,200
		No. of Detections	**Maximum Concentration (μg/L)**
Benzene	10	0	-
Freon	10	1	3.5
Phenols	10	7	5
Toluene	10	0	-
Tetrachlorethylene	10	5	3.0
Trichloroethylene	10	9	9
1,1,1-Trichloroethane	10	0	-
1,2-trans-Dichloroethylene	10	1	2.0

Source: Vowinkel et al. 1985.

TABLE 5.4 Analytical Results for Pesticides in Soil Samples Collected from in Front of Building 41 (mg/kg)[a]

Analyte	6118	6119	6120	6121	6122
p,p'-DDE	0.83	ND	ND	ND	ND
o,p'-DDT	0.73	ND	ND	ND	ND
p,p'-DDT	3.63	ND	ND	ND	ND
Chlordane metabolites[b]	ND	ND	4.19	ND	ND
cis-Chlordane	ND	ND	0.17	ND	ND
trans-Chlordane	ND	ND	0.18	ND	ND
2,4-D[c]	0.32	ND	ND	ND	ND
Total	5.51	ND	4.54	ND	ND

[a]ND means not detected.

[b]Total constituents.

[c]As acid equivalent.

Source: USAEHA 1989.

accumulation area for an estimated 10 gal/yr of waste oil (Solecki 1989c). Wastes are stored inside on the concrete floor. Reportedly, no radioactive materials were ever used or stored at this Site.

5.11.2 Geology and Hydrology

Four bedrock units and several unconsolidated units are found at PTA. Limited information regarding bedrock geology specific to this area is available, so a discussion of the orientation and placement of the units is not presented. The underlying formations in the area of Bldg. 60 include the Green Pond Conglomerate, Leithsville Formation, and Precambrian gneiss. The specifics of these formations are discussed in Sec. 2 of Volume 1 and Sec. 5.2.2 of this volume. Groundwater in these formations is usually contained in fractures, and well yields are low to moderate. Flow in this area is estimated to be south-southeast toward Green Pond Brook.

Soils in the area of Bldg. 60 are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

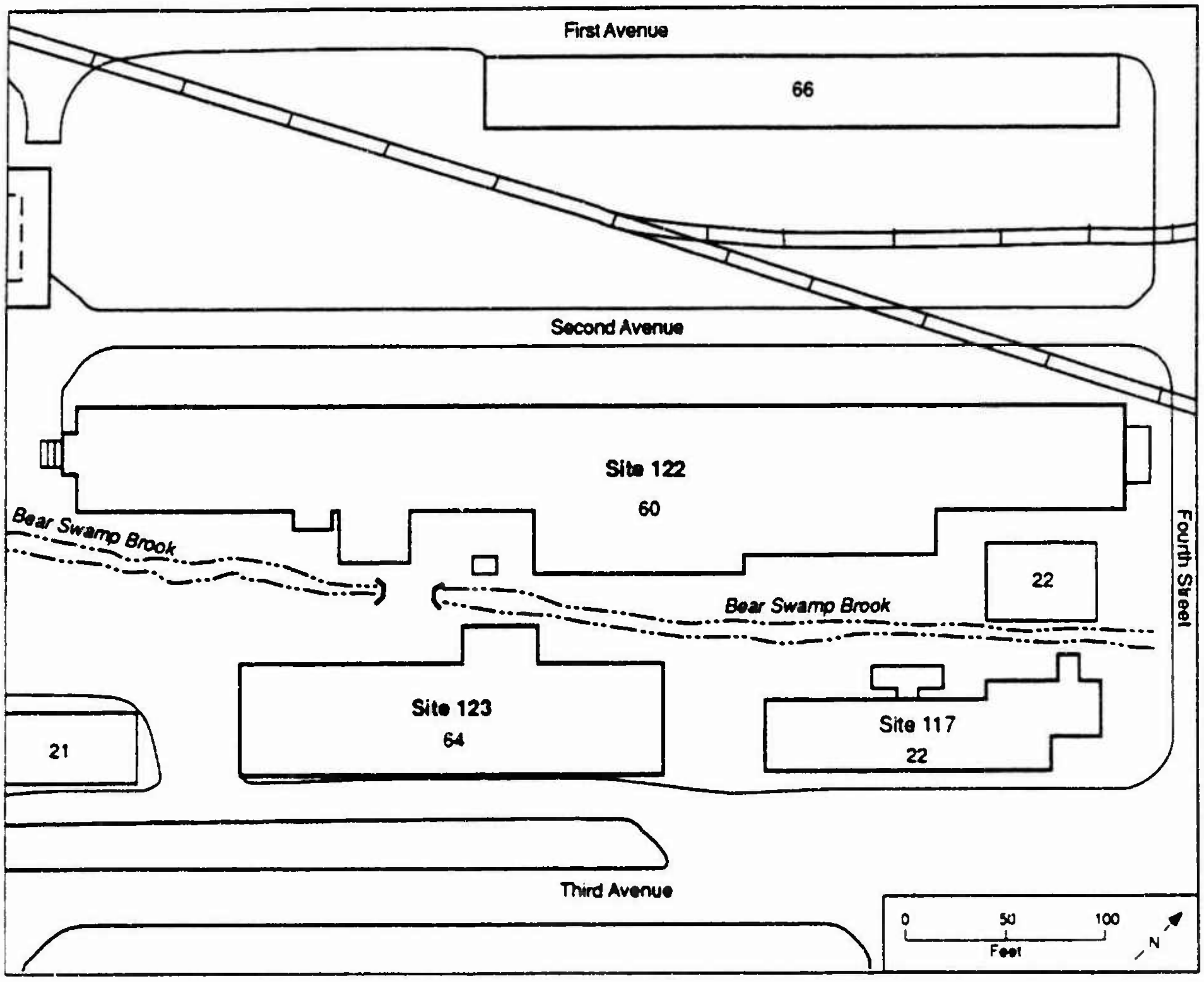

FIGURE 5.24 Layout of Site 122, the Building 60 Satellite Waste Accumulation Area, and Site 123, the Building 64 Metal Plating Shop (Source: Adapted from USACE 1984b)

5.11.3 Existing Contamination

Information from previous investigations of Bldgs. 24 and 31 has shown that there are several sources of contamination associated with this area (see Secs. 5.2 and 5.4). The potential contaminant at this Site is waste oil. As discussed in Sec. 5.9.3, waste disposal practices at Sites adjacent to Bear Swamp Brook should be evaluated. Based on available information, the potential for release of contaminants from this Site is considered to be low.

5.11.4 Proposed RI Plan

Activities for this Site should be coordinated with those recommended for Sites 21/37 and 29. In order to address the potential for contamination resulting from Site operations, a phased investigation is recommended.

5.11.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area.

In addition to the sampling of visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area and three surface water and sediment samples should be collected from Bear Swamp Brook (one upstream, one next to the Site, and one downstream).

All samples should be analyzed for TCL volatiles, TCL semivolatiles, and explosives.

5.11.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

5.12 SITE 123 — BUILDING 64, METAL PLATING SHOP

5.12.1 Site History

Building 64 is immediately south of Bldg. 22 (Site 117) and adjacent to Bear Swamp Brook. Figure 5.24 shows Site details. Building 64 was built in 1942 and renovated in 1956. It was used as a metal plating shop. PTA personnel reported that Bldg. 64 was also used for handling materials recovered from the proving grounds, which contained beryllium and depleted uranium. Reportedly, the material was brought into the building in bags that contained dust. Dust from shaking the bags reportedly settled on the floor. During routine cleaning of the building, it is possible that the dust was swept outside.

5.12.2 Geology and Hydrology

Four bedrock units and several unconsolidated units are found at PTA. Limited information regarding bedrock geology specific to this area is available, so a discussion of the orientation and placement of the units is not presented. The underlying formations in the area of Bldg. 64 include the Green Pond Conglomerate, Leithsville Formation, and Precambrian gneiss. The specifics of these formations are discussed in

Sec. 2 of Volume 1 and Sec. 5.2.2 of this volume. Groundwater in these formations is usually contained in fractures, and well yields are low to moderate. Flow in this area is estimated to be south-southeast toward Green Pond Brook.

Soils in the area of Bldg. 64 are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

5.12.3 Existing Contamination

Information from previous investigations of Bldgs. 24 and 31 has shown that there are several sources of contamination associated with this area (see Secs. 5.2 and 5.4). Potential contaminants at this Site include plating shop wastes (metals), beryllium, depleted uranium, and corrosives. As discussed in Sec. 5.9.3, waste disposal practices at Sites adjacent to Bear Swamp Brook should be evaluated. During interviews, PTA personnel reported that, when the building was a plating shop, the brook downstream of the building was green and brownish-red as a result of operations. Based on available information, Site 123 is considered to have a moderate to high potential for the release of contaminants.

5.12.4 Proposed RI Plan

Activities for this Site should be coordinated with those recommended for Sites 21/37 and 29. A phased investigation is recommended in order to assess the potential for contamination resulting from past operations.

5.12.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area.

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations in each loading and handling area and three surface water and sediment samples should be collected from Bear Swamp Brook (one upstream, one next to the Site, and one downstream).

All samples should be analyzed for TCL metals, uranium, nitrate, sulfate, and cyanide.

5.12.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

5.13 SITE 182 — BUILDING 5, ARSENAL REPRODUCTION AND TRAINING OFFICES

5.13.1 Site History

Building 5 is located west of Bear Swamp Brook near First Avenue, close to where Bear Swamp Brook takes a turn toward Green Pond Brook. A map of the Site is shown in Fig. 5.25. Building 5 was built as a storage building in 1918 and was renovated in 1968. It is currently used for computer-aided design (CAD) services and has two photoprocessing units at the south end of the building. Exemption from the RCRA Part B permit is claimed for the photoprocessing units, and a closure plan has been prepared. The building will be closed under New Jersey hazardous waste regulations because it never had interim status.

5.13.2 Geology and Hydrology

The area around Bldg. 5 is flat and at 700 ft above sea level. The surface soil in the area is a combination of Ridgeway Series and Urban Land with a reworked soil profile. The bedrock beneath is the Green Pond Conglomerate. Surface water in the vicinity of Bldg. 5 would eventually flow southeast into Bear Swamp Brook.

5.13.3 Existing Contamination

This Site was selected for study because of the two photoprocessing units at the south end of the building.

The closure plan indicates that one of the two photoprocessors is directly connected to a silver recovery unit, whose effluent is directed to the sewer. Waste chemicals from the other photoprocessing unit is accumulated in 5-gal cube-tainers, stored on metal shelves, and transferred to Bldg. 314 for silver recovery. The maximum waste inventory during a three-month period is six 5-gal containers of spent photochemicals.

Attention should be given to the fact that Bldg. 5 has a corrugated asbestos roof, especially if the building is being considered for demolition, during which a potential for asbestos release will need to be considered.

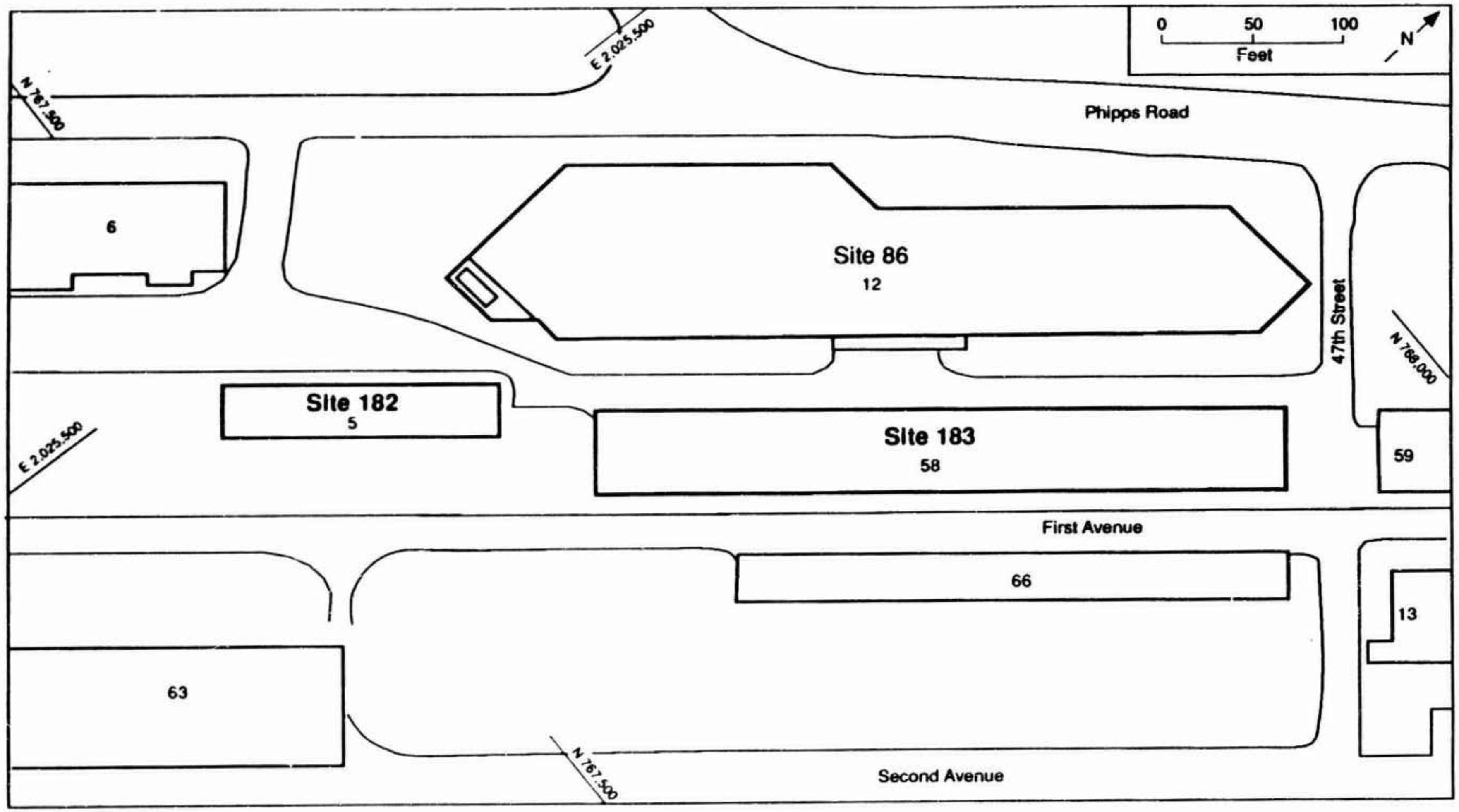

FIGURE 5.25 Layout of Site 182, Building 5, and Site 183, Building 58 (Source: Adapted from USACE 1984b)

5.13.4 Closure Plan

The revised closure plan for Bldg. 5 includes removing the hazardous waste inventory; removing and disposing of any contaminated floor tiles; detergent-washing and rinsing the shelves, walls, and floors; and taking two wash water or rinsate grab samples and two chip samples and analyzing them for priority pollutant metals, to check the effectiveness of the cleaning procedure.

5.13.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of Bldg. 5 be impossible, the RI sampling plan described below will be modified to take that into account.

5.13.5.1 Phase I

The exterior of Bldg. 5 should be inspected along the perimeters. No further action is necessary if no soil staining is found. If stained soil or spill areas are noted, one surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each stain or spill area. The samples should be analyzed for cyanide and TCL metals.

5.13.5.2 Phase II

One soil boring should be drilled near each area of the contaminated surface soil identified in Phase I. Soil samples should be collected from each boring and analyzed for cyanide and TCL metals.

5.13.5.3 Phase III

To evaluate the movement of contaminants into groundwater, monitoring wells should be installed if the Phase II soil borings show contaminants. The well locations should depend upon the location of the contaminated soil boring samples. Groundwater should be monitored quarterly for significant contaminants, with a review of the results after one year.

5.14 SITE 183 — BUILDING 58, GRAPHIC REPRODUCTION AND TRAINING

5.14.1 Site History

The Site is located on First Avenue near Bldg. 24 (Fig. 5.25). Built in 1937 as a storage building, Bldg. 58 occupies an area of 1,784 m^2 (19,200 ft^2). In 1971, the building was listed as a printing plant (PTA 1971). More recently, the building was described as containing the Arsenal Reproduction and Training Offices (Foster Wheeler 1988b). A photoprocessing facility is located inside the building.

A closure plan has been prepared for the photoprocessing unit in Bldg. 58 (Foster Wheeler 1988b), which will be closed in accordance with NJDEP hazardous waste regulations because it never had interim status.

5.14.2 Geology and Hydrology

The Site is situated near an outlet of an unnamed valley and at the foothill of Green Pond Mountain. Underlying the Site is a layer of Quaternary deposits about 30 m (100 ft) thick (Lacombe et al. 1986) overlying the Leithsville dolomite and Green Pond Conglomerate. Judging from the records of wells near Bldg. 24, the upper portion of the Quaternary deposit at the Site probably consists of fine- to coarse-grained unsorted sands. On the surface of the Site, the native soil has been disturbed by the development of PTA. The soil has been classified as Urban Land soil (Wingfield 1976).

The upper portion of the Quaternary deposit forms a water-table aquifer on the Site. The aquifer receives recharge from the northwest. Groundwater flows to the southeast towards the brook. The hydraulic conductivity of the aquifer is estimated as moderate to high.

5.14.3 Existing Contamination

Annual amounts of waste generated from the photoprocessing facility are 416 L/yr (110 gal/yr) of spent acid developer and 23 L/yr (6 gal/yr) of fixer (Solecki 1989c). They are stored in 5-gal plastic containers located on the floor adjacent to the photoprocessing equipment. When four containers are accumulated, they are transferred to the Property Disposal Office, Bldg. 314 (Foster Wheeler 1988b).

There is no information on the waste generated from other operations in the building.

5.14.4 Closure Plan

The revised closure plan for the photoprocessing facility in Bldg. 58 (Foster Wheeler 1988b) includes the removal of all hazardous materials from the facility. Then, the floors and the shelves of the facility will be examined for discoloration or residues of spent photochemicals. Any floor tiles determined to be contaminated will be disposed of as hazardous waste. After all containers are removed, the shelves, walls and floors will be washed with detergent and rinsed with clean water. Two wash or rinsate grab samples and two chip samples will be collected for priority pollutant metal analyses (Fig. 5.26).

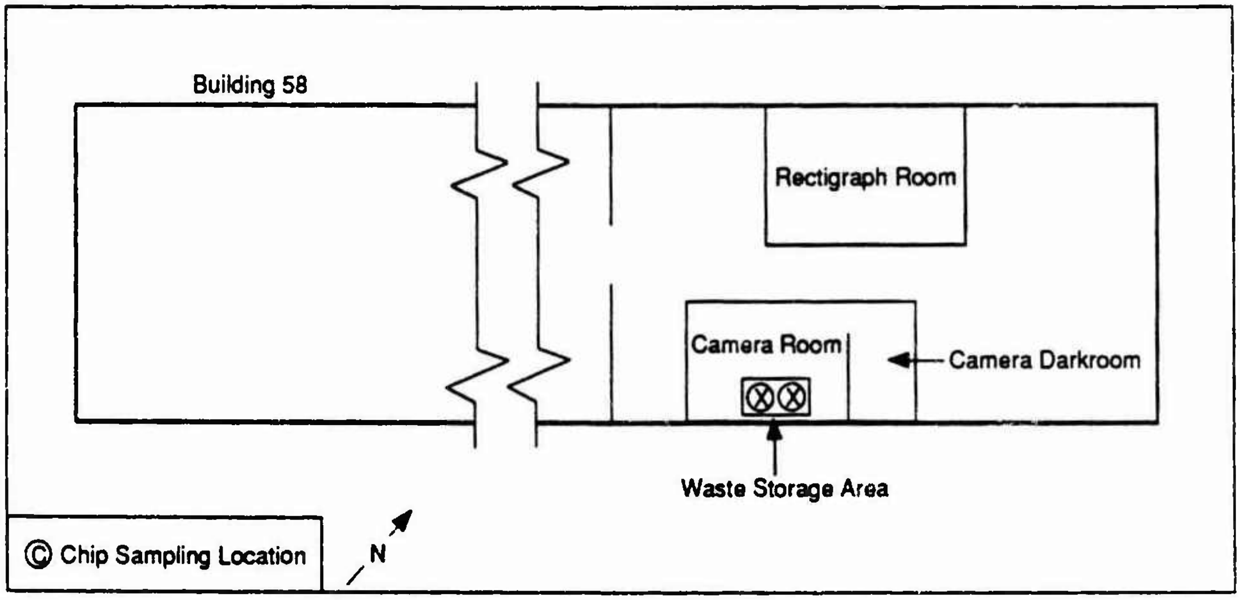

FIGURE 5.26 Closure Sampling Locations for Building 58 (Source: Adapted from Foster Wheeler 1988b)

5.14.5 Proposed RI Plan

The proposed phased sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of the facility not be possible, the RI sampling plan will be modified as new data become available.

5.14.5.1 Phase I

A field inspection should be conducted inside and around the building to locate areas with signs of contamination. If such areas are located, one surface soil sample should be collected to a depth of 0.3 m (1 ft) in the center of each area outside the building. The samples should be analyzed for cyanide and TCL metals.

5.14.5.2 Phase II

If contamination is found, a soil boring should be drilled in each identified area of surface soil contamination. Soil samples should be taken from each boring and analyzed for the contaminants found in the surface soil sample.

6 AREA E: BUILDING 95 AREA

6.1 INTRODUCTION

Area E contains four Sites, two associated with Bldg. 95 and two, the Sewage Treatment Plant Sludge Beds and the Golf Course Maintenance Shop, located nearby. Both groundwater and soil contamination occur in the Area and contributed to the listing of Picatinny Arsenal on the NPL.

6.2 SITE 22 — BUILDING 95 IMPOUNDMENTS

6.2.1 Site History

Site 22 is located between Third and Fourth Avenues and south of First Street. It consists of an area formerly occupied by two unlined sand filter lagoons and one unlined sludge drying bed. These impoundments were closed under interim status in 1981. Between the early 1960s and October 1981, treated wastewater from a metal-plating and etching operation in Bldg. 95, 91 m (300 ft) northeast of the Site, was discharged into the sand filtration lagoons, and sludge from the treatment process was placed into the sludge drying bed. Operations at the plating and etching facility were intermittent, but could have produced up to 34,000 L (9,000 gal) of wastewater effluent and 64 kg (141 lb) of treatment sludge per day. Contaminants in the treated wastewater and sludges from Bldg. 95 include volatile organics, heavy metals, acids, and numerous inorganic compounds.

A map showing the location of these impoundments and Bldg. 95 is provided in Fig. 6.1. A more detailed description of the wastewater streams and the wastewater treatment system in Bldg. 95 is presented in Sec. 6.4.

The sludge drying bed was 6.7 by 6.1 m (22 by 20 ft) and 0.76 m (2.5 ft) deep. Constructed of earth, it had asphalt sidewall surfacing and a sand and gravel layered bottom. A splash plate was provided to disperse the liquid, minimizing damage to the clay surface. A pipe buried in the gravel bottom drained liquid from the drying bed to the adjacent sand filters via gravity (Foster Wheeler 1987a).

The two sand filter bed lagoons each had a capacity of 47,200 L (12,500 gal). In addition to receiving wastewater from the sludge drying bed, they also received filtrate liquid pumped directly from the wastewater treatment system in Bldg. 95. In these lagoons, splash plates were provided to break the fall of entering liquid streams. The liquid flowed over a 0.8-m (33-in.) layer of sand and segregated gravel layers and then into a pipe buried in the gravel. From there, it flowed by gravity to a drainage ditch and into Green Pond Brook (Foster Wheeler 1987a).

The sludge in the drying bed and the sand filter lagoons was cleaned annually prior to closure of these impoundments. Sludges were last picked up in December 1979.

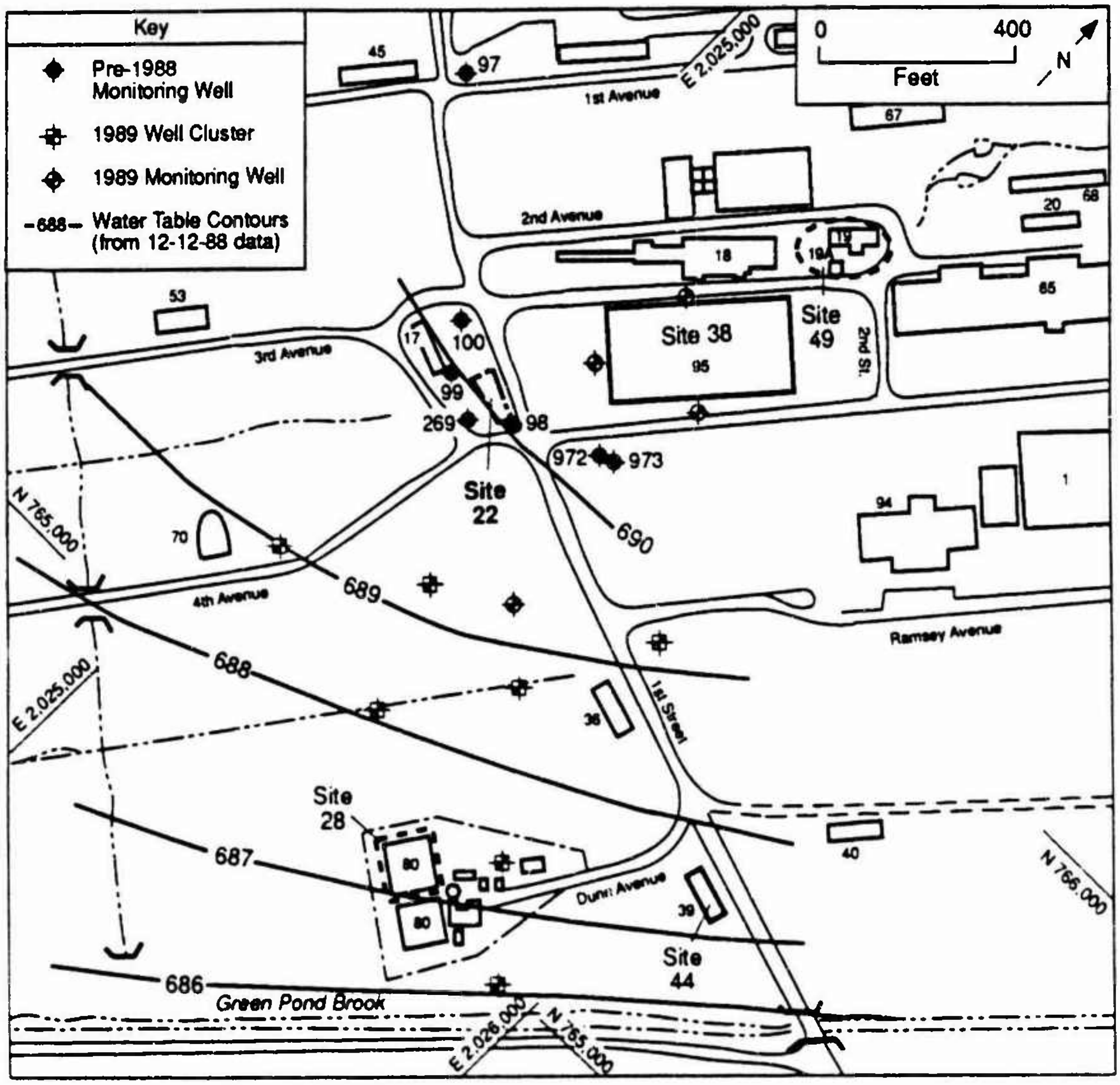

FIGURE 6.1 Layout of Site 22, the Building 95 Impoundments, Showing Monitoring Wells (Sources: Map adapted from USACE 1984a; well locations from USGS 1989)

In October 1981, after hazardous chemicals were detected in nearby water supply wells, the drying bed and sand filter lagoons were decommissioned. About 235 m^3 (315 yd^3) of sand and sludge material was excavated, manifested, and shipped off-post for disposal as a hazardous waste. The excavation to a depth of 2.4 m (8 ft) was backfilled with clean soil, graded, capped with a layer of bentonite, covered with topsoil, and seeded (Foster Wheeler 1987a). The cap was inspected in June 1988 by ANL staff. It appeared intact and was covered with healthy vegetation.

As "interim" closure of the Bldg. 95 impoundments was completed, without a formal notification to NJDEP, a closure plan was developed in 1987, under NJDEP direction (Foster Wheeler 1987c).

6.2.2 Geology and Hydrology

Site 22 is situated in the valley drained by Green Pond Brook. Soils in the area are sandy loam, classified in the Preakness Series. They are usually deep, nearly level, poorly drained soils containing mostly granitic material, with small quantities of other minerals, such as quartzite, sandstone, and shale. These soils have moderately rapid permeability, have a seasonally high water table, and are subject to flooding. An area of soils in the Charlisle Muck Series is found south of First Street. The Charlisle Muck is a deep, nearly level, poorly drained organic soil formed in low swampy areas. It may be high in peat content, consisting of the remains of sphagnum moss. These soils have rapid permeability, have a high water table, and are compressible under load (Sargent 1988).

In the vicinity of the Site, the topography is relatively flat. The difference between the altitude of the impoundment area and the altitude along the bank of Green Pond Brook is less than 0.9 m (3 ft).

A generalized geohydrologic section across the valley just east of Site 22 shows that a surficial water-table aquifer and two confined aquifers underlie the contaminated area. The depth to water in the vicinity of Site 22 ranged from 1.3 to 2 m (4 to 6 ft) in 1987. The confining bed, which separates the water-table aquifer from the 9-m (30-ft) thick confined glacial aquifer, is composed of as much as 46 m (150 ft) of interbedded fine sand, silt, and clay. It is discontinuous and leaky.

The groundwater flow in the water-table aquifer, as well as the confined aquifers, is southwesterly toward Green Pond Brook (Sargent 1988). The gradient of the water table is flat. A gradient of 0.002 from well 97 to well 270 was measured in April 1984 and again on September 11, 1984 (Vowinkel et al. 1985).

Average hydraulic conductivities of 8.4 and 7.3 m/d (27.7 and 24 ft/d) for April and September 1984, respectively, were estimated for the Bldg. 95 area, using the log method. These conductivity values reflect the abundance of fine sediments in this area. If an average porosity of 0.25 is assumed and an average gradient of 0.002 is used, then an approximated velocity of 6 cm/d (0.2 ft/d) is calculated. This velocity suggests a travel time of about 26 years for groundwater movement from well 97 to Green Pond Brook (Vowinkel et al. 1985).

6.2.3 Existing Contamination

6.2.3.1 Soil Contamination

Because of contaminants carried in treated effluents and sludges from the metal-plating and etching operations in Bldg. 95, the operation of seepage pits at Site 22 could have caused contamination of soils underneath the sludge drying bed, sand filter lagoons, and underground pipeline; soils in the area surrounding the impoundments; and sediments in the drainage ditch between the impoundments and Green Pond Brook.

Data on soil contamination of the Site are very limited. Analysis of sludges in the drying bed conducted prior to excavation indicated the presence of copper (53 ppm), chromium (1.6 ppm), lead (2 ppm), nickel (0.58 ppm), and tetrachloroethylene and ethylbenzene (each less than 15 ppb) (Gaven 1986). A broken 4-in. pipeline was found when monitoring well 98 was being drilled in 1981. The pipeline was apparently used for transferring wastewater from the impoundments to a drainage ditch. Analysis of soils around the broken pipe revealed a cyanide concentration of 150 mg/kg and a copper concentration of 1,460 mg/kg, suggesting that soils beneath the underground pipeline could also be contaminated (Vowinkel et al. 1985).

USGS sampled unsaturated zone gas on September 21-22, 1988 (Sargent 1989). Soil gas was collected at nine locations, including three within the boundary of the former impoundments and six in the area downgradient of the impoundments. Three or four probes situated at different depths were installed at each location. The soil gas samples were tested for seven VOCs. The data summarized in Table 6.1 show that tetrachloroethylene, 1,1,1-trichloroethane, and trichloroethylene were the most frequently detected compounds. The sampling locations are shown in Fig. 6.2. VOCs were not detected at locations VP95-5 and -7, and were detected at the other locations. The highest concentrations were measured at VP95-6, a location about 25 m (90 ft) downgradient of the former sludge bed. These data indicate that VOCs have migrated in the subsurface along the direction of groundwater flow. This migration is consistent with the groundwater data discussed in Sec. 6.2.3.2.

6.2.3.2 Groundwater Contamination

ECGS Data

In 1985, as part of a water resources investigation of PTA, USGS (Vowinkel et al. 1985) conducted a valleywide electromagnetic conductivity geophysical survey (ECGS). The purpose was to delineate areas of high electrical conductivity. The ECGS results show elevated conductivity throughout the entire area affected by Site 22, including the area downgradient of the former impoundments and the area surrounding the ditch that carried the effluents from the impoundments to Green Pond Brook. Areas with apparent conductivities exceeding 15 mmho/m are shown in Fig. 6.3.

Monitoring Well Data

The groundwater in the vicinity of Site 22 has been monitored since 1981. Prior to 1988, there were seven monitoring wells in the area. These wells are shown in Fig. 6.1. In the USGS well numbering system, these wells are identified as 97, 98, 99, 100, 269, 972, and 973. Of these, well 97 is situated upgradient of the Site and the next four wells (98-100 and 269) are either near or downgradient of the impoundments. Wells 972 and 973 are situated southeast of Bldg. 95; their locations appear to be outside of the migration path of contaminants from the impoundments on the Site, based on the estimated groundwater flow direction.

TABLE 6.1 Results of Organics Analysis for Soil Gas from the Site 22 Area (μg/L)

Site	Chloro-ethane	cis-1,2-Dichloro-ethylene	1,1-Dichloro-ethane	1,1-Dichloro-ethylene	Tetra-chloro-ethylene	1,1,1-trichloro-ethane	Trichloro-ethylene
VP95-1	0.10	<0.10	<0.10	ND[a]	2.60	0.43	3.55
VP95-2	ND	ND	ND	ND	0.61	0.15	0.10
VP95-3	<0.10	ND	ND	ND	ND	ND	ND
VP95-4	ND	0.18	0.45	ND	2.56	0.85	4.32
VP95-5	0.24	<0.10	0.41	ND	5.22	0.78	8.56
VP95-6	ND	ND	0.78	0.52	6.99	15.68	0.26
VP95-7	ND	ND	ND	ND	<0.10	ND	ND
VP95-8	ND	ND	ND	<0.10	ND	1.32	ND

[a]ND = concentration is below detection limit of 0.030 μg/L. Quantitation limit is about 0.10 μg/L. Measured September 21-22, 1988.

Source: Sargent 1989.

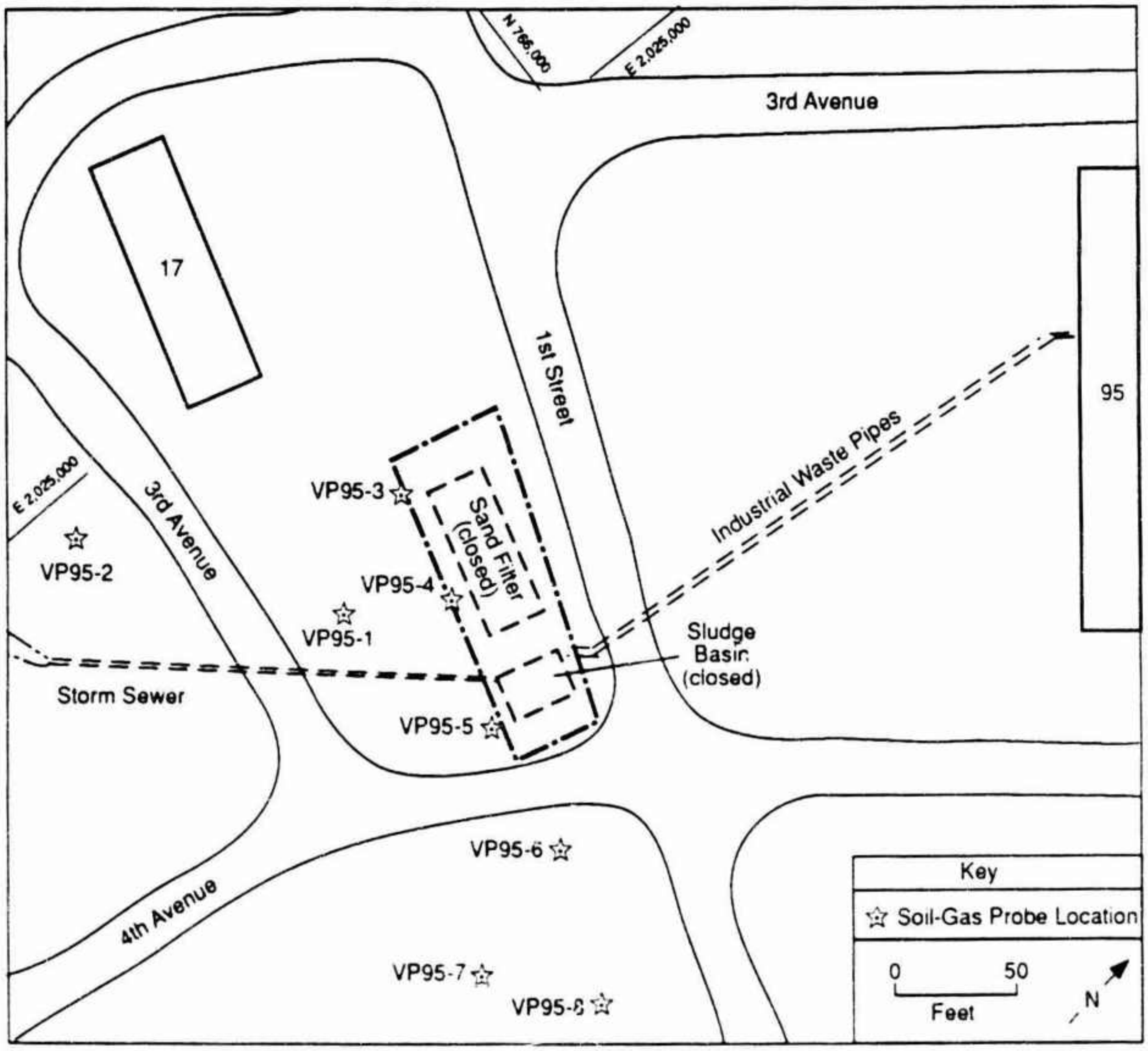

FIGURE 6.2 Soil-Gas Probe Locations at Site 22 (Sources: Map adapted from USACE 1984b; probe sites from Sargent 1989)

Pertinent construction data for existing wells in the vicinity of Site 22 are listed in Table 6.2. Wells 97-100 and 269 are shallow wells, ranging from 20 to 30 ft deep. Wells 972 and 973 are intermediate wells; their depths are 120 and 200 ft, respectively.

Wells 97-100 were constructed in March 1981 and were sampled and monitored as frequently as quarterly between 1981 and 1985. Well 269 was drilled in December 1983 and sampled twice from November 1984 to January 1985. Wells 972 and 973 were constructed and sampled in 1987.

The monitoring results of these wells are reported in Sargent et al. (1986) and a groundwater data printout made available to ANL (Sargent 1988). These data are summarized in Table 6.3.

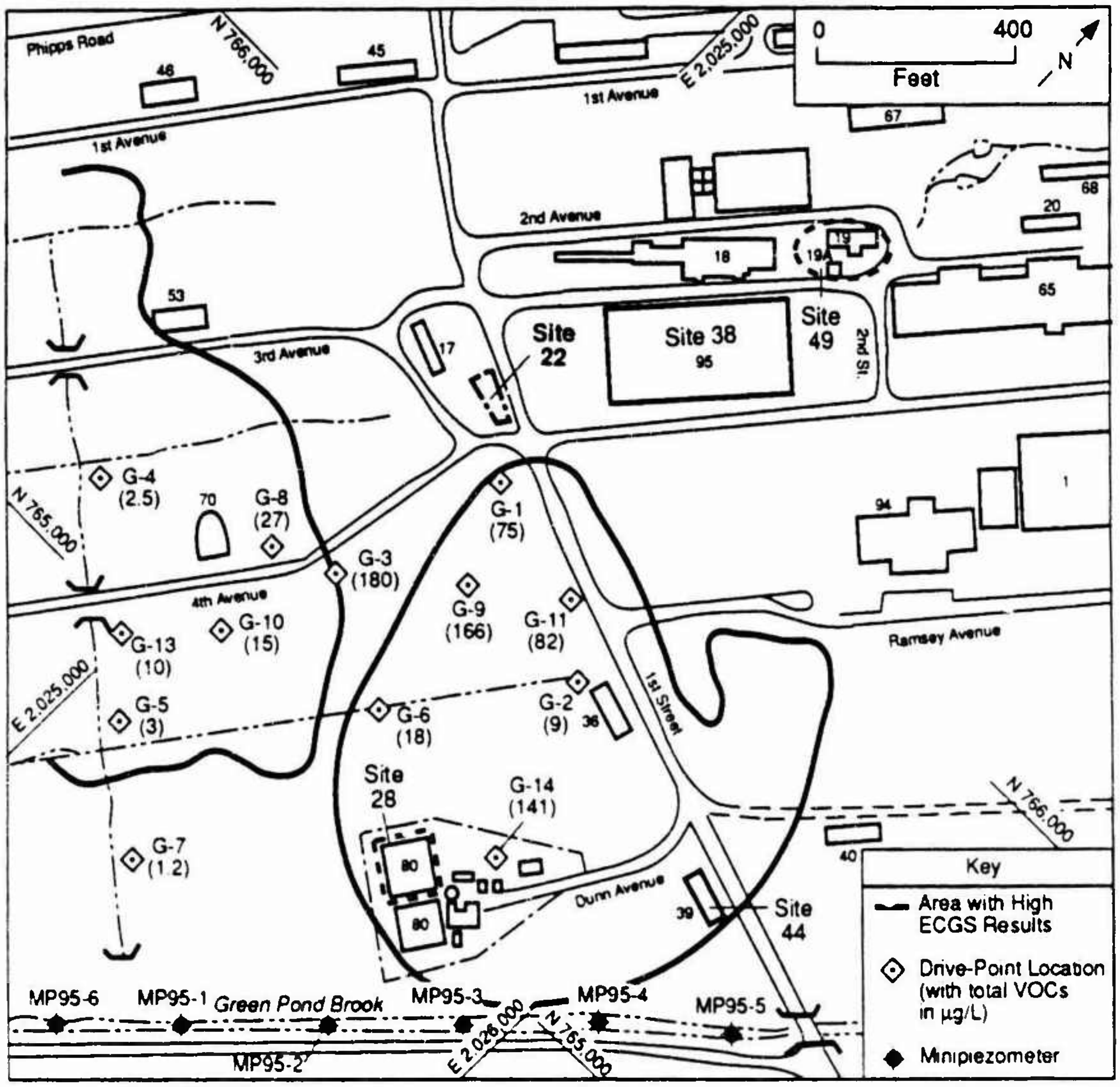

FIGURE 6.3 Results of Electromagnetic Conduction and Geophysical Surveys and Locations of Minipiezometers and Drive-Point Sampling at Site 22 (Source: Adapted from Sargent 1989)

The upgradient well (No. 97) has been contaminated with heavy metals, including chromium, copper, lead, and arsenic, and VOCs, such as TCE and phenol. Indicator parameters were present in the water table wells in the site and in the downgradient wells at higher concentrations than in the upgradient well. The intermediate wells (972 and 973) show no contamination and had better quality than the upgradient well. As mentioned earlier, these wells are located somewhat outside the path of contaminant migration from the impoundments. It is also possible that groundwater contaminants in this area have not reached the depths of these wells.

Values for specific conductance, sulfate concentration, and total dissolved solids are, in general, higher for wells 98, 99, 100, and 269 than for well 97. The total dissolved solids (TDS) concentrations for wells 98 and 100 have exceeded the 500-mg/L secondary

TABLE 6.2 Construction Data for Monitoring Wells near Site 22

Parameter[a]	972 (95-1)[b]	973 (95-2)	97 (11)	98 (12A)	99 (12B)	100 (12C)	269 (12D)
Date drilled	9/09/87	9/28/87	3/9/81	3/9/81	3/9/81	3/9/81	12/3/83
Water surface elevation (ft)[c]	692.11	690.68	690.70	689.50	689.70	687.80	689.98
Ground surface elevation (ft)	695.2	695.2	696.1	694.3	693.6	694.0	693.98
Screen depth, top (ft)	100	190	9	9	8	3	25
Screen depth, bottom (ft)	120	200	20	18	19	13	30

[a]The geologic unit found in all wells was stratified drift; all screens are 4 in. in diameter.

[b]Each well has two identification numbers: the top number (e.g., 972) is the USGS number and the bottom number in parentheses (e.g., 95-1) is the local identifier.

[c]Water levels were measured in wells 972 and 973 during September and October 1987; the dates of the other measurements are not known.

Sources: USGS (Sargent 1988) for wells 972 and 973; Sargent et al. (1986) for all other wells.

TABLE 6.3 Selected Analytical Results for Groundwater from Wells near Site 22 (μg/L)

Parameter	Well 97 No. of Samples	Well 97 Range (μg/L)[a]	Well 97 % ADL[b]	Well 97 Monitoring Period	Well 100 No. of Samples	Well 100 Range (μg/L)[a]	Well 100 % ADL[b]	Well 100 Monitoring Period
pH	15	5.8 - 7.9	100	5/81 - 1/85	14	6.4 - 7.9	100	5/81 - 1/85
Specific conductance (μS/cm at 85°C)	4	435 - 503	100	5/81 - 1/85	5	716 - 960	100	5/81 - 1/85
Total dissolved solids (mg/L)	8	248 - 328	100	5/81 - 7/84	7	340 - 626	100	5/81 - 6/84
Sulfate (mg/L)	10	20 - 46	100	5/81 - 1/85	9	16 - 110	100	5/81 - 1/85
Cadmium	19	<10	42	5/81 - 1/85	17	<10	47	5/81 - 1/85
Chromium	19	3 - 72	73	5/81 - 1/85	17	2 - 16	59	5/81 - 1/85
Copper	16	<2 - 16	75	1/81 - 7/84	14	<2 - 100	60	5/81 - 6/84
Lead	18	<5 - 28	83	1/81 - 1/85	16	3 - 64	91	5/81 - 1/85
Selenium	17	<1 - 8	5	1/81 - 1/85	15	<1 - 8	16	5/81 - 1/85
Arsenic	18	<2 - 9	16	1/81 - 1/85	16	<5 - 28	27	5/81 - 1/85
Cyanide	18	<10	0	1/81 - 1/85	16	<1 - 4	10	5/81 - 1/85
Benzene	22	ND - 1.0	5	5/81 - 1/85	27	ND - 4.5	9	4/81 - 1/85
Chloroform	22	ND	0	5/81 - 1/85	26	ND - 8.0	14	4/81 - 1/85
1,1-Dichloroethylene	22	ND	0	5/81 - 1/85	27	ND	0	4/81 - 1/85
trans-1,2-Dichloroethylene	22	ND - 2.2	9	5/81 - 1/85	27	ND - 15.0	23	4/81 - 1/85
Methylene chloride	22	ND	0	5/81 - 1/85	25	ND	0	4/81 - 1/85
Tetrachloroethylene	22	ND	0	5/81 - 1/85	27	5 - 243	100	4/81 - 1/85
Toluene	22	ND - 5.0	14	5/81 - 1/85	27	ND - 11.4	9	4/81 - 1/85
Trichloroethylene	22	ND - 81.0	95	5/81 - 1/85	27	ND - 69.0	96	4/81 - 1/85
1,1,1-Trichloroethane	22	ND - 2.4	5	5/81 - 1/85	27	ND - 7.6	18	4/81 - 1/85
1,1-Dichloroethane	22	ND	0	5/81 - 1/85	27	ND - 2.5	15	4/81 - 1/85
Freon-113	20	ND - 8.0	42	5/81 - 7/84	25	ND - 15.0	16	4/81 - 7/84
Total phenol	15	ND - 8.0	53	9/82 - 1/85	14	ND - <50	20	9/82 - 1/85
Total organic carbon	12	ND - 4,700	17	2/83 - 1/85	11	ND - 27,000	27	4/81 - 1/85

TABLE 6.3 (Cont'd)

Parameter	Well 99				Well 269			
	No. of Samples	Range (μg/L)[a]	% ADL[b]	Monitoring Period	No. of Samples	Range (μg/L)[a]	% ADL[b]	Monitoring Period
pH	16	6.2 - 7.9	100	1/81 - 1/85	2	7.2 - 7.3	100	11/84 - 1/85
Specific conductance (μS/cm at 85°C)	6	690 - 1,150	100	1/81 - 1/85	2	625 - 650	100	11/84 - 1/85
Total dissolved solids (mg/L)	9	277 - 484	100	1/81 - 7/84	-	-	-	-
Sulfate (mg/L)	11	25 - 110	100	1/81 - 1/85	2	32 - 33	100	11/84 - 1/85
Cadmium	20	<1 - 12	30	1/81 - 1/85	2	<5	0	11/84 - 1/85
Chromium	20	3 - 180	70	1/81 - 1/85	2	<25	0	11/84 - 1/85
Copper	17	<1 - 470	75	5/81 - 7/84	-	-	-	-
Lead	19	<1 - 44	79	5/81 - 7/84	2	2 - 8	100	11/84 - 1/85
Selenium	18	<1 - 14	11	1/81 - 1/85	2	<1	0	11/84 - 1/85
Arsenic	19	<1 - 12	26	1/81 - 1/85	2	<1	0	11/84 - 1/85
Cyanide	11	<1 - 50	5	1/81 - 1/85	2	<10	0	11/84 - 1/85
Benzene	31	ND - 6.6	6	4/81 - 1/85	2	ND	0	11/84 - 1/85
Chloroform	31	ND - 3.9	9	4/81 - 1/85	2	ND	0	11/84 - 1/85
1,1-Dichloroethylene	32	ND - 11.7	16	4/81 - 1/85	2	ND	0	11/84 - 1/85
trans-1,2-Dichloroethylene	32	ND - 14.0	28	4/81 - 1/85	2	3 - 6	100	11/84 - 1/85
Methylene chloride	30	ND	0	4/81 - 1/85	2	ND	0	11/84 - 1/85
Tetrachloroethylene	32	ND - 213	97	4/81 - 1/85	2	-	100	11/84 - 1/85
Toluene	31	ND - 2.4	16	4/81 - 1/85	2	ND	0	11/84 - 1/85
Trichloroethylene	32	ND - 120	94	4/81 - 1/85	2	5.7 - 21.0	100	11/84 - 1/85
1,1,1-Trichloroethane	31	ND - 53	48	4/81 - 1/85	2	ND - 3.4	50	11/84 - 1/85
1,1-Dichloroethane	32	ND - 39	31	4/81 - 1/85	2	ND	0	11/84 - 1/85
Freon-113	28	ND - 25	17	4/81 - 1/85	-	29 - 44	-	-
Total phenol	15	ND - 7	33	6/82 - 1/85	2	<50	0	11/84 - 1/85
Total organic carbon	12	ND - 3,100	25	2/83 - 1/85	2	3,000 - 39,000	100	11/84 - 1/85

TABLE 6.3 (Cont'd)

Parameter	Well 98				Well 972[c]		Well 973[c,d]	
	No. of Samples	Range (µg/L)[a]	% ADL[b]	Monitoring Period	No. of Samples	Range (µg/L)[a]	No. of Samples	Range (µg/L)[a]
pH	14	6.3 - 8.3	100	1/81 - 1/85	1	11.8	1	8.9
Specific conductance (µS/cm at 85°C)	5	975 - 1,060	100	1/81 - 1/85	1	281	1	214
Total dissolved solids (mg/L)	8	438 - 569	100	1/81 - 7/84			-	-
Sulfate (mg/L)	9	35 - 110	100	1/81 - 1/85	1	25	1	26
Cadmium	14	<10	52	1/81 - 1/85	1	<5.16	1	<5.16
Chromium	14	2 - 44	83	1/81 - 1/85	1	<5.96	1	<5.96
Copper	12	6 - 44	90	1/81 - 7/84	1	<7.93	1	<7.93
Lead	14	2 - 43	91	1/81 - 1/85	1	<18.6	1	<18.6
Selenium	12	<1 - 12	5	1/81 - 1/85	1	<9.66	1	<9.66
Arsenic	13	<1 - 10	9	1/81 - 1/85	1	4	1	<3.07
Cyanide	12	<1 - 10	12	1/81 - 1/85	1	<10	1	<10
Benzene	30	ND - 4.4	6	4/81 - 1/85	-	-	-	-
Chloroform	31	ND - 10.4	10	4/81 - 1/85	-	-	-	-
1,1-Dichloroethylene	31	ND - 320	84	4/81 - 1/85	1	ND	1	ND
trans-1,2-Dichloroethylene	31	ND - 14	45	4/81 - 1/85	1	<1.2	1	<1.2
Methylene chloride	31	ND - 90	5	4/81 - 1/85	-	-	-	-
Tetrachloroethylene	31	3.5 - 386	100	4/81 - 1/85	1	<1	1	<1
Toluene	31	ND - 9.4	13	4/81 - 1/85	-	-	-	-
Trichloroethylene	31	ND - 129	91	4/81 - 1/85	1	<1	1	<1
1,1,1-Trichloroethane	31	ND - 1780	91	4/81 - 1/85	1	<1	1	<1
1,1-Dichloroethane	31	ND - 90	81	4/81 - 1/85	-	-	-	-
Freon-113	29	ND - 42	14	4/81 - 1/85	-	-	-	-
Total phenol	15	ND - 9.0	20	9/82 - 1/85	-	-	-	-
Total organic carbon	11	ND - 5,000	63	3/83 - 1/85	1	2,300	1	400

TABLE 6.3 (Cont'd)

[a]Units for reported value ranges are μg/L except pH and as noted for conductance, TDS, and sulfate. ND means not detected.

[b]Percentage above detection level.

[c]Sampled once in 1987.

[d]Screen setting is 190-200 ft below the ground surface.

Source: Sargent et al. 1986 for wells 97-100 and 269; Sargent 1988 for wells 972 and 973.

drinking water standards. The concentration of lead exceeded the 50-μg/L MCL for well 100. The MCL for cadmium (10 μg/L) was exceeded in well 99, for selenium (10 μg/L) in wells 98 and 99, and for chromium (50 μg/L) in well 99 and upgradient well 97. From 1981 to 1985, the concentrations of these metals fluctuated, but did not appear to decline.

Trichloroethylene (TCE) has been detected in all monitoring wells in the area, except intermediate wells 972 and 973. More than 80% of the samples from water table wells, including upgradient well 97, had TCE values exceeding the 5-μg/L MCL. The maximum TCE level was measured in well 98 at 128.9 μg/L. From 1981 to 1985, TCE concentrations in affected wells fluctuated from nondetection to 100 μg/L.

Tetrachloroethylene, undetected in well 97, was measured in nearly all samples from other water table wells. The maximum concentration of 386 μg/L was detected in well 98.

Another VOC frequently detected in the affected wells is 111TCE. The maximum concentration of 1,774 μg/L was measured in well 98. This value exceeds the 200-μg/L MCL. In well 99, this compound fluctuated in concentration from not detected (ND) to less than 900 μg/L and appears to have peaked in 1981.

1,1-Dichloroethylene has also been detected at concentrations above the MCL (7 μg/L) in the affected wells. It was detected in more than 80% of samples from well 98 between 1981 and 1985; the maximum concentration found was 320 μg/L. The concentration of this compound has not shown a definite trend in well 98, but it appears to have peaked in well 99.

Drive-Point Data

In addition to monitoring wells, USGS used a drive-point sampling device to collect vertically spaced groundwater samples at 13 locations in the area (Sargent 1989). Six locations (G-1 through G-6) were sampled in 1986, and the other eight locations (G-7 through G-14) were sampled in October 1988. The locations of the drive-point sample collection points are shown in Fig. 6.3. Analysis of drive-point samples was limited to a selected 13 volatile organic compounds. The results on six of the VOCs are given in Table 6.4. The other seven VOCs (see the footnote in Table 6.4) were generally detected at low concentrations or below their detection limits. The groundwater in the area is roughly defined by drive points G-1, G-3, G-9, and G-11 and appears to have the highest VOC concentrations, with up to 180 μg/L total VOC detected. At location G-14, which is farthest to the south among the 13 drive-point locations, water samples from 10 to 20 ft deep contain up to 141 μg/L of total VOCs. These data suggest that the groundwater plume initiated from the impoundment area had migrated downgradient in a southeasterly direction toward Green Pond Brook for at least 270 m (900 ft). For samples from the drive-point locations, including G-4, G-5, G-7, and G-13, that are located along the effluent ditch connecting the impoundment area and Green Pond Brook, the VOCs values are generally very low or below detection limits. The data suggest that the effluent ditch is much less of a contamination source than the former impoundments.

TABLE 6.4 Analytical Results for Drive-Point Water Samples from the Site 22 Area (μg/L)[a]

Sample Number (local)	Sample Depth (ft)	1,1,1-Trichloroethane	Tetrachloroethylene	1,1-Dichloroethane	1,1-Dichloroethylene	Trichloroethylene	1,2-cis-Dichloroethylene
G-1	10	6	45	1	2	19	2
G-1	15	2	24	<1	3	23	1
G-1	20	9	23	1	1	23	1
G-1	25	2	4	<1	<1	15	1
G-1	30	<1	1	<1	<1	2	<1
G-1	35	<1	1	<1	<1	2	<1
G-1	40	<1	<1	<1	<1	1	<1
G-1	45	<1	<1	<1	<1	2	<1
G-2	10	3	<1	<1	2	4	<1
G-2	15	4	<1	<1	<1	<1	<1
G-2	20	1	<1	<1	<1	<1	<1
G-2	25	<1	<1	<1	<1	<1	<1
G-2	30	<1	<1	<1	<1	<3	<1
G-2	35	<1	<1	<1	<1	<1	<1
G-2	40	<1	<1	<1	2	<1	<1
G-2	45	<1	<1	<1	<1	<1	<1
G-2	50	<1	<1	<1	<1	<1	<1
G-3	10	3	<1	4	<1	<1	<1
G-3	15	18	<1	14	3	<1	<1
G-3	20	140	<1	33	14	<1	6
G-3	25	120	<1	3	6	<1	<1
G-3	30	170	<1	2	8	<1	<1
G-3	35	14	<1	<1	<1	<1	<1
G-3	40	3	<1	<1	<1	<1	<1
G-3	45	2	<1	<1	<1	<1	<1

TABLE 6.4 (Cont'd)

Sample Number (local)	Sample Depth (ft)	1,1,1-Trichloro-ethane	Tetra-chloro-ethylene	1,1-Di-chloro-ethane	1,1-Di-chloro-ethylene	Tri-Chloro-ethylene	1,2-cis-Dichloro-ethylene
G-4	10	<1	<1	<1	<1	<1	<1
G-4	15	<1	<1	<1	<1	<1	2
G-4	20	1	1	<1	<1	<1	<1
G-4	25	<1	<1	<1	<1	1.5	<1
G-4	30	1	<1	<1	<1	<1	<1
G-4	35	<1	<1	<1	<1	<1	<1
G-4	40	<1	<1	<1	<1	<1	<1
G-4	45	<1	<1	<1	<1	<1	<1
G-5	5	<1	<1	<1	<1	<1	<1
G-5	10	<1	<1	<1	<1	<1	<1
G-5	15	<1	<1	<1	<1	<1	<1
G-5	20	<1	<1	<1	<1	<1	<1
G-5	25	1	<1	<1	<1	<1	<1
G-5	30	<1	<1	<1	<1	<1	<1
G-5	35	1	<1	<1	<1	<1	<1
G-5	40	<1	<1	<1	<1	<1	<1
G-6	10	<1	<1	<1	<1	<1	<1
G-6	15	<1	<1	18	<1	<1	<1
G-6	20	<1	<1	<1	<1	<1	<1
G-6	25	<1	<1	<1	<1	<1	<1
G-6	30	<1	<1	<1	<1	<1	<1
G-6	35	<1	<1	<1	<1	<0.1	<0.1
G-7	6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-7	11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-7	16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-7	20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-7	25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

TABLE 6.4 (Cont'd)

Sample Number (local)	Sample Depth (ft)	1,1,1-Trichloro-ethane	Tetra-chloro-ethylene	1,1-Di-chloro-ethane	1,1-Di-chloro-ethylene	Tri-Chloro-ethylene	1,2-cis-Dichloro-ethylene
G-8	10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-8	15	<0.1	<0.1	0.5	<0.1	<0.1	<0.1
G-8	20	<0.1	<0.1	9.7	<0.1	<0.1	<0.1
G-8	25	<0.1	<0.1	26.94	<0.1	<0.1	<0.1
G-8	30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-8	35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-8	40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-8	43	<0.1	<0.1	<0.1	<0.1	<0.3	<0.1
G-9	10	53.4	31.8	8.1	5	19.8	3.7
G-9	15	23	78.8	4.8	5.52	46.8	4
G-9	20	11.4	18.7	4.1	12.3	20.4	5.1
G-9	25	0.33	0.6	<0.1	<0.1	0.2	<0.1
G-9	30	<0.1	0.3	<0.1	<0.1	<0.1	<0.1
G-9	35	<0.1	0.2	<0.1	<0.1	<0.1	<0.1
G-9	40	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
G-9	45	<0.1	0.4	<0.1	<0.1	0.1	<0.1
G-10	10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-10	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-10	20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-10	25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-10	30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-10	35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-10	40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-10	45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-10	50	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

TABLE 6.4 (Cont'd)

Sample Number (local)	Sample Depth (ft)	1,1,1-Trichloro-ethane	Tetra-chloro-ethylene	1,1-Di-chloro-ethane	1,1-Di-chloro-ethylene	Tri-Chloro-ethylene	1,2-cis-Dichloro-ethylene
G-11	10	3.2	14.2	<0.1	<0.1	9.7	<0.1
G-11	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-11	20	14.3	36.4	2.9	3	19.9	2.2
G-11	25	<0.1	0.4	2.3	3.6	0.6	<0.1
G-11	30	4.3	0.4	0.2	<0.1	0.1	<0.1
G-11	35	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
G-13	10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-13	15	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-13	20	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-13	25	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-13	30	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-13	35	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-13	40	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-13	45	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-13	50	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
G-14	10	19.9	<0.1	31	19.3	0.3	<0.1
G-14	15	52.3	<0.1	56.7	30.2	0.4	<0.1
G-14	20	2	<0.1	40	<0.1	<0.1	<0.1
G-14	25	0.1	<0.1	0.7	<0.1	<0.1	<0.1
G-14	30	0.4	0.2	1.9	<0.1	0.6	<0.1

[a]All constituents are dissolved. Locations G-1 through G-6 were sampled in 1986, and G-7 through G-14 were sampled in 1988. Other VOCs measured in the samples included 1,1,2-trichloroethane, 1,2-trans-dichloroethylene, toluene, chlorobenzene, chloroform, trichloromethane, and vinyl chloride.

Source: Sargent 1989.

Stream-Bed Minipiezometer Sampling

USGS installed minipiezometers at five locations at Green Pond Brook south of the Site to provide groundwater quality data and groundwater gradients under and adjacent to Green Pond Brook. The locations of these minipiezometers are shown in Fig. 6.3. At each location, three minipiezometers were installed across the streambed. Groundwater samples were collected from these locations in fall 1988 and analyzed for VOCs (Sargent 1989). The results are shown in Table 6.5. The VOCs measured were either detected below the detection limit or sporadically at low concentrations close to levels observed in surface water samples from the brook. On the basis of the minipiezometer data, the contaminants migrating in groundwater from the upgradient sources (e.g., Bldg. 95 impoundments and USTs) had apparently not reached the brook before the fall 1988 sampling.

New Monitoring Wells

To provide the information necessary to define the extent of contaminant migration in groundwater, USGS proposed to install 21 cluster wells at nine locations in the study area (USGS 1989). All of these wells were to be installed in the unconfined glacial aquifer, with screened intervals near the top of the water table (about 15-20 ft), in the middle of the water-table aquifer (25-30 ft), and directly above the confined unit (35-50 ft). The proposed locations of these wells are shown in Fig. 6.1. They were reportedly installed in summer 1989 (Sargent 1990). The exact well location and well construction data have not yet been made available to ANL. Note that three single wells are located just outside Bldg. 95. These are specifically designed to provide upgradient and downgradient data for the building. The other wells, all in clusters, are designed to monitor the impacts of the contaminant sources in this general area, most noticeably the Bldg. 95 impoundments.

6.2.4 Closure Plan

As indicated in Sec. 6.2.1, the Bldg. 95 impoundments will be closed in accordance with New Jersey hazardous waste regulations because they never had interim status. The closure is scheduled to be a clean closure. The closure plans and modifications are summarized below. The detailed closure plan is described in Foster Wheeler (1987c) and Clune (1988b).

Test holes will be drilled through the center of the closed, old sludge drying basin and two sand filter lagoons to a depth reaching the upper aquifer. The composite soil samples will be collected over 0.6-m (2-ft) intervals of the borings. In addition, two core samples will be taken from the locations outside and downgradient from the lagoon, and eight shallow soil samples to a depth of 1 foot will be taken from random locations downgradient from the lagoon site.

All these soil samples will be tested for pH, total organic carbon (TOC), total organic halogens (TOX), conductivity, and priority pollutant metals. If TOC and TOX concentrations exceed background levels, then the soil will be tested for the volatile organic portion of the priority pollutants' analysis.

TABLE 6.5 Analytical Results for Water Samples from Minipiezometers near Site 22 (μg/L)

Local Identifier[b]	Dichloro-bromo-methane	1,2-Dichloro-ethane	Chloro-form	Methylene Chloride	Tetra-chloro-ethylene	1,1-Dichloro-ethane	1,2-Dichloro-propane	Vinyl Chloride	Tri-chloro-ethylene
MP95-1C	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<1	0.6	<0.1
MP95-1L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
MP95-3C	0.2	<0.1	<0.1	0.6	0.1	<0.1	<0.1	0.4	0.2
MP95-3R	0.2	<0.1	2.2	<0.1	0.3	<0.1	<0.1	<0.1	1.7
MP95-4R	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	<0.1	<0.1	<0.1
MP95-5C	<0.1	0.8	<0.1	<0.1	<0.1	<0.1	6.4	<0.1	<0.1
MP95-5R	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	6.3	<0.1	<0.1
MP95-6C	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.8
MP96-6L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2

[a]All constituents are dissolved. Samples were analyzed in fall 1988.

[b]Results were <0.1 μg/L for all analytes for samples from minipiezometers 1R, 2C, 2L, 2R, 4C, 4L, 5L, and 6R.

Source: Sargent 1989.

If tests on the soil samples reveal that the soil below these impoundments is not contaminated, then the cleanup of the lagoon area at the 1981 closure can be considered complete. If the soil samples indicate that soils below these impoundments are still contaminated, the areas occupied by the impoundments will be identified and the contaminated soils excavated until clean soil is reached. The contaminated soil will be disposed of at permitted sites, and the excavation pits will be backfilled with clean fill, resurfaced with top soil, and seeded.

The same cleanup procedures will apply if the core samples and surface soil samples from areas downgradient of the impoundments are found to be contaminated.

The underground pipes from Bldg. 95 to the impoundments will be investigated and remedied. The exact location of these pipes will be determined by using an appropriate, proven technique. To ensure that soil underneath the pipes is clean, four random soil samples will be collected from locations under the pipes and analyzed for pH, TOC, TOX, conductivity, and metals. If the soil under the pipelines is contaminated, then both the pipes and the soils will be removed by excavation and disposed of as hazardous waste. Excavation of soil will continue until clean soil is reached. The excavation will then be restored to prevent soil erosion.

If the soil underneath the pipelines is found uncontaminated, these pipes will be backflushed with water. They will be further cleaned by methods such as mechanical scouring and hydraulic scouring and then capped. Details of pipe locating, cleaning, and testing techniques are presented in Foster Wheeler (1987c). The rinsate and wash-water samples will be collected and tested. If found to be hazardous, the wash water and rinsate will be disposed of as hazardous waste. If not, they will be sent for treatment at the Arsenal industrial wastewater treatment plant.

The closure plan does not include the postclosure groundwater monitoring program. However, an ongoing groundwater monitoring program by USGS will be continued for this area. In addition to wells previously existing in the Site, 21 monitoring wells at nine locations were drilled in summer 1989 (see Sec. 6.2.3.2). These wells should be sampled initially for analysis of trace metals, common constituents, explosive compounds, and volatile organic compounds. In addition, six wells located in the most highly contaminated areas of the plume should be sampled for analysis of base/neutral and acid-extractable compounds, organochlorine pesticides, PCBs, lead, mercury, and selenium. Water levels would also be measured in all wells to develop maps of the water table elevation (USGS 1989). When the new groundwater data are available, they should be reviewed, and the groundwater sampling plan revised and a remediation plan proposed, if necessary.

6.2.5 Proposed RI Plan

No additional sampling is proposed for Site 22. If a clean closure is not possible, additional work may be needed.

6.3 SITE 28 — SEWAGE TREATMENT PLANT SLUDGE BEDS

6.3.1 Site History

The sewage treatment plant located near Bldg. 80 was built in 1938. It was designed to provide primary and secondary treatment and chlorination for sanitary sewage generated at PTA. Located near the junction of Green Pond Brook and First Street, the plant currently has a capacity of 0.4 million gal/d and consists of two Imhoff tanks, a trickling filter dosing chamber, a secondary settling tank, a chlorine contact tank, and two chlorinators. Effluent from this facility is discharged to Green Pond Brook. It is presently regulated under the New Jersey Pollutant Discharge Elimination System (NJPDES) (Permit NJ002500, outfall DSN001) (Kurisko 1985). A schematic flow diagram of the sewage treatment plant is shown in Fig. 6.4.

Site 28 consists of four inactive sand trickling filter beds that were used prior to 1971 for drying sludges generated in the sewage treatment system (see Fig. 6.5). The sewage treatment plant was modified in the mid-1960s to include a secondary clarifier, which replaced the sludge drying beds.

The area occupied by the inactive sludge beds is about 4,000 ft^2. The beds are surrounded by a low berm that is overgrown with weeds. These beds are reportedly underlain by an impervious liner and a leachate collection system.

6.3.2 Geology and Hydrology

Site 28 is situated in the lower portion of the valley drained by Green Pond Brook, which flows about 250 ft to the southeast of the Site. The topography near the Site is flat. Soils are classified as Adrian Muck, which is a very poorly drained organic soil underlain by sandy deposits at a depth of 16-50 in. These soils are highly permeable, and the water table is close to the surface most of the time. These soils are subject to flooding from streamflow (Wingfield 1976).

Three aquifers are found in the study area. The water-table aquifer is situated primarily within the top 35 ft of the section. The depth to water is generally less than 10 ft. Underlying the water-table aquifer is the confining bed, which is 150 ft thick in some areas. The confining bed is discontinuous and leaky. A confined glacial aquifer of about 30 ft underlies the confined bed (Harte et al. 1986).

There are no monitoring wells associated with the Site. However, the data collected from wells to the north of the Site (i.e., Sites 21 and 22) indicate that the groundwater in this area would most likely flow in a southeasterly direction toward Green Pond Brook (Sargent 1988). The gradient of the water table is flat (about 0.002), and the groundwater flow velocity is low (about 0.2 ft/d). More detailed information on the geology and hydrology pertinent to Site 28 is found in Sec. 6.2.2.

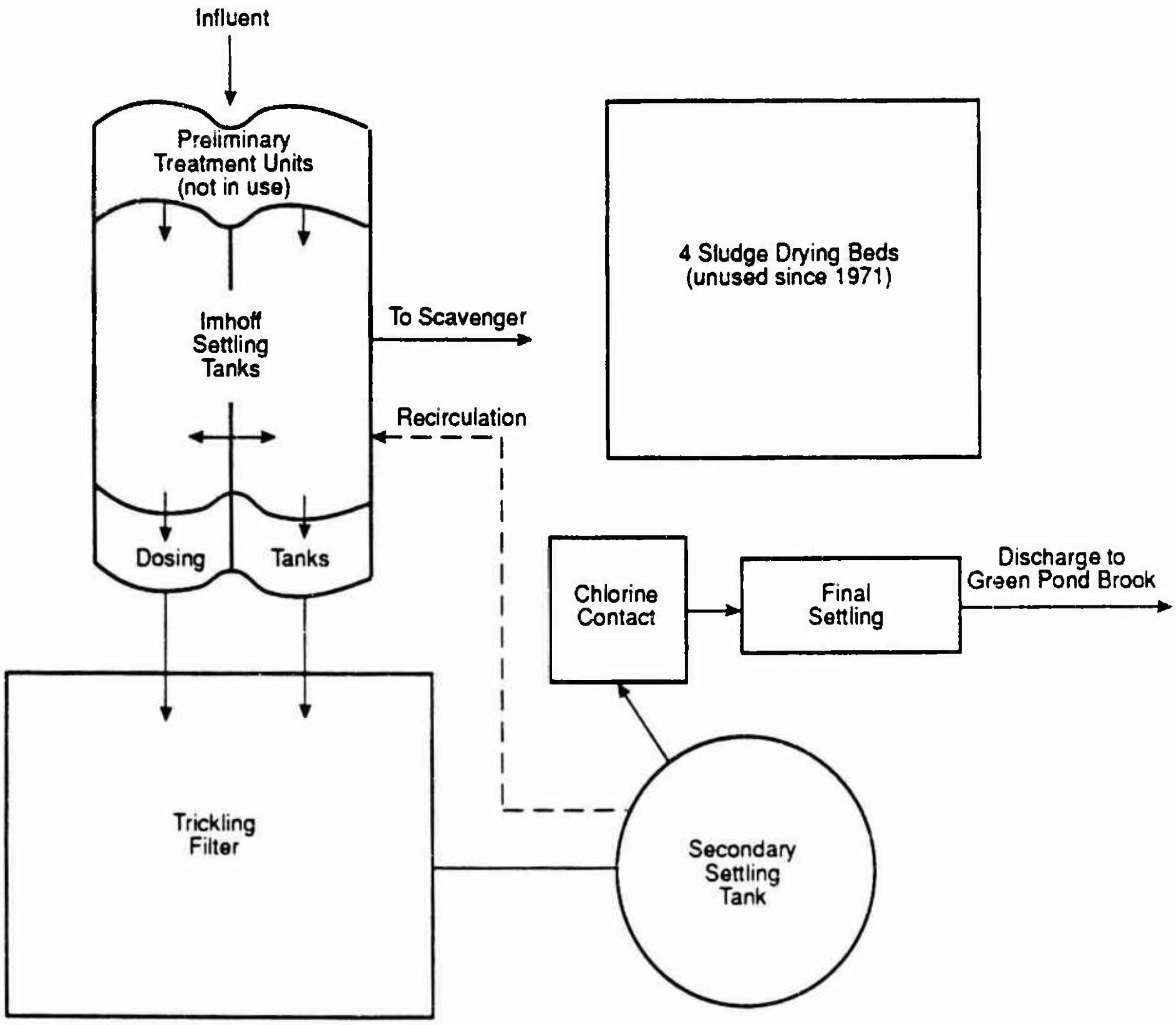

FIGURE 6.4 Schematic of the PTA Sewage Treatment Plant (Source: Adapted from Malloy 1986)

6.3.3 Existing Contamination

6.3.3.1 Soil

Under the Dames & Moore program, two soil samples were collected from each of the four sludge beds. The sample locations are identified as SS28-1 through SS28-8 in Fig. 6.5. These samples, which consisted of loose sand and silt, were collected from 0.15 to 0.3 m (0.5 to 1 ft) deep and analyzed for oil and grease, and 13 metals. The analytical results in Table 6.6 show that zinc was the only metal at concentrations indicative of contamination. Other metals were measured at concentrations within the estimated ranges of the regional soils. Oil and grease was detected in one of the eight samples, indicating very limited contamination by organics. These data apparently indicate that soils in sludge beds 1 and 4 have higher metal levels than those in sludge beds 2 and 3.

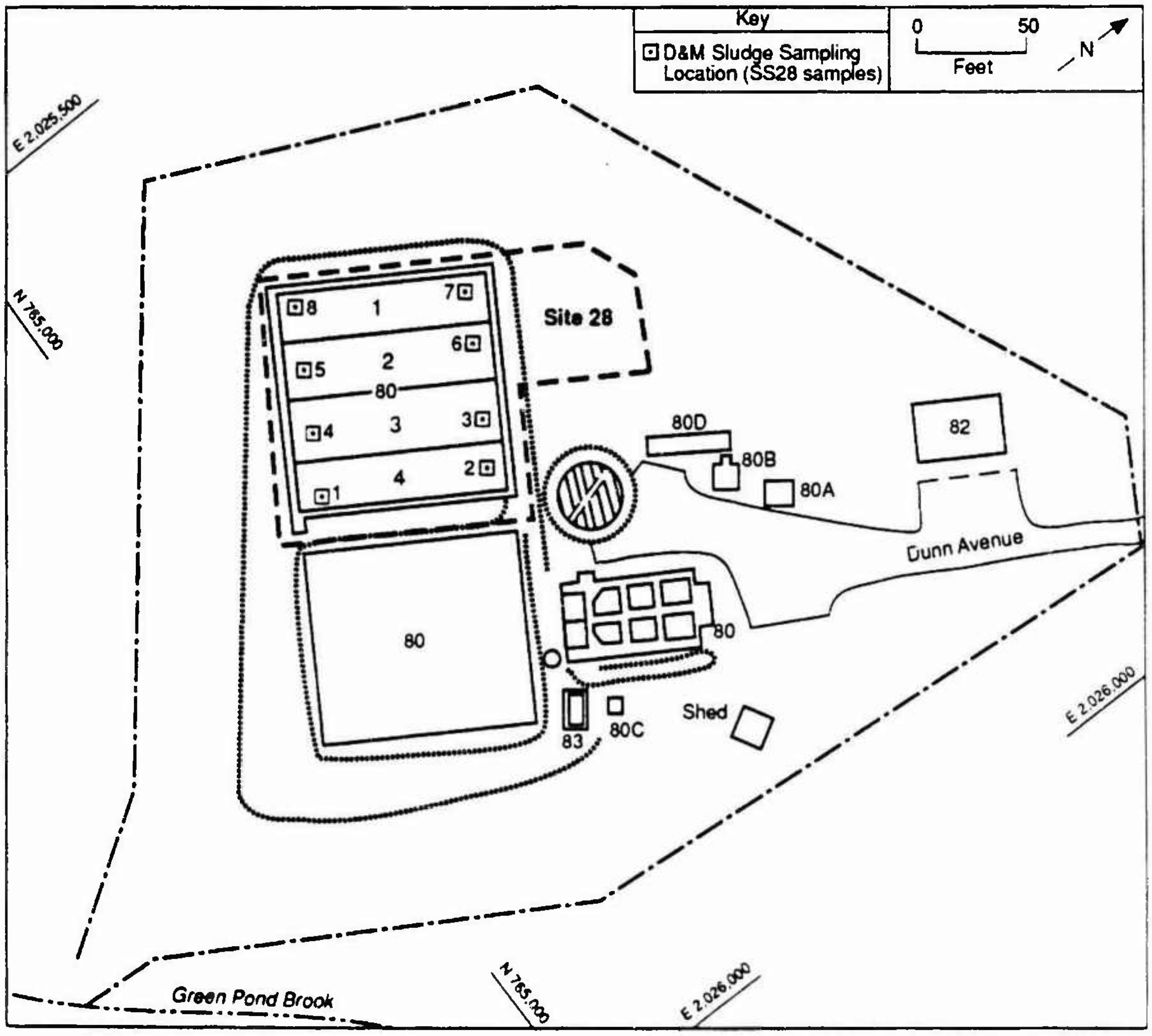

FIGURE 6.5 Layout of Site 28, the Sewage Treatment Plant Sludge Beds (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

6.3.3.2 Groundwater

There is no existing monitoring well associated with Site 28. A groundwater monitoring network has been placed in the area north of the Site between Bldg. 95 and the sewage treatment plant. The monitoring data (Sec. 6.2.3) indicate that a contaminated groundwater plume is migrating in a southerly direction from Bldg. 95 toward Green Pond Brook.

In 1985, as part of a water resources investigation of PTA, USGS (Vowinkel et al. 1985) conducted a valleywide ECGS to delineate areas showing high electrical conductivity. High conductivities are often associated with groundwater contamination. The ECGS results show elevated conductivity throughout the area surrounding the sewage treatment plant. The high conductivity may be due to contaminated groundwater, but it could also be due to other factors such as changes in soil types and moistures, and the presence of underground utilities.

TABLE 6.6 Analytical Results for Samples from the Sewage Sludge Drying Beds (ppm)[a]

Sample	Ag	As	Cd	Cr	Pb	Cu	Zn	O&G
SS28-1	4.1	5.5	2.4	5.0	5.0	BDL	122	530
SS28-2	5.3	2.9	0.6	10.0	18.0	22.5	92.9	BDL
SS28-3	BDL	BDL	0.5	2.5	4.9	BDL	79.3	BDL
SS28-4	BDL	BDL	1.0	3.5	7.1	BDL	120	BDL
SS28-5	BDL	BDL	0.8	3.5	6.8	14.2	119	BDL
SS28-6	BDL	BDL	0.7	2.8	4.8	BDL	118	BDL
SS28-7	BDL	3.7	0.8	4.7	7.5	BDL	155	BDL
SS28-8	3.6	4.3	0.6	5.1	11.0	17.6	146	BDL

[a]BDL means below detection limit.

Source: Dames & Moore 1989.

6.3.4 Proposed RI Plan

6.3.4.1 Phase I

The data presented in Sec. 6.3.3 apparently indicate that the material in the sludge beds in Site 28 does not have metals at concentrations indicative of environmental contamination. The presence of oil and grease in one of eight samples indicates very limited organic contamination. Furthermore, the bottoms of the sludge beds are reportedly protected with an impermeable liner and leachate collection system, which eliminates the possibility of groundwater contamination. For these reasons, no additional sampling is proposed for the sludge beds.

To prevent groundwater contamination from the sewage treatment plant, the system components of the plant should be carefully examined for leakage. These components include the sewer lines, effluent pipes, trickling filter, secondary settling tanks, Imhoff tanks, and chlorinators. Proper corrective action should be taken if leakage occurs. No industrial discharges are allowed in the Picatinny sewage system. Composite samples of the sewage and treatment sludge should be collected and analyzed to determine whether they contain excessive levels of contaminants that are usually not present in sewage, including TCL metals, TCL volatiles, TCL semivolatiles, and PCBs.

6.3.4.2 Phase II

The impact of the sewage treatment plant on groundwater should be monitored. The new and expanded groundwater database described in Sec. 6.2 indicates that a well cluster may be needed between Site 28 and Green Pond Brook (see Fig. 6.5). This well cluster should be monitored in conjunction with other wells in the area of Site 22.

6.4 SITE 38 — BUILDING 95, PLATING AND ETCHING WASTEWATER TREATMENT FACILITY

6.4.1 Site History

6.4.1.1 Plating and Etching Process

Building 95 is located between Third and Fourth Avenues, in the area bounded by First and Second Streets (Fig. 6.6). It was erected in 1960 and initially was intended to replace Bldg. 24's plating operations. However, because of the demand for printed circuit boards used for weapons at that time, metal plating never became the primary function.

The printed circuit-board shop in Bldg. 95 contains a metal plating and etching operation. The operation begins with cleaning and rinsing the boards, followed by various coating, etching, and sealing steps. Chemicals used include sulfuric, hydrochloric, and chromic acids; trichloroethane; methylene chloride; and various accelerators, catalysts, and conditioners (Foster Wheeler 1987a).

6.4.1.2 Wastewater Treatment Process

The major sources of wastewater from the production of printed circuit boards are metal plating (copper, tin, and lead), photodeveloping, chrome etching, photochemical resistant etching, and demineralizing. The resultant wastewater from these sources, as well as drips, spills, and floor drain effluent, are collected in underground storage tanks T-8 (400 gal) and T-9 (400 gal) and then transferred to T-5 (2,000 gal) for treatment. In tank T-5, sulfuric acid was added to lower the pH, followed by sulfur dioxide to convert hexavalent chromium into trivalent chromium, and by sodium hydroxide to promote precipitation. After being transferred to underground storage tank T-4 (7,500 gal), the sludge would precipitate, and supernatant would be transferred to tank T-3 (5,000 gal). When the impoundments (see Sec. 6.2) south of the building were in operation, the sludge in tank T-4 was pumped into the sludge drying bed, while the liquid from tank T-3 was pumped to the sand filters.

A schematic flow of the water treatment system in Bldg. 95 is given in Fig. 6.7. After filtration, the treated effluent flowed to Green Pond Brook via a drainage ditch. When the accumulated sludge in the drying bed reached a certain level, it was dredged out and hauled to a hazardous waste landfill. This was done only twice during 1961 to 1981, the operating life of these impoundments. More detailed discussion of the history of these impoundments is given in Sec. 6.2.

Since the decommissioning of sludge drying bed and sand filters in 1981, the sludge and effluent from tank T-4 have been periodically pumped out into a tank truck

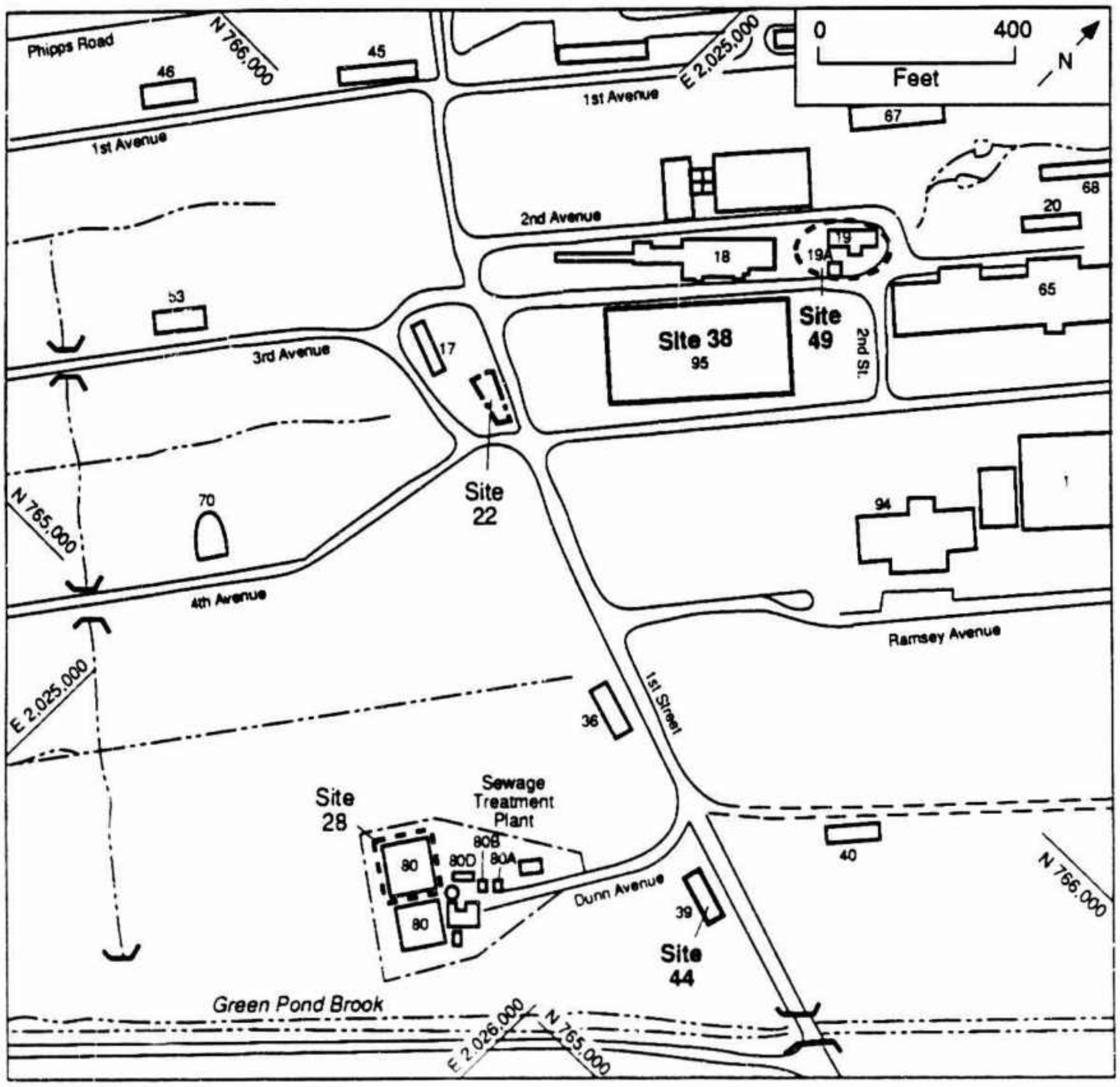

FIGURE 6.6 Layout of Site 38, the Plating/Etching Wastewater Treatment Facility at Building 95 (also shown are Site 44, Building 39, and Site 49, Buildings 19 and 19A) (Source: Adapted from USACE 1984a)

operated by a certified waste hauler and transported to an authorized hazardous waste disposal site. Tank T-3 has been used for storage only when levels in T-4 are excessive. Spent baths, spills, and rinse drainages from the etching step are routed and stored in T-6 for subsequent disposal.

No firm data are available for quantity and composition of wastewater produced in Bldg. 95. During the past several years, the plating and etching facility has been used less frequently. All wastes generated are hauled away for off-post treatment. Based on manifest records, the disposal contractor, Waste Conversion, Inc., provided disposal of the waste volumes presented in Table 6.7. Based on these data, wastewater generation is estimated to range from 35,000 to 40,000 gal/yr. In certain years, this quantity may have been exceeded; however, this is impossible to verify since the system contained no recording device.

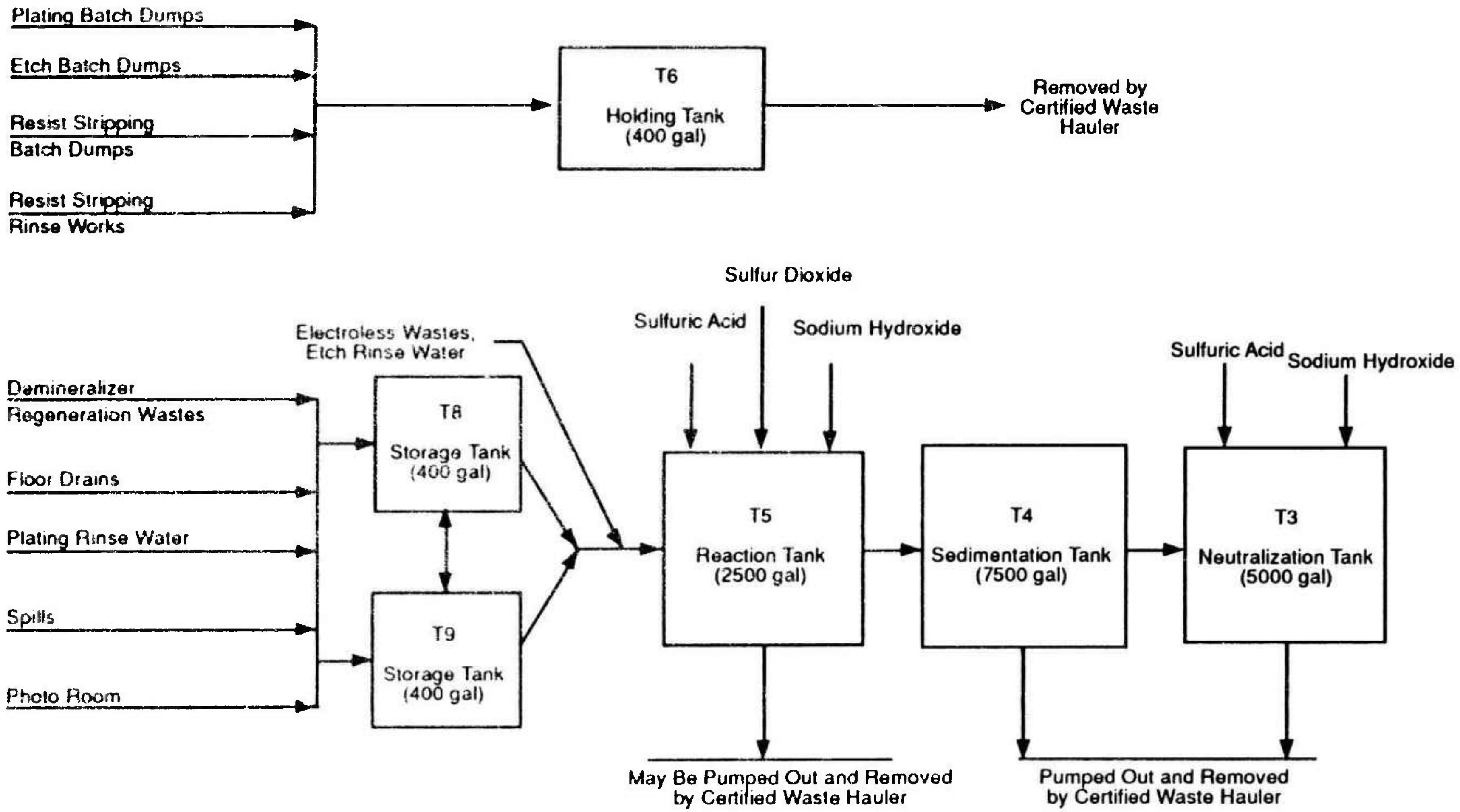

FIGURE 6.7 Schematic for the Wastewater Treatment System in Building 95 (Source: Adapted from Foster Wheeler 1987a)

TABLE 6.7 Volume of Off-site Waste Shipments from Building 95

Year	Shipments	Gallons
1983	6	29,500
1984	7	44,500
1985	3	18,000
1986 thru 8/87	0	0

Source: Foster Wheeler 1987a.

Presently, circuit-board production is low, and only small quantities of wastewater are produced, stored, and transported off site. Off-post shipments of hazardous wastes are accomplished by using proper manifest procedures in accordance with NJAC 7:26-7.4. The wastes are transported by a licensed waste hauler to an authorized treatment, storage, or disposal facility in accordance with NJAC 7:26-7.5 and 7.6. Procedures used comply with PTA standard operating procedures (SOPs) (Foster Wheeler 1987a).

6.4.1.3 Underground Storage Tanks

Building 95 has nine underground tanks, T-1 through T-9. Information pertinent to these tanks is summarized in Table 6.8. All of these tanks are made of cement walls built into the lower foundation of the building. Five of these tanks (T-4, T-5, T-6, T-8, and T-9) are lined with acid-resistant brick. The exterior of the acid-resistant brick of T-6, T-8, and T-9 is coated with an epoxy acid-proof liner to preserve brick integrity. Tank T-3 is not lined since it is used for neutral waste pumped to the waste basin. Tanks T-1, T-2, and T-7 are unlined and have never been used (Anderson 1988b).

All nine tanks were installed in 1958. Acid-proof liners were added to tanks T-6 and T-8 in 1968. Tanks T-6, T-8, and T-9 were repaired and fitted with membrane liners in 1979. Maintenance was performed in 1985 when the interior of T-3 was regrouted and sealed, and the acid-proof membranes in tanks T-6, T-8, and T-9 were refurbished with epoxy. Despite the upgrade, six tanks (T-3, T-4, T-5, T-6, T-8, and T-9) failed integrity tests in 1988, and they have not been used since (Solecki 1989b).

These six USTs, T-3, T-4, T-5, T-6, T-8, and T-9, are presently included in the RCRA Part B permit application submitted by PTA in November 1988 (Foster Wheeler 1988d). The three unused USTs, T-1, T-2, and T-7, will be closed under interim status (Foster Wheeler 1988b).

TABLE 6.8 Underground Storage Tanks in Building 95

Tank	Capacity (gal)	Lining[a]	Contents
T-1	5,000	None	Never used
T-2	5,000	None	Never used
T-3	5,000	None	Plating wastes
T-4	7,500	Acid-resistant brick	Plating wastes
T-5	2,000	Acid-resistant brick	Untreated plating waste
T-6	400	Epoxy-coated, acid-resistant brick	Untreated plating waste
T-7	400	None	Never used
T-8	400	Epoxy-coated, acid-resistant brick	Untreated plating waste
T-9	400	Epoxy-coated, acid-resistant brick	Untreated plating waste

[a]All tanks are concrete.

Source: Foster Wheeler 1987a, 1988d.

6.4.2 Geology and Hydrology

Due to its proximity, Site 38 should have geological and hydrological characteristics similar to those of Site 22 (Sec. 6.2).

6.4.3 Existing Contamination

6.4.3.1 Radioactive Materials

Thickness-gaging beta scopes are employed in the etching process in Bldg. 95. Various sealed beta sources are used, such as C-14, Ru-106, Sr-90, Tl-204, Pm-147, and Ra D+E (all <0.6 mCi). The area has been regularly checked, and no leak from the sources has been detected (Ward 1988).

6.4.3.2 Soil

The wastewater treatment system in Bldg. 95 consists of a series of underground concrete storage and treatment tanks. Over the past 20 years, leakage from some of these tanks has occurred (Anderson 1988b). Some leaks were contained and contamination was prevented. For example, about 15 years ago, tanks T-6 and T-8 leaked through the wall into the pump rooms. The leakage was totally contained, and tanks were repaired soon after the detection of the leak.

If any leakage from these tanks had gone into the ground, the soil under the building would have been the first to be contaminated. However, there are no data on soil contamination at the Site.

6.4.3.3 Groundwater

Before 1989, the area adjacent and downgradient to Bldg. 95 was monitored with a network of seven wells. The sampling results from these wells are discussed in detail in Sec. 6.2. Available data from 1981 to 1987, summarized in Table 6.2, Sec. 6.2, indicate that area groundwater has been contaminated. Although these wells are located on the pathway of pollutant migration from Bldg. 95, it is apparent that the wells have been affected primarily by seepage from the former sludge lagoon and sand filters discussed in Sec. 6.2 (i.e., Site 22). Well 98, located next to and downgradient of the former impoundment area, appears to have the worst contamination of the seven wells. Data for intermediate wells 972 and 973, both installed in 1987 and sampled once, show no contamination. These two wells appear to be in the path of any contaminants from Bldg. 95.

As discussed in Sec. 6.2, in summer 1989, 21 cluster wells were installed near Bldg. 95 and impoundments. Of these wells, three water table wells are located adjacent to the walls of Bldg. 95 (see Fig. 6.1) in order to provide monitoring data of operations inside the building. Monitoring data from these wells have not been made available yet.

6.4.4 Closure Plan

The unused tanks, T-1, T-2, and T-7, will be closed under interim status. The revised closure plans include removal of tank contents and a high-pressure cold-power wash and rinse. Two grab samples of the rinsate and wash water will be collected for each tank and analyzed for priority pollutant metals. After inspection of the tanks, a core sample of the concrete will be collected from the bottom of each tank and analyzed for priority pollutant metals (see Fig. 6.8). From each location where a core sample has been taken, a soil sample will be collected to a depth of 1 ft from beneath each tank and analyzed for priority pollutant metals, EP toxicity for metals, halogenated VOCs, and cyanides. After flushing and removing the tanks' piping systems, if no soil contamination is found, the tanks will be filled with an inert material and capped with a 6-in. layer of concrete. If the underlying soils are contaminated, PTA will work with NJDEP to develop a plan for determining the extent of contamination and the required remediation.

6.4.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. Should clean closure not be possible, the RI plan should be revised once new data become available.

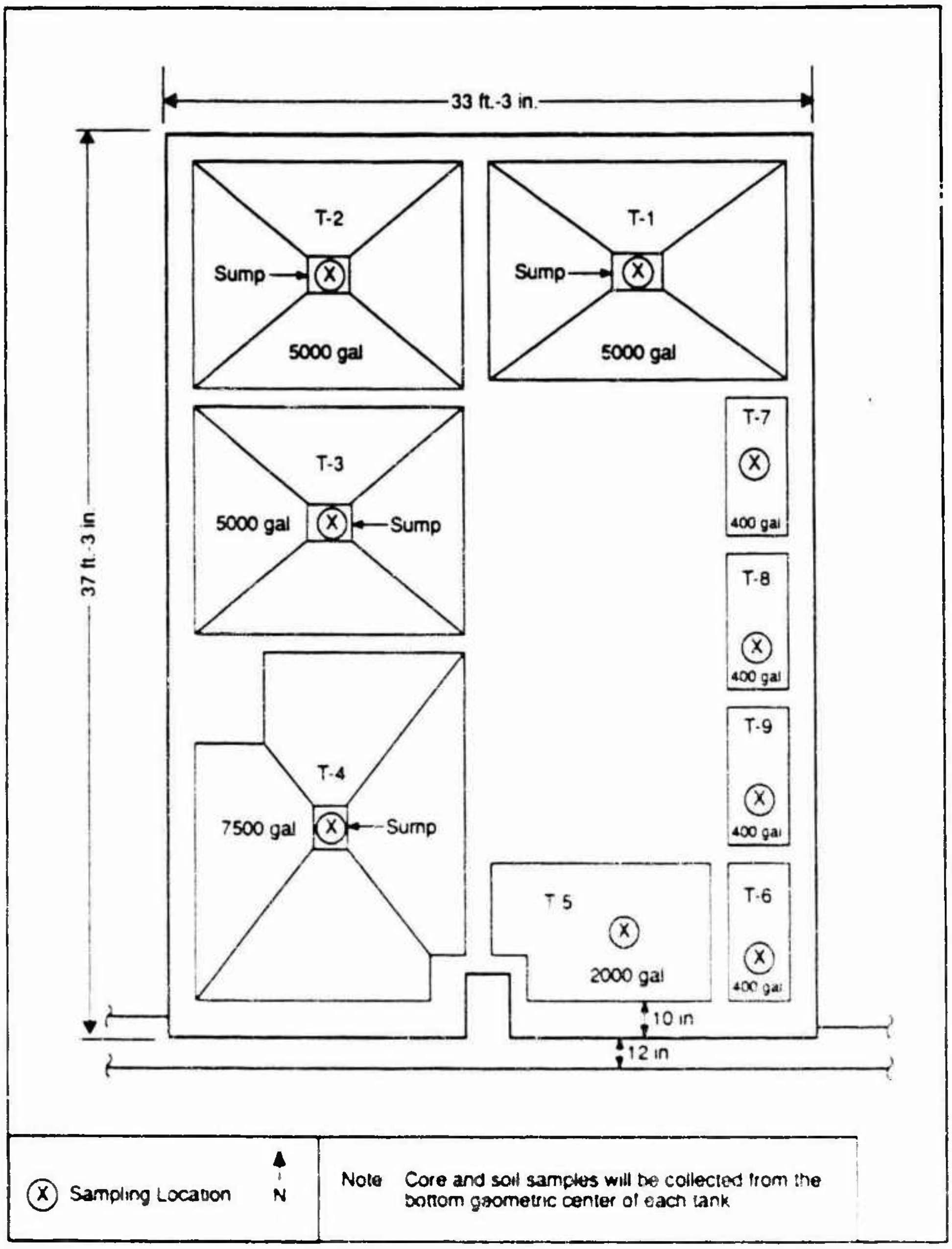

FIGURE 6.8 Closure Sampling Locations for the Building 95 Tanks (Source: Adapted from Foster Wheeler 1989)

6.4.5.1 Phase I

Six of the USTs in Bldg. 95 (tanks T-3 through T-6, T-8, and T-9), which were used as part of the industrial wastewater treatment system, are a major environmental concern because they have not been used since 1988 when they failed integrity tests. It is recommended that these six tanks be closed as soon as approval can be obtained from the NJDEP. The proposed sampling plan for these six tanks is basically the same as that in the closure plans for tanks T-1, T-2, and T-7 (see Sec. 6.4.4), except that samples are needed from the soil around the tanks. Before remedial action begins, six soil samples from beneath the tanks and six grab samples from inside the tanks should be collected and analyzed for all TCL parameters, cyanide, and TCLP leachability (if necessary).

The former wastewater impoundments south of Bldg. 95 are being treated as an independent Site (No. 22), and extensive soil sampling is proposed and described for Site 22 in Sec. 6.2. In addition, ongoing groundwater sampling and analyses, conducted by the USGS (also see Sec. 6.2) in compliance with NJDEP requirements, will help determine whether groundwater remediation is needed in the area.

6.4.5.2 Phase II

If the soil under the six tanks is contaminated, additional soil and groundwater sampling will be required to delineate the extent of contamination.

6.5 SITE 44 — BUILDING 39, GOLF COURSE MAINTENANCE SHOP

6.5.1 Site History

Building 39 is located off of First Street northwest of Green Pond Brook and adjacent to the golf course at the south part of the PTA. The Site location is shown in Fig. 6.6 (see Sec. 6.4). Built in 1981, the building is basically a maintenance shed used to house equipment (e.g., lawn mowers) and gasoline, oil, and grease. The building is 104 by 29 ft with a concrete foundation, wood floor, hollow tile walls, and a corrugated asbestos roof (Anderson 1988b).

The building has been used for storing and preparing small quantities of pesticides and herbicides. These are mixed and transferred to equipment before applying them to the golf course and other grounds. The empty containers and utensils used to prepare the pesticides and herbicides are triple-washed before storage in the building, and the tanks are triple rinsed, with the rinsate sprayed on the target areas (Anderson 1988b).

The principal type of hazardous materials in the area are oil and grease for the equipment maintenance activities and pesticides and herbicides handled inside and outside of the building. In addition, waste solvents are generated from a small-parts degreasing operation. The waste oil and solvents are placed in metal drums and are stored outside on pallets south of the building.

Building 39 is to be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

6.5.2 Geology and Hydrology

Site 44 is situated in the lower portion of the valley drained by Green Pond Brook, which flows about 250 ft southeast of the Site. In the vicinity, the topography is flat. Soils are classified as Adrian Muck, which is a very poorly drained organic soil underlain by sandy deposits at a depth of 16-50 in. Permeability is high in these soils, and at most times the water table is close to the surface. These soils are subject to flooding from stream flow (Wingfield 1976).

Three aquifers are found in the study area. The water table aquifer is primarily within the top 35 ft of the land surface. A confining bed, as much as 150 ft thick in some areas, separates the water-table aquifer from a confined glacial aquifer about 30 ft thick.

There are no existing monitoring wells at the Site. However, based on data collected from wells north of the site (i.e., Sites 21 and 22), groundwater in this area should flow in a southeasterly direction toward Green Pond Brook (Sargent 1988). The gradient of the water table is flat, estimated to be about 0.002. The groundwater flow velocity is low, about 0.2 ft/d. More detailed information on the Site's geology and hydrology can be found in Sec. 6.2.2.

6.5.3 Existing Contamination

Handling and storage of waste oils, pesticides, and herbicides have resulted in waste generation and possibly soil contamination. For years, drums of waste oil were reportedly stored outside the building, leaving an area of contaminated soil (Anderson 1988b). Also, a sump nearby has been used for rinsing off grass clippings and for mixing herbicides and pesticides.

An underground tank for storing gasoline was installed next to the building 7-8 years ago. However, other substances (such as mixed oils) may have been put into the tank.

An on-site sampling program was conducted by USAEHA at this Site in July 1988 to determine the extent of contamination (USAEHA 1989). A total of 11 soil samples and 1 sediment sample were collected from the vicinity of Bldg. 39 and analyzed for pesticides, herbicides, and PCBs. The sample locations are shown in Fig. 6.9. Surface soil samples consisted of a composite of approximately five cores. Each core was 6-7 cm in diameter and was collected at the surface to a depth not exceeding 6-7 cm. Each sediment sample was a grab sample collected with a garden trowel from a single point. Analytical data are given in Table 6.9.

The results reveal a pattern of excessively high pesticide residue levels. Half of the samples collected contained total pesticide residue loads above the action levels of

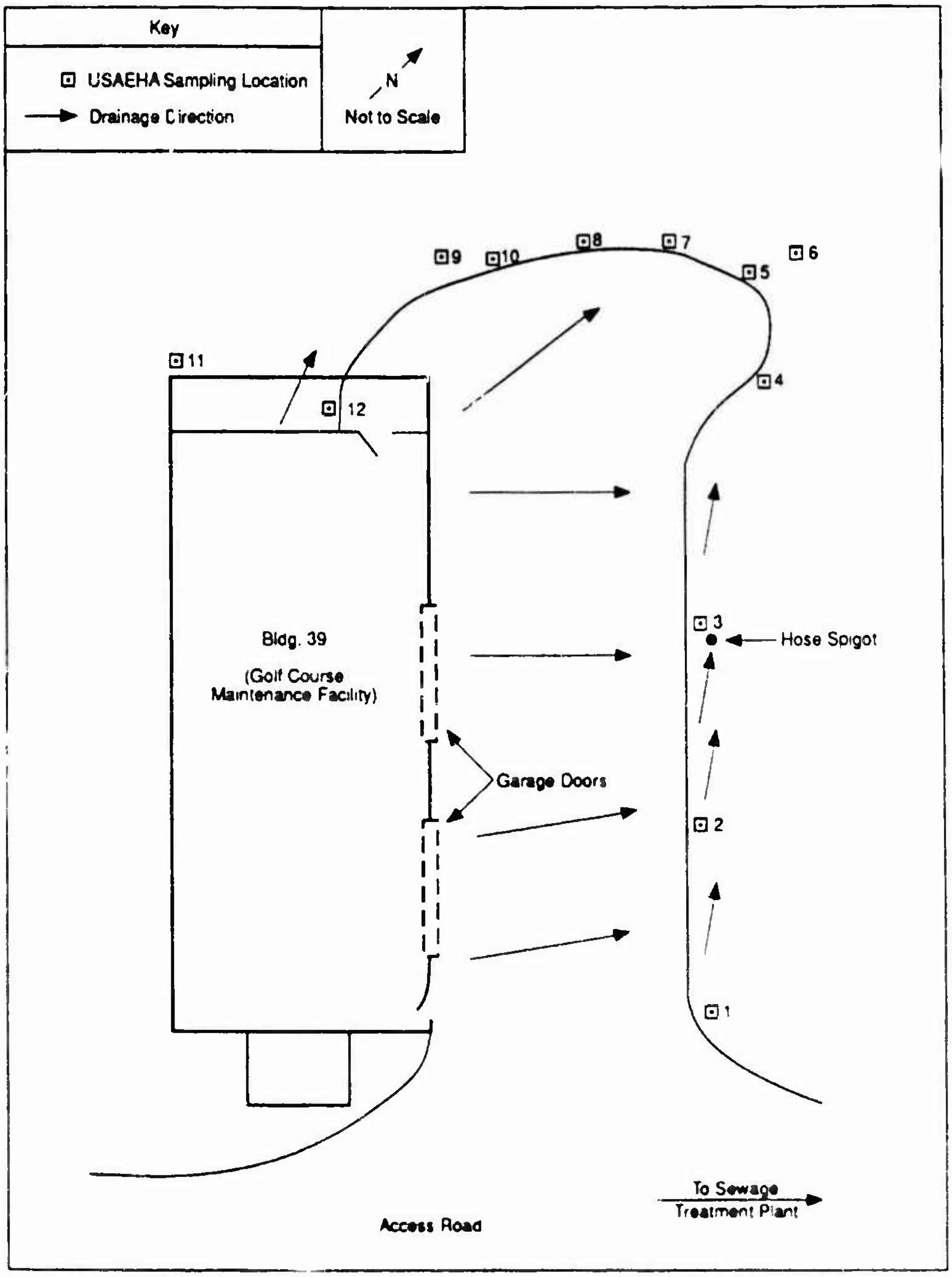

FIGURE 6.9 Locations of Soil and Sediment Sampling at Site 44 (Source: Adapted from USAEHA 1989)

TABLE 6.9 Selected Analytical Results for Soil and Sediment Samples from Site 44 (mg/kg dry weight)[a]

Compound	01	02	03[b]	04	05	06	07	08	09	10	11	12
o,p'-DDD	ND	ND	1.50	ND	ND	ND	ND	0.40	ND	ND	25.9	ND
p,p'-DDD	ND	ND	4.79	ND	ND	ND	ND	1.01	ND	0.27	173	0.18
o,p'-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.41	ND
p,p'-DDE	ND	ND	0.22	ND	ND	0.40	ND	0.22	ND	0.35	15.4	0.24
o,p'-DDT	ND	ND	ND	ND	ND	0.82	ND	2.52	ND	0.87	235	0.40
p,p'-DDT	ND	ND	0.93	0.91	ND	3.82	ND	9.61	0.65	4.07	1,108	2.37
Chlordane												
Technical	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metabolites	ND	0.58	ND	0.86	17.0	0.90	ND	4.48	ND	ND	ND	ND
cis-Chlordane	ND	ND	0.67	ND	ND	ND	ND	ND	0.08	ND	ND	ND
trans-Chlordane	ND	ND	1.11	ND	ND	ND	ND	ND	0.13	ND	ND	ND
Oxychlordane	ND	ND	ND	ND	MD	ND	ND	ND	ND	ND	ND	ND
Other[c]	ND	ND	0.28	0.10	ND	0.16	ND	0.65	ND	ND	3.78	ND
Total	0	0.58	9.50	5.70	17.0	6.10	0	18.89	0.86	5.56	1,562.49	3.19

[a]ND means not detected.

[b]Sample 3 is a sediment sample; all others are soil samples.

[c]Includes aldrin, endrin, dieldrin, HCB, BHC (alpha), BHC (beta), BHC (delta), lindane, 1-hydroxychlordene, heptachlor, heptachlor epoxide, methoxychlor, mirex, toxaphene, PCBs, chlorpyrifos, ronnel, diazinon, methyl parathion, parathion, malathion, 2,4-D, 2,4-DB, 2,4,5-T, silvex, bromacil, simazine, atrazine, and propazine.

Source: USAEHA 1989.

the USAEHA. Two samples indicated extreme contamination. Sample 3 (a sediment sample) contained nearly 100 times the pesticide concentration threshold for sediment (0.1 mg/kg). This sample was collected from the asphalt-surfaced area surrounding the building where runoff tended to concentrate.

Sample 11 was collected from an area where outdoor spray rigs were parked when not in use. The soil sample had a total pesticide content more than 500 times higher than the established limit.

DDT, DDT metabolites, chlordane, and chlordane metabolites were the most prevalent compounds detected. Neither DDT nor chlordane is currently registered for use as a pesticide and neither has been used or stored at the installation.

Seven locations inside the building were selected for wipe sampling. Two wipe samples were collected at each location. No pesticide residue was detected in these samples (USAEHA 1989).

6.5.4 Closure Plan

As indicated in Sec. 6.5.1, Bldg. 39 will be undergoing RCRA closure (Foster Wheeler 1988b; Solecki 1989a). The revised closure plan is described below.

The hazardous waste inventory stored outdoor in the pallets will be transferred to Bldg. 3100 for storage prior to off-post disposal. Following the removal of hazardous wastes, one soil sample will be collected from the area underneath the pallet storage (see Fig. 6.10). The soil sample will be analyzed for petroleum hydrocarbons, volatile organic compounds, priority pollutant metals, EP toxicity metals (if necessary), herbicides, and pesticides. If the soil is found to be contaminated, additional samples will be taken to determine the extent of contamination.

6.5.5 Proposed RI Plan

The proposed phased sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, the RI plan will be modified as new data become available.

6.5.5.1 Phase I

The underground gasoline tank next to Bldg. 39 should be inspected for leakage and its status reviewed with respect to RCRA compliance. If the tank leaks, two soil samples should be collected from underneath the tank and analyzed for TCL volatiles and TCL semivolatiles.

Contaminated soil around Bldg. 39 may be transported into the air due to wind erosion and become a source of air pollution. It is proposed that six air quality samples

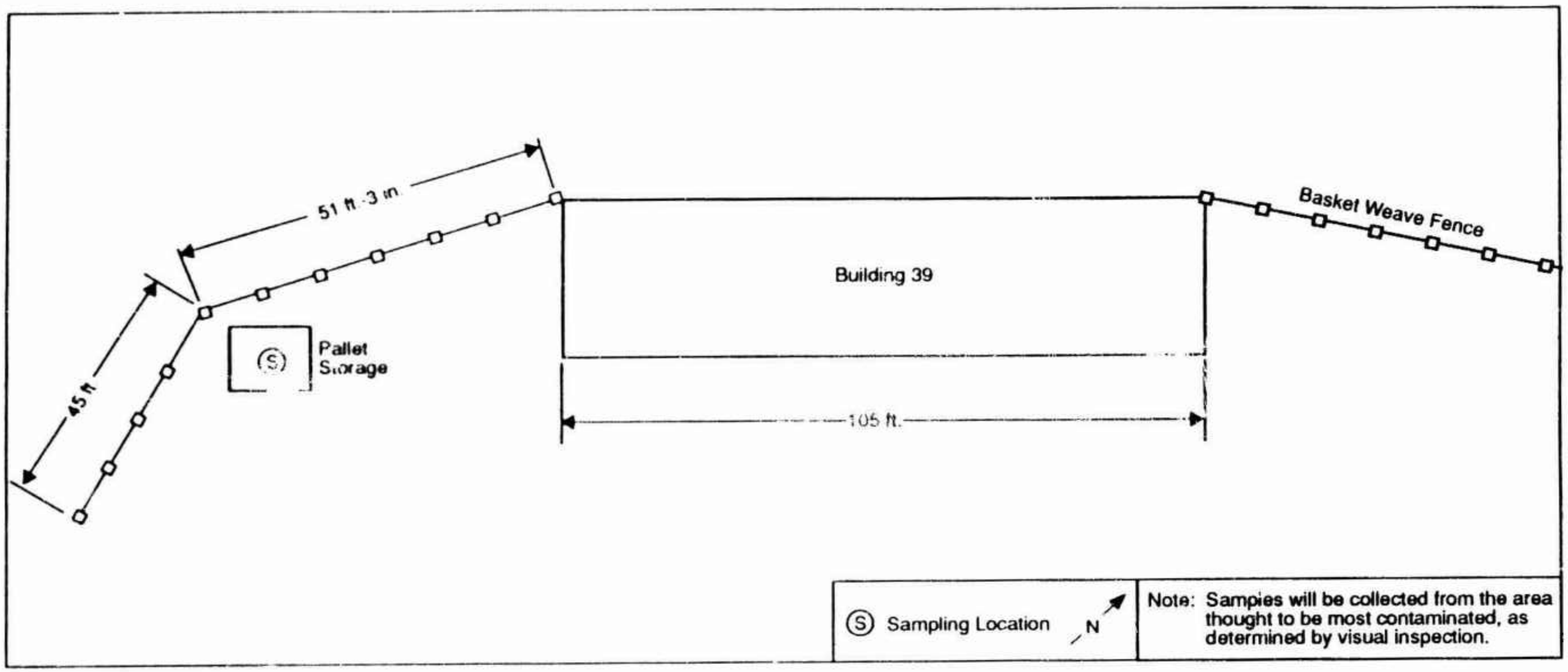

FIGURE 6.10 Closure Plan Sampling for Site 44 (Source: Adapted from Foster Wheeler 1989)

should be taken in the area to gather data as to the extent of air pollution in and around the area. The samples should be analyzed for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, herbicides, and asbestos.

6.5.5.2 Phase II

Building 39 is scheduled for clean closure. At closure, all hazardous wastes and contaminated soils in the Site will be removed and properly disposed of, and the building surfaces decontaminated, if necessary. PTA should work with NJDEP to establish final cleanup requirements. Additional sampling may be needed to establish specific plans for building decontamination, waste removal, and excavation of contaminated soils and sediments discussed in Sec. 6.5.3.

7 AREA F: PROPELLANT AREA

7.1 INTRODUCTION

Most buildings in this Area, located east of Green Pond Brook, housed propellant, manufacturing, mixing, and testing activities. Drinking water wells are located in this Area and are known to be contaminated. There are 17 Sites in this Area.

7.2 SITE 60 — BUILDING 163, PHOTOGRAPHY LABORATORY

7.2.1 Site History

The Site is located next to Site 104 (Bldg. 162) on Kibler Road near the distal end of an alluvial fan at Robinson Run (Fig. 7.1). Building 163 covers an area of 557 m^2 (5,994 ft^2). It has a slate roof and brick walls and was built in 1942 (PTA 1971).

The building was designed as a laboratory and has been used as a photography laboratory. A unlined 1,000-gal concrete underground tank is located adjacent to the northeast corner of the building (Foster Wheeler 1988b). In the past, waste photo-processing chemicals were drained from two sinks to the tank via a 2-in. PVC pipe. The tank was decommissioned in 1984.

Currently, the amounts of wastes generated include 8 gal/mo of developer, 8 gal/mo of bleach/fixer, 4 gal/mo of black-and-white fixer, and 4 gal/mo of developer (Solecki 1989c). Wastes are stored inside the building on a wooden floor.

A RCRA closure plan has been prepared for the underground storage tank near Bldg. 163 (Foster Wheeler 1988b). It will be closed in accordance with NJDEP hazardous regulations because it never had interim status.

7.2.2 Geology and Hydrology

The geologic settings and topography of the Site are similar to those of Site 104. Refer to Sec. 7.4.2 for information.

7.2.3 Existing Contamination

Most of the chemicals generated in Bldg. 163 are not hazardous and are biodegradable, according to Kodak data sheets. Possibly hazardous contaminants released in the past include silver, cyanide, and hydroxylamine. Because no water and soil data are available, the extent of contamination is not known.

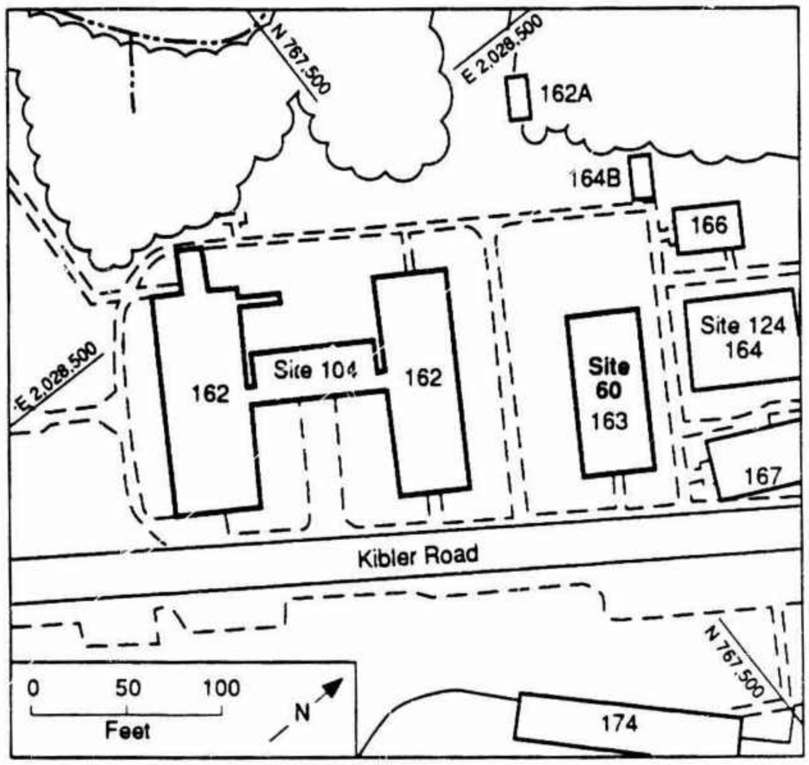

FIGURE 7.1 Layout of Site 60, Photographic Laboratory at Building 163 (Source: Adapted from USACE 1984b)

7.2.4 Closure Plan

A revised RCRA closure plan has been prepared for the UST adjacent to Bldg. 163 on the Site (Foster Wheeler 1988b). During closure, the UST and its associated pipes will be excavated and decontaminated. Stained soil, soil surrounding the tank, the contents of the tank, and the rinsate generated from the decontamination operation will be sampled. One sample from inside the tank will be analyzed for priority pollutant metals, VOCs, and cyanide; six soil samples for priority pollutant metals, VOCs, cyanide, and, if necessary, EP toxicity for metals; one or two condensate or rinsate grab samples for priority pollutant metals; and two chip samples for priority pollutant metals (Fig. 7.2).

7.2.5 Proposed RI Plan

The proposed phased sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, the RI sampling plan may have to be modified.

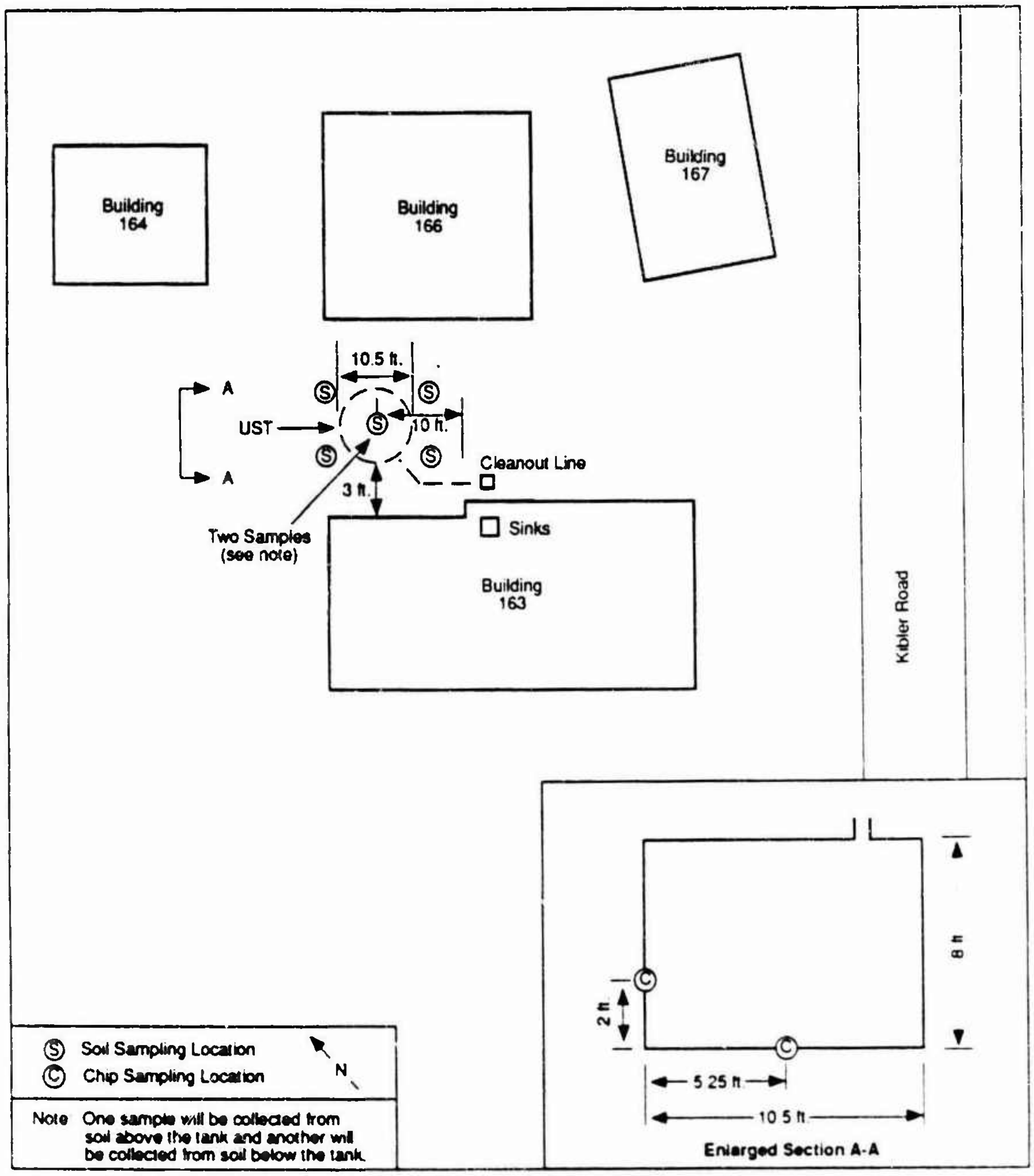

FIGURE 7.2 Closure Sampling Locations for Building 163 (Sources: Adapted from Foster Wheeler 1988b, 1989)

7.2.5.1 Phase I

A field inspection should be carried out inside and outside the building to locate signs of contamination, with nothing further to be done if the areas are clean. One surface soil sample should be taken to a depth of 0.3 m (1 ft) in each area of observed contamination. All the soil samples should be analyzed for cyanide and TCL metals.

7.2.5.2 Phase II

If significant contamination is found in the Phase I results, one soil boring is needed for each area of soil contamination located by the Phase I results. In order to delineate the extent of the contamination, additional soil and water sampling may be needed, depending on the Phase I results.

7.3 SITE 61 — BUILDINGS 171 AND 176, WASTE DUMPS BEHIND BUILDINGS

7.3.1 Site History

The Site is located in Green Pond Brook valley near the southwestern end of Ninth Street. The site includes two brick buildings, 171 and 176 (Fig. 7.3).

Building 171 was built in 1948 and has been used for administrative offices. In the basement of the building is a graphics department (Foster Wheeler 1988b). Two photoprocessor units, an ITEK 430 and a VGC 320, are operated using resin-coated (RC) processing chemicals. Waste chemicals are accumulated in a 5-gal plastic carboy, which rests on the floor next to the photoprocessors (Foster Wheeler 1988b).

During interviews, PTA personnel reported that propellants were dumped behind Bldg. 171. From 1955 to 1962, it was common to find yellow, tan, and pink materials floating on the creek behind the building.

Building 176 was designed for laboratory use when it was built in 1944. It is now used as an administrative building. Before 1960, in order to build a road across the creek at Ninth Street near Bldgs. S-406 and 176, the swamp in this area was reportedly filled in with trash, including car bodies and unknown materials. Behind Bldg. 176 is a shed in which photoprocessing waste (RC fixer and RC developer) is stored.

Currently, Bldg. 171 is operated as a less-than-90-day accumulation area. The maximum inventory of hazardous waste stored in the building is estimated to be the maximum quantity generated during a 3-mo period; that is, one 5-gal plastic container of spent photochemicals (Foster Wheeler 1988c). A RCRA closure plan has been prepared for the photographic processing facility in the basement of Bldg. 171 (Foster Wheeler 1988c). It will be closed in accordance with NJDEP hazardous waste regulations because it never had interim status.

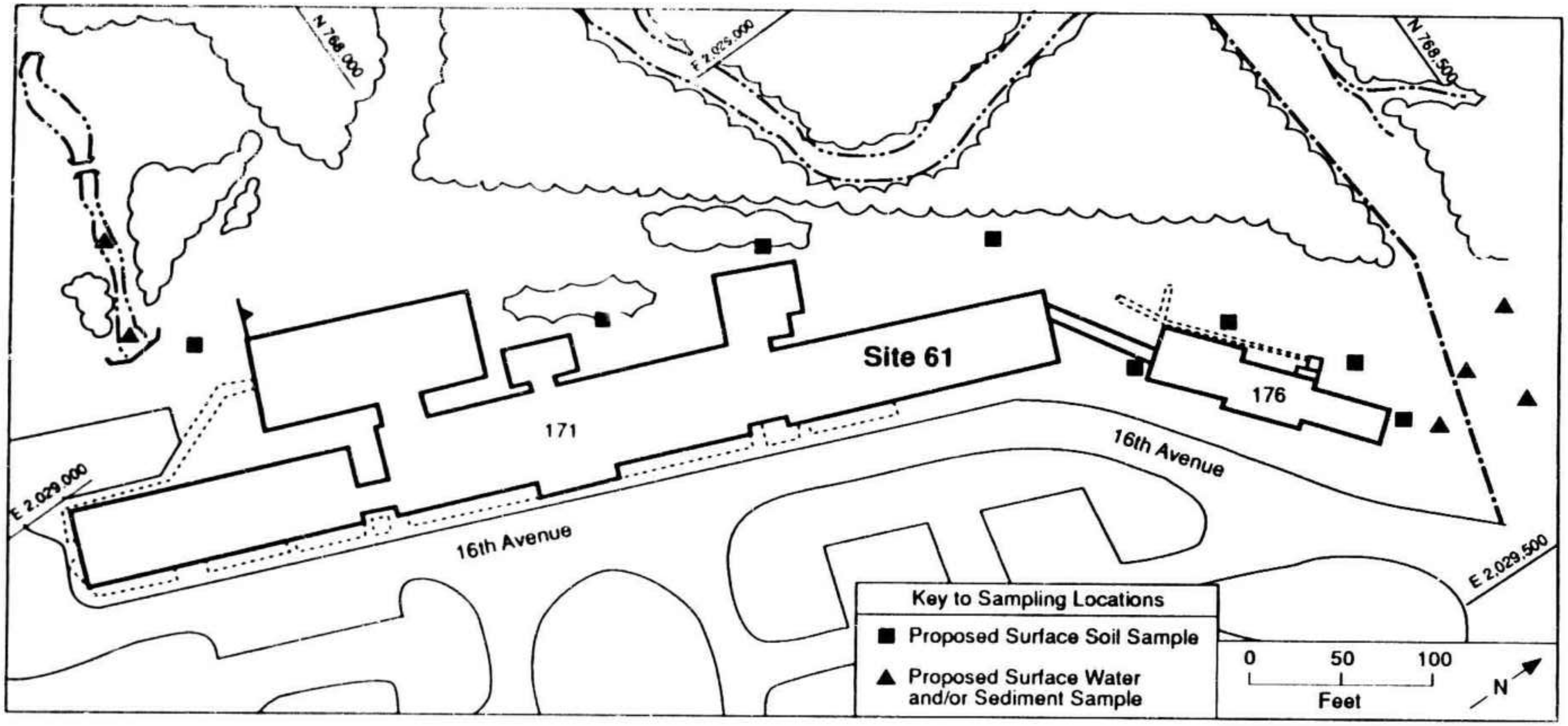

FIGURE 7.3 Layout of Site 61, Waste Dumps behind Buildings 171 and 176 (Source: Adapted from USACE 1994b)

7.3.2 Geology and Hydrology

The Site is situated on the distal portion of the alluvial fan of the Robinson Run. To the north and the south, the Site is bounded by creeks. The two creeks eventually discharge into Green Pond Brook, less than 100 ft west of the Site.

Because of land development in the past, portions of the creeks as well as their surrounding swampy areas have been artificially filled. The fill may be up to 3 m (10 ft) thick (Harte et al. 1986). Between the fill and the alluvial fan deposit is an organic muck layer, a few feet thick. The fan deposit is estimated to be about 85 ft thick and is overlying Leithsville dolomite (Harte et al. 1986).

The alluvial fan deposit forms a water-table aquifer on the Site. This aquifer probably is hydrologically separated from the bedrock dolomite aquifer by a till or a bedrock weathered zone. The hydraulic conductivity of the water-table aquifer is expected to be moderate to high. The local flow direction of the groundwater in the fan deposit varies, depending on the presence of the creeks and Green Pond Brook.

7.3.3 Existing Contamination

Major concerns at the Site are the reported dumpings of propellants behind Bldg. 171, trash filling of the swamp near the northern end of the Site, and the generation of photoprocessing waste in the basement of Bldg. 171.

During interviews, PTA personnel reported that between 1955 and 1962, propellant dumping was very common behind Bldg. 171. The reported appearance of yellow, tan, and pink floating materials on the creek from 1955 to 1962 indicates that extensive propellant contamination is possible behind the building and in a creek in the west part of the Site. However, the extent of the contamination is not clear; no soil and water quality data are available for areas within and downgradient of the Site.

7.3.4 Closure Plan

The revised closure plan for the photoprocessing facility in Bldg. 171 (Foster Wheeler 1988c) includes the removal of all hazardous materials in the facility. Then, the floors and the shelves of the facility will be examined for discoloration or residues of spent photochemicals. Any floor tiles determined to be contaminated will be disposed of as hazardous waste. After all containers are removed, the shelves, walls, and floors will be washed with detergent and rinsed with clean water. Two wash or rinsate samples and two chip samples will be collected and analyzed for priority pollutant metals (Fig. 7.4).

7.3.5 Proposed RI Plan

The proposed phased sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of the facility not be possible, the RI sampling plan below will be modified as new data become available.

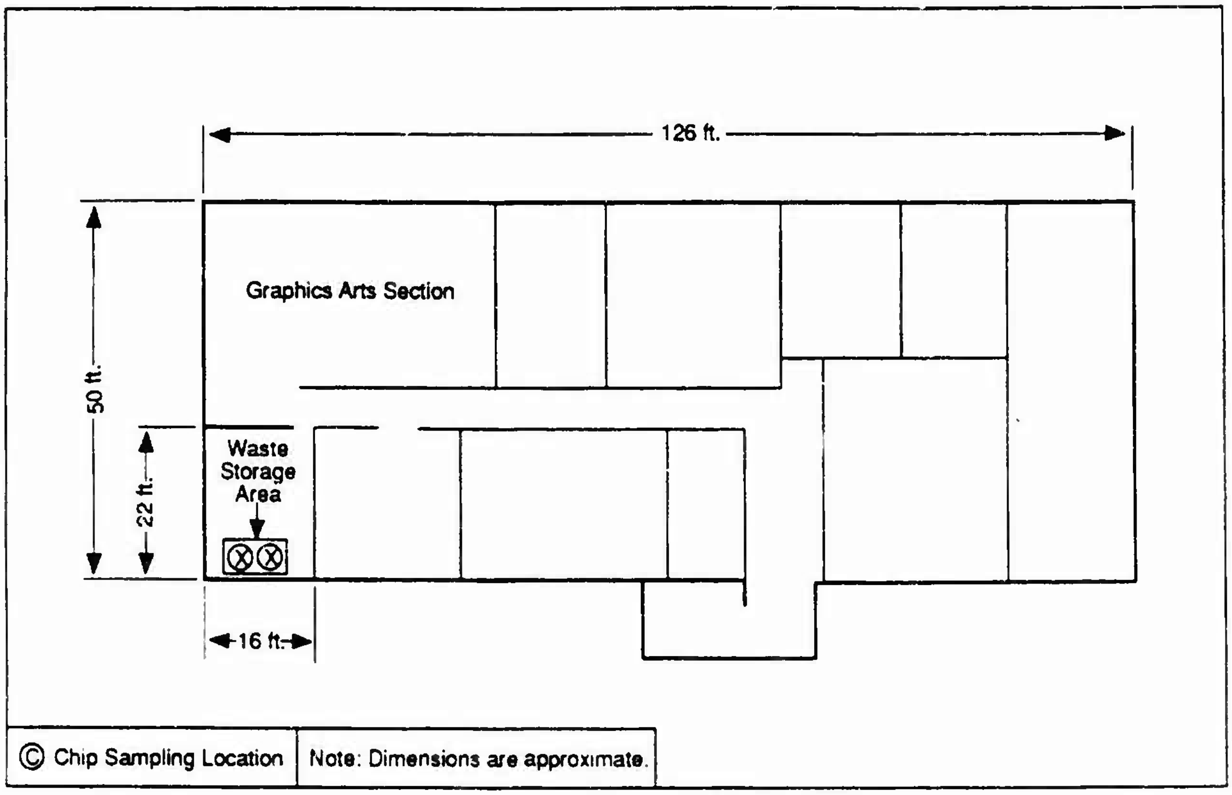

FIGURE 7.4 Closure Sampling Locations for Building 171 (Sources: Adapted from Foster Wheeler 1988b, 1989)

7.3.5.1 Phase I

A reconnaissance survey around Bldgs. 171 and 176 is needed to locate areas with signs of contamination or dump areas. The containers of photoprocessing chemicals stored in the shed behind Bldg. 176 should be inspected for leakage. One surface soil sample should be collected to a depth of 0.3 m (1 ft) in the center of any located contamination or dump area and analyzed for propellants, cyanide, and TCL metals.

One sediment sample should be collected from each drain outfall from Bldg. 171. Four surface soil samples, each to a depth of 0.6 m (2 ft), should be collected behind Bldg. 171. Suggested locations are shown in Fig. 7.3. From the creek south of Bldg. 171, two sediment samples and two surface water samples should be collected to a depth of 0.3 m (1 ft). All the above samples should be analyzed for propellants, cyanide, and TCL metals.

From the swamp between Bldgs. 176 and S406, four surface water and four sediment samples should be collected, each to a depth of 0.6 m (2 ft), and analyzed for TCL metals, propellants, and explosives. Four surface soil samples should be collected around Bldg. 176 and analyzed for TCL metals and cyanide. Suggested locations are shown in Fig. 7.3.

7.3.5.2 Phase II

If contamination is indicated in the Phase I soil samples, a soil boring at the center of each identified waste dump or contamination area should be drilled to the water table or bedrock, whichever comes first. Soil samples should be collected from the borings and analyzed for parameters found to be significant in the Phase I results.

If needed, additional sediment and soil samples should be collected and monitoring wells installed to delineate the extent of the contamination.

7.4 SITE 104 — BUILDINGS 161 AND 162, CHEMICAL LABORATORIES

7.4.1 Site History

Building 162 is a three-floor building situated in the middle of Green Pond Brook valley, at the intersection of Kibler Road and Farley Avenue (Fig. 7.5). The building, which has brick walls and a slate roof, covers an area of 2,277 m^2 (24,512 ft^2). It was built in 1942 for use as a chemical control laboratory for propellant and ammunition analyses. A lime pit for acid neutralization was reportedly located behind the building. The pit was reportedly used from the 1950s to the 1960s. Propellants were aged for about 10 years in stability tests. Building 161 is not shown on the current PTA master plan map.

7.4.2 Geology and Hydrology

Building 162 was built on a swamp area near Green Pond Brook, which is about 60 m (200 ft) northwest of the building. To the east, the swamp lies on a gently sloping surface at the distal end of an alluvial fan.

The soils on the Site belong to Otisville Series (Sargent 1988). The permeability of the soils is high. Organic muck may be present near the surface. Since the Site is situated on a swamp adjacent to Green Pond Brook, the water table is expected to be shallow. Water flow is to the west-northwest, towards Green Pond Brook.

The well log of well 276 (Harte et al. 1986) shows that the bedrock in the vicinity of the Site belongs to the Leithsville Formation dolomite and is about 80 ft deep. The upper portion of the bedrock has been weathered into a silty clay. Above the bedrock is a thick sequence of Quaternary sandy deposits. They range from silts and fine-grained sands to gravels.

7.4.3 Existing Contamination

During interviews, PTA personnel reported that in the past, chemicals were commonly dumped into sewers and sinks in buildings. In Bldg. 162, laboratory benches

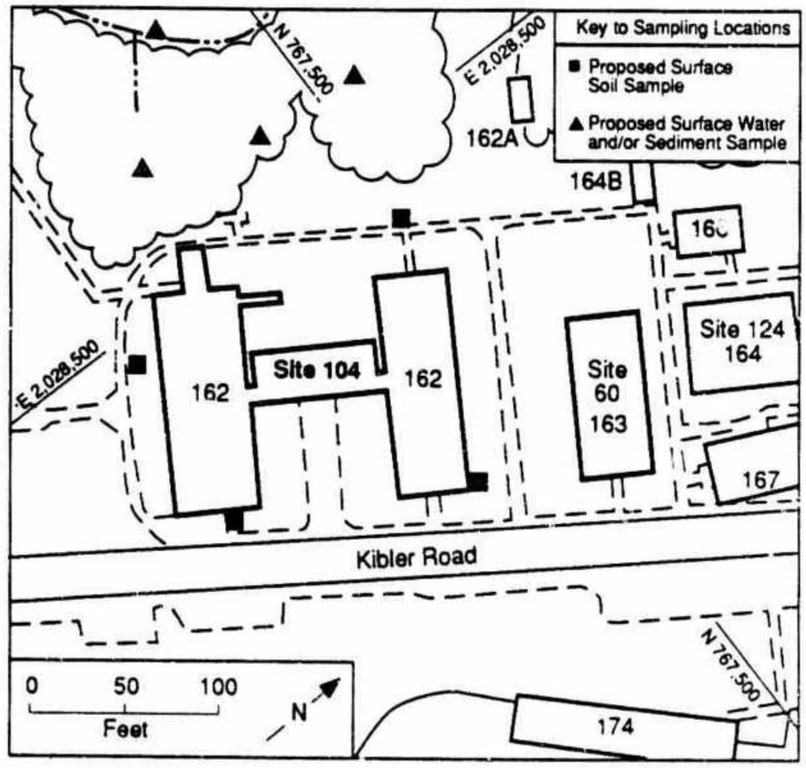

FIGURE 7.5 Layout of Site 104, Chemical Laboratories at Buildings 161 and 162 (Source: Adapted from USACE 1984b)

were reportedly washed down with carbon tetrachloride, with the drainage then flowing to the swamp behind the building. The building contained solvent recovery cans. Large quantities of mercury were also reportedly used. The solid-waste materials, including explosives generated from the building, were sent to the burning ground. Scrap metal was flashed (burned) and then sold. Acid-neutralization products may be present in the lime pit.

Propellants and chemicals were reported being dumped behind Bldg. 162. According to interviewed PTA personnel, several buildings, which were located behind Bldg. 162 and may now be destroyed, may be contaminated. From 1955 to 1962, reportedly it was very common to see yellow, tan, and pink materials floating on the creek.

In 1976 Bldg. 162 was decontaminated. Existing pipes and sewers were removed and replaced. No more information is available to ANL.

7.4.4 Proposed RI Plan

7.4.4.1 Phase I

A field inspection should be conducted around the buildings, in the swamp, and in the creek to locate signs of visible contamination; the reported propellant and chemical dump areas and the lime pit should be inspected as well. If the lime pit can be located, a soil boring should be drilled and samples collected from the top, pit bottom, and bottom of the boring. If the lime pit cannot be located by the inspection, a geophysical survey should be conducted to locate the pit. One surface soil sample should be collected to a depth of 0.6 m (2 ft) from the area of each propellant and/or chemical dump that is identified. One surface soil sample should be taken for each identified contamination area outside the building.

Also, one surface soil sample should be collected to a depth of 0.6 m (2 ft) from each side of each building (a total of eight samples). From the swamp behind the building, three sediment samples, each to a depth of 0.3 m (1 ft), and three surface water samples (if possible) should be collected. Suggested locations are shown in Fig. 7.5. From the creek downgradient of the buildings, one surface water sample and one 0.3-m (1-ft) deep sediment sample should be collected. One sediment sample should be collected from the area of the outfall of any located building drain. All Phase I samples should be analyzed for TCL volatiles, TCL semivolatiles, TCL metals, propellants, explosives, nitrates, and sulfate.

7.4.4.2 Phase II

If contamination is found in the Phase I samples, soil samples should be collected from soil borings located at each area of surface soil contamination. The samples should be analyzed for the contaminants found in the Phase I samples. If the lime pit soil boring samples show significant contamination, one monitoring well should be installed downgradient of the lime pit to monitor the groundwater contamination. Water samples should be collected and analyzed for contaminants found in the soil borings.

7.4.4.3 Phase III

Additional soil, sediment, and water samples may be required to delineate the extent of the contamination, depending on the Phase II results.

7.5 SITE 106 — BUILDING 1010, PROPELLANT PLANT

7.5.1 Site History

Building 1010 was located to the west of an abandoned railroad track bed, just south of Bott Road near the south end of Picatinny Lake. It was destroyed under the Toxic Energetics Cleanup Program (TECUP). During interviews, PTA personnel reported that Bldg. 1010 was a propellant plant and was also used as an acid recovery area. Some, and possibly all, of the storage tanks and transformers containing PCBs reportedly leaked. When the building was destroyed, the transformers were reportedly knocked over and their contents spilled onto the ground. The PCB transformers are currently stored on pallets at the Site. When the building was torn down, some of the asbestos from the building was buried on the Site.

7.5.2 Geology and Hydrology

Building 1010 is located approximately 670 ft south of the south end of Picatinny Lake. The ground surface slopes to the southwest. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 106 have been classified by the Soil Conservation Service, U.S. Department of Agriculture (USDA), as Urban land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 106 flows north to northwest towards Picatinny Lake and Green Pond Brook.

7.5.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site, and past activities have not been well documented. Propellants, acids, and PCBs are possible contaminants at this Site.

7.5.4 Proposed RI Plan

7.5.4.1 Phase I

The area around Bldg. 1010 as well as the transformer storage area should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly stained area. In addition, one surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the former building's location and from each side of the storage area (a total of eight samples). All samples should be analyzed for propellants, PCBs, and nitrates. The asbestos burial area should remain undisturbed. This area should be posted to avoid health and safety risks that could arise if the area is excavated.

7.5.4.2 Phase II

If contamination is found, additional surface soil sampling may be required to determine its extent. Soil borings may be required for contaminated areas identified during Phase I. Samples should be collected from the borings; at least two samples should be collected from each boring. The samples should be analyzed for contaminants identified during Phase I.

7.6 SITE 111 — BUILDINGS 454 AND 455, PROPELLANT BAG FILLING AREA

7.6.1 Site History

The Site is located on Sixteenth Avenue about 180 m (600 ft) south of Picatinny Lake (Fig. 7.6). Building 454, built in 1941, has hollow-tile and concrete walls and a corrugated asbestos roof; it covers an area of 2,074 m^2 (22,320 ft^2). During interviews, PTA personnel reported that the building was used for propellant bag filling. Propellant powder was loaded into bags, which were shaken before they were sewed. It was reported that the bags often fell on the floor and that propellant dust and grains were spilled. The floor was swept up during each shift.

Building 455 was built in 1930 with hollow-tile walls and a corrugated iron roof. The building occupies an area of 1,590 m^2 (17,110 ft^2). In the early 1970s, it was used as a leather and textile plant (PTA 1971). It is now used for propellant bag filling.

7.6.2 Geology and Hydrology

The Site is situated at the foothill of an unnamed mountain in the southwest portion of PTA. It is covered by a layer of Quaternary deposits more than 12 m (40 ft) thick (Lacombe et al. 1986). Probably, the deposits are mainly composed of glacial till overlying Precambrian gneiss bedrock. Sand layers may be present in the till, as indicated in a nearby well log. The soil on the Site was classified as Urban Land soil (Wingfield 1976). The nature of native soil has been disturbed by land development. Fine- to coarse-grained sands may be found below the soil. The hydrological conditions at the Site are not known. Groundwater probably follows the topography and flows west toward Green Pond Brook.

7.6.3 Existing Contamination

During interviews, PTA personnel reported that double-based and triple-based propellants are handled on this Site. The bag filling operation would be expected to generate propellant dust. It was reported by PTA personnel that propellants were "dusted out" in the back of the buildings. No more information is available to ANL.

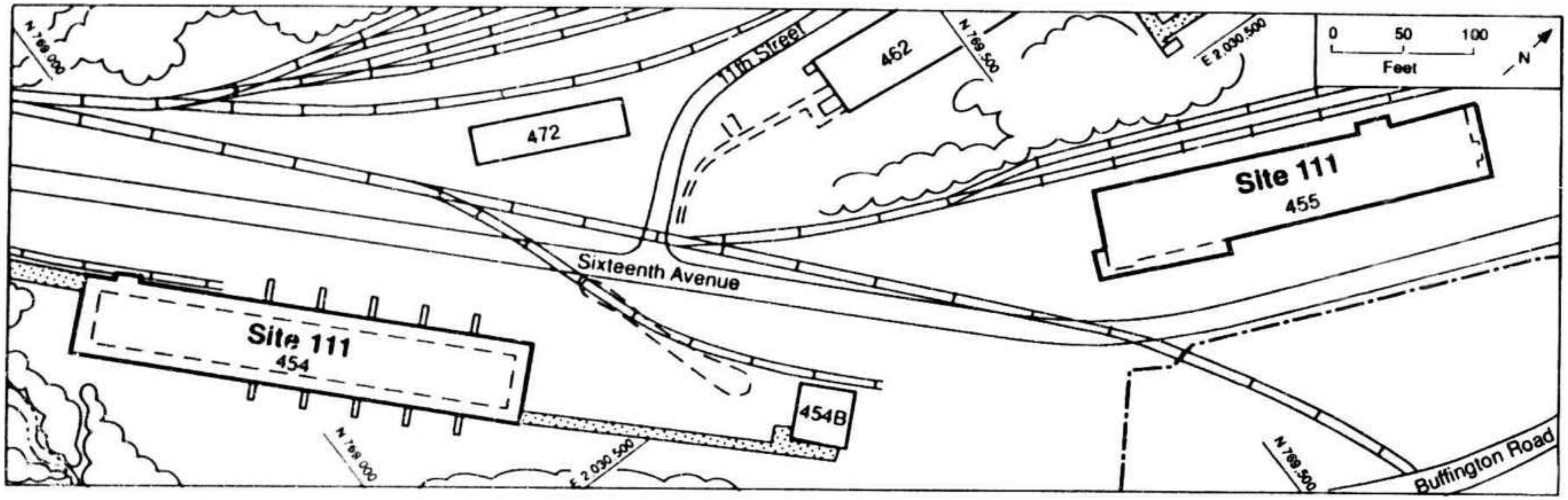

FIGURE 7.3 Layout of Site 111, Propellent Bag Filling Area at Buildings 454 and 455 (Source: Adapted from USACE 1984b)

7.6.4 Proposed RI Plan

7.6.4.1 Phase I

A field inspection should be conducted around each building to locate signs of contamination, drains, and drain outfalls. If contaminated areas are visible, one surface soil sample should be collected to a depth of 0.3 m (1 ft) from each area. If drains are found, one sediment sample should be collected to a depth of 0.6 m (2 ft) from each outfall area.

Two surface soil samples should be collected to a depth of 0.6 m (2 ft) from each loading area of Bldg. 454. In addition, one surface soil sample should be taken from each side of each building (at least eight samples). All soil and sediment samples should be analyzed for propellants. If contamination is not found in any samples, no further action is needed.

7.6.4.2 Phase II

If contamination is found in the Phase I samples, additional soil samples may be required to delineate the extent of contamination.

7.7 SITE 124 — BUILDING 166, PROPELLANT TEST

7.7.1 Site History

Building 166 is located on Kibler Road next to Bldg. 163, on the distal part of the alluvial fan at Robinson Run (Fig. 7.7). It is a brick building with a slate roof, an area of 318 m^2 (3,418 ft^2), and was built in 1942 for surveillance testing (PTA 1971). Propellants have been tested in a conditioning chamber inside the building.

7.7.2 Geology and Hydrology

The geologic settings and hydrology of the Site are similar to those of Site 104. Refer to Sec. 7.4 for information.

7.7.3 Existing Contamination

Waste propellant is being generated at a rate of 13.6 kg/mo (30 lb/mo) from propellant tests. The waste is stored in red cans, which are placed on the concrete floors inside the building (Solecki 1989c). At present, there are no data regarding propellant contamination of groundwater, surface water, or sediments on the Site.

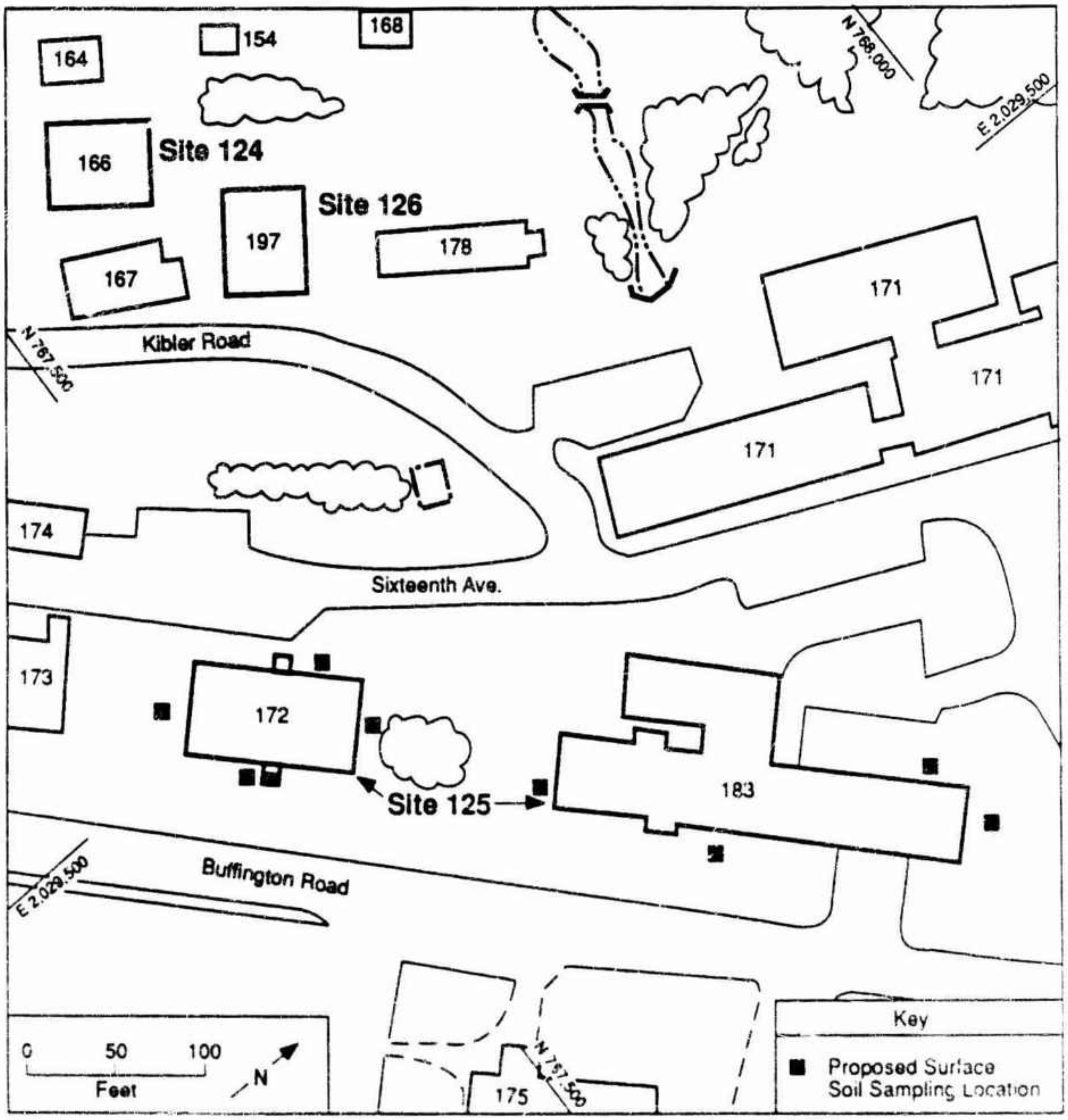

FIGURE 7.7 Layout of Site 124, Building 166; Site 125, Buildings 172 and 173; and Site 126, Building 197 (Source: Adapted from USACE 1984b)

7.7.4 Proposed RI Plan

7.7.4.1 Phase I

A field inspection should be conducted within and around the building to locate areas with signs of contamination. One surface soil sample should be collected to a depth of 0.3 m (1 ft) for each area identified outside the building. The samples should be analyzed for propellants and explosives. A composite sample should be prepared from three soil samples (each to a depth of 0.15 m [6 in.]) taken from three areas near the PCB transformer, and analyzed for PCBs. If contamination is not found in the samples, no further RI action is needed.

7.7.4.2 Phase II

If soil contamination is found, a soil boring should be drilled to the water table at each contaminated area. Soil samples should be taken from each boring and analyzed for explosives and propellants.

7.8 SITE 125 -- BUILDINGS 172 AND 183, OFFICE BUILDING AND LUBRICANT TESTING AREA

7.8.1 Site History

The Site, located in the vicinity of Buffington Road and Farley Avenue, lies on an alluvial fan created by Robinson Run (Fig. 7.7). Building 172, built in 1942, has an area of 1,454 m^2 (15,650 ft^2) and has been used for administration. Building 183 was built in 1945 as a laboratory for metal testing. The building was listed in 1971 as a nonmetallic material facility (PTA 1971).

7.8.2 Geology and Hydrology

The Site is situated on a gently sloping alluvial fan, about 245 m (800 ft) from the main stream of Green Pond Brook. The material underlying the Site is expected to be sands and gravels resting directly on bedrock. From a geophysical survey (Lacombe et al. 1986), the fan deposit is considerably less than 100 ft thick. The bedrock underlying the Site probably consists of Cambrian Leithsville dolomite and/or Hardyston Quartzite.

The fan deposit and bedrock form two aquifers under the Site. Their hydrologic connectivity is not clear. Groundwater movement through the bedrock aquifer relies on solution channels and fractures in the bedrock.

The groundwater flow direction of the alluvial fan aquifer is estimated as following topography towards Green Pond Brook. Because of the coarse texture of the fan deposit. the hydraulic conductivity would be high.

7.8.3 Existing Contamination

No contamination data were collected for the Site. During interviews with PTA personnel, it was reported that Bldg. 172 may have been contaminated in the past. No data are available regarding the type of the contaminant. For Bldg. 183, the wastes generated from current lubricant testing and chemicals with expired lifetimes include 30 L/yr (8 gal/yr) of waste lubricant, 30 L/yr (8 gal/yr) of waste adhesive, 38 L/yr (10 gal/yr) of waste solvent, and 57 L/yr (15 gal/yr) of acid (Solecki 1989c). Wastes are placed on benches inside the building.

7.8.4 Proposed RI Plan

7.8.4.1 Phase I

A field survey should be conducted around the buildings to locate areas with signs of contamination. One surface soil sample should be collected to a depth of 0.3 m (1 ft) in the center of each located area of soil contamination. One surface soil sample should be collected from each side of Bldgs. 183 and 172 (eight samples, see Fig. 7.7). All Phase I samples should be analyzed for TCL semivolatiles, TCL metals, nitrates, and sulfates. A composite sample should be prepared from three soil samples (each to a depth of 0.15 m) taken from three areas near each of the two PCB transformers in and near Bldg. 183 and analyzed for PCBs (a total of two composite samples). If contamination is not found, no further RI action is needed.

7.8.4.2 Phase II

If contamination is found in the Phase I results, additional soil and groundwater sampling will be needed to determine the extent of the contamination. The types and locations of the samples depend on the results.

7.9 SITE 126 — BUILDING 197, PROPELLANT TESTING

7.9.1 Site History

Building 197, located on Kibler Road next to Site 124, is on the distal part of the alluvial fan of Robinson Run (Fig. 7.7). Built in 1956 for surveillance testing, it is a brick building with a composition-shingle roof and covers an area of 317.5 m^2 (3,418 ft^2). Propellant has been tested in a conditioning chamber inside the building.

7.9.2 Geology and Hydrology

The geologic settings and hydrology of the Site are similar to those of Site 104. Refer to Sec. 7.4 for information.

7.9.3 Existing Contamination

The waste generated is from propellant testing in a conditioning chamber. About 5 lb/mo of propellant waste is generated. The waste is collected and stored in red cans inside the building (Solecki 1989c).

7.9.4 Proposed RI Plan

7.9.4.1 Phase I

A field inspection should be conducted around the building to locate areas with signs of contamination. One surface soil sample should be collected to a depth of 0.3 m (1 ft) from each identified area outside the building. The samples should be analyzed for propellants. If contamination is not found in the samples, no further RI action is needed.

7.9.4.2 Phase II

If contamination is found in the surface soil samples, one soil boring should be drilled in each area of surface soil contamination. Soil samples should be taken from each boring and analyzed for the contaminants found in the surface soil.

7.10 SITE 138 — BUILDINGS 404, 407, AND 408, CHEMICAL LABORATORY AND PROPELLANT PLANTS

7.10.1 Site History

The Site is located close to the intersection of Sixteenth Avenue and Ninth Street (Fig. 7.8) in Green Pond Brook valley. Building 404, built in 1906, is a chemical laboratory reportedly used to test (burn) propellants. It has brick and tile walls and a corrugated galvanized iron roof; it covers an area of 533 m^2 (5,731 ft^2). Building 407 occupies an area of 1,953 m^2 (21,026 ft^2); it has concrete walls and a corrugated asbestos roof. During interviews, PTA personnel reported that Bldg. 407 was used as a chemical laboratory and then as an energetics laboratory at which propellants were manufactured. Building 408, built in 1920, was a nitration building. It covers an area of 572 m^2 (6,157 ft^2), and it has hollow-tile walls and roll roofing. It was reported that Bldg. 408 has been used for explosive melt casting and chemical synthesis operations. Now, it is reportedly used for chemical storage.

7.10.2 Geology and Hydrology

The Site is situated at the foothill of an unnamed mountain about 610 m (2,000 ft) southwest of Picatinny Lake. The land surface in the vicinity of the Site slopes gently toward the central valley. Otisville Series soils occupy the Site. The soils consist of well-drained deposits of gravels and sands.

The surficial deposits on the Site range in thickness from about 20 m (65 ft) near Bldg. 407 to more than 30 m (100 ft) near Bldg. 408 (Lacombe et al. 1986). They range primarily from silts to gravels of fluvial and lacustrine origins. Organic peat may be present near surface. The upper layer of the surficial deposits forms a water-table aquifer on the Site. The groundwater of the aquifer probably flows to the

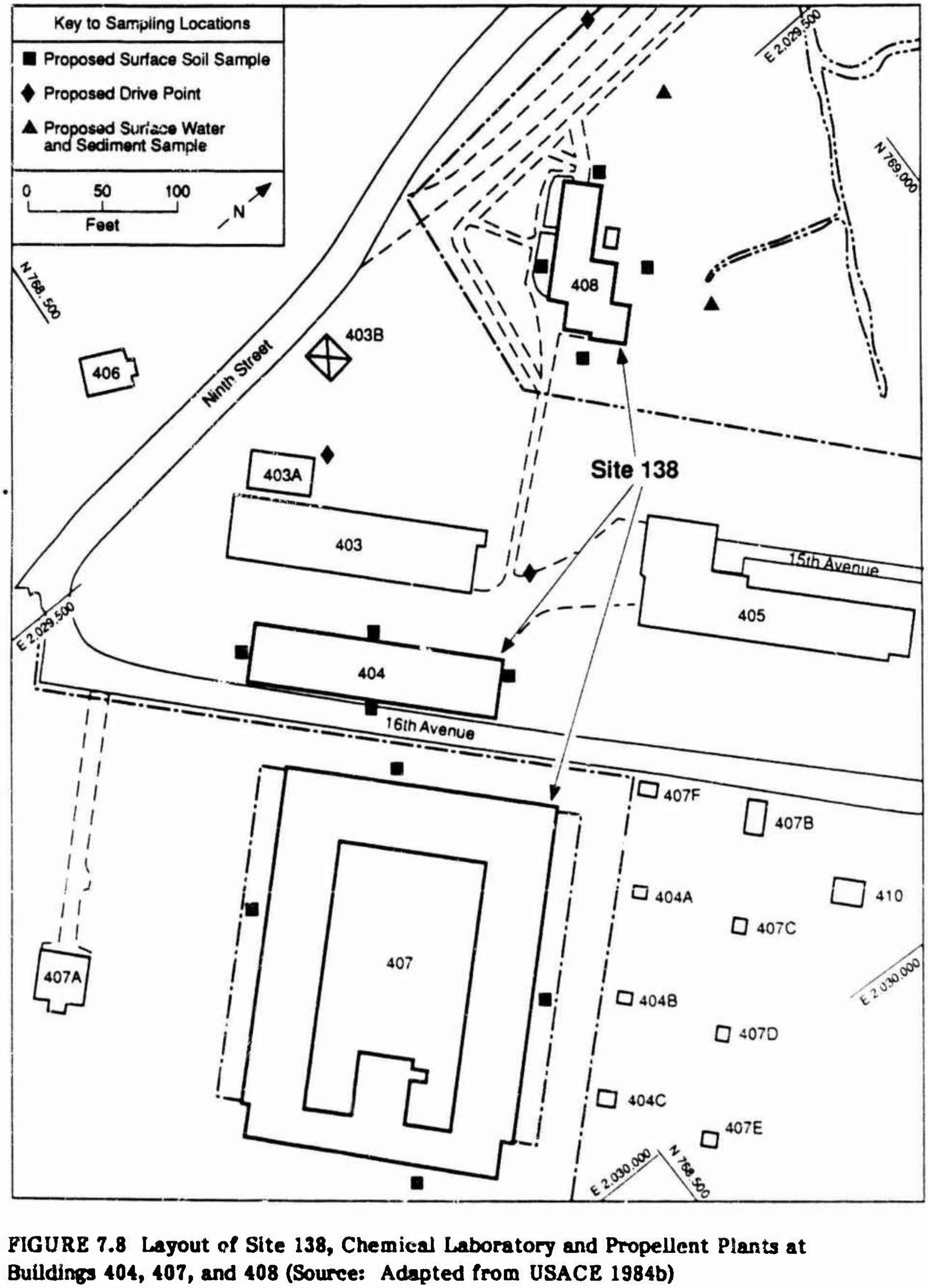

FIGURE 7.8 Layout of Site 138, Chemical Laboratory and Propellent Plants at Buildings 404, 407, and 408 (Source: Adapted from USACE 1984b)

west-northwest, toward the brook. The bedrocks underlying the surficial deposits include Cambrian Hardyston Quartzite and Leithsville dolomite.

7.10.3 Existing Contamination

During interviews, PTA personnel reported that wastewater generated from explosive melt casting and chemical synthesis operations in Bldg. 408 was discharged into a nearby swamp about 8 yr ago. Currently, chemicals used in past operations (4.1 kg of aluminum powder, 0.05 kg of potassium chlorate, and 0.05 kg of barium nitrate and unknown chemicals) are stored inside the building. The building reportedly contained settling tanks, which have not been used for the last several years.

For Bldg. 407, no contamination is known. During interviews, however, PTA personnel reported that the building may have been contaminated due to past operations. Empty aerosol cans generated from the cleaning of mechanical assemblies are stored on concrete slabs inside the building (Solecki 1989c).

In Bldg. 404, empty aerosol cans generated from the cleaning of mechanical assemblies (at a rate of 36 cans/yr) are stored on concrete slabs (Solecki 1989c).

No more information is available to ANL.

7.10.4 Proposed RI Plan

7.10.4.1 Phase I

A field inspection should be conducted around each building to locate signs of contamination, drains, and drain outfalls. If contaminated areas are visually identified, collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the buildings. If drain outfalls are located, one sediment sample should be collected from each outfall area.

To evaluate any past dumping of chemicals, one surface soil sample should be collected to a depth of 0.6 m (2 ft) from each side of each building (12 samples in all), two surface water and two sediment samples to a depth of 0.3 m (1 ft) from the nearby swamp, and two drive-point water samples from each of three different areas (a total of six water samples) downgradient from the buildings. Suggested locations are shown in Fig. 7.8. One sediment sample should be collected from each settling tank in Bldg. 408. All the above samples should be analyzed for nitrates, TCL metals, TCL volatiles, TCL semivolatiles, explosives, and propellants. A composite sample should be prepared from three soil samples (to a depth of 0.15 m [6 in.]) taken from three areas near the transformer of Bldg. 404, and analyzed for PCBs.

7.10.4.2 Phase II

If contamination is found in the Phase I samples, additional soil and surface water samples may be required to delineate the extent of the contamination. Meanwhile, two monitoring wells should be installed downgradient of the Site to monitor groundwater quality. The locations of the wells should be determined based on Phase I results. The groundwater samples should be analyzed for TCL metals, TCL volatiles, explosives, and propellants.

7.11 SITE 139 — BUILDING 424, PROPELLANT PROCESSING

7.11.1 Site History

The Site is located between Thirteenth and Fifteenth Avenues, about 305 m (1,000 ft) southwest of Picatinny Lake (Fig. 7.9). The 348-m^2 (3,749-ft^2) building, which was built in 1904, has a corrugated galvanized roof and hollow-brick tile walls (PTA 1971). Building 424 is a propellant plant. As reported by PTA personnel, the building has felting operations using nitrocellulose slurry.

7.11.2 Geology and Hydrology

The Site is situated in the central valley of PTA near an abandoned channel. It is covered by a thick layer of silts, sands, and gravels about 37 m (120 ft) thick (Lacombe et al. 1986) and overlying either Leithsville dolomite or Hardyston Quartzite. The soils on the Site belong to the Carlisle Muck Series (Wingfield 1976). The muck is a deep, nearly level, poorly drained organic soil formed in low swamp areas (Sargent 1988). High water tables and rapid permeabilities are expected to be found in soils on the Site.

A water-table aquifer, a confined sediment aquifer, and a confined bedrock aquifer probably exist at the Site. The water-table aquifer is separated from the underlying aquifers by silty materials. Hydrological connection among aquifers is possible. The water-flow directions of the three aquifers are not clear.

7.11.3 Existing Contamination

During interviews, PTA personnel reported that a slurry pipeline broke in the 1950s and spilled a greenish slurry containing ground-up single-base propellant (nitrocellulose). In decontaminating the area, pits were reportedly dug. They still may be on the Site. It was also reported that a large storage tank was used to collect wastewater in the 1960s. No more information is available to ANL.

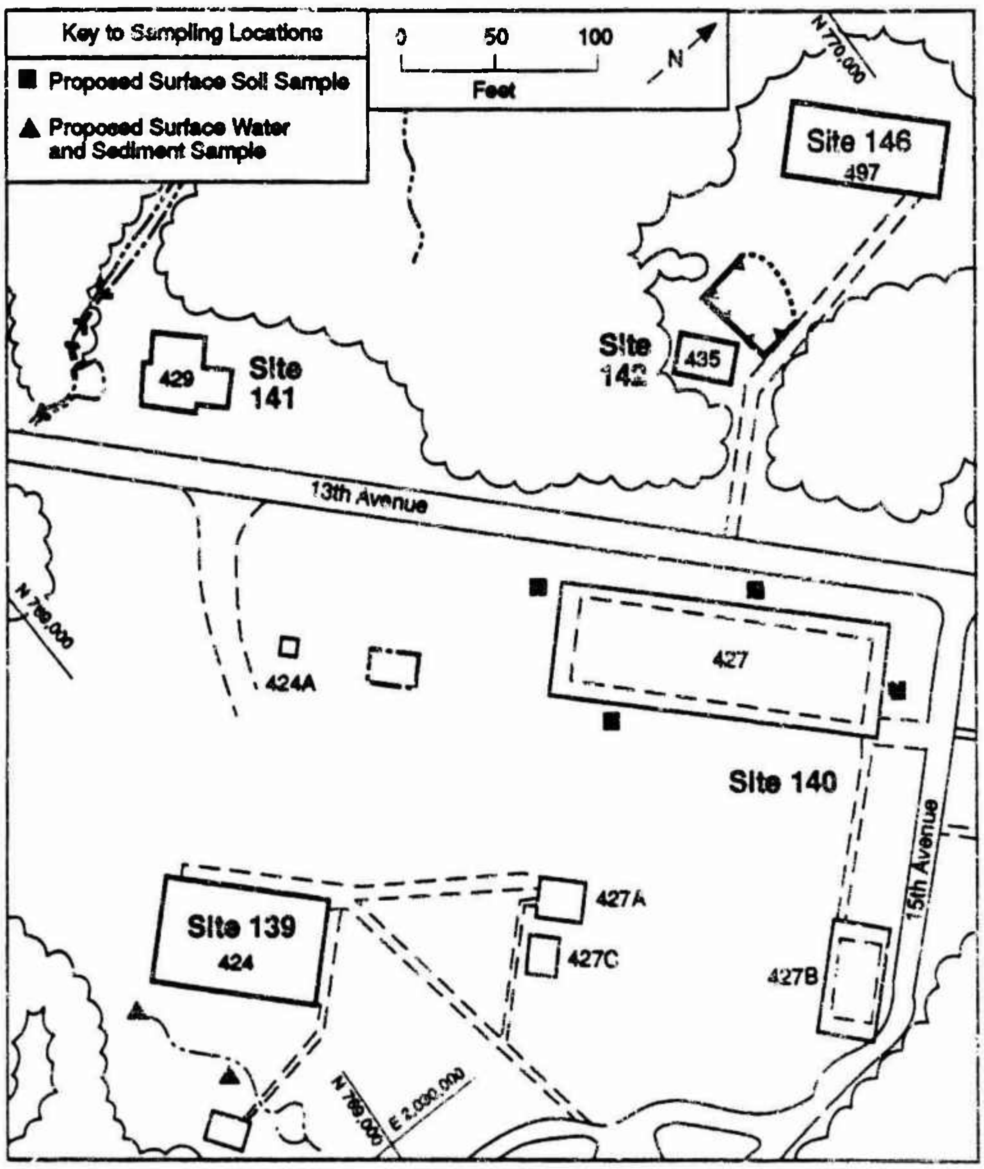

FIGURE 7.9 Layout of Site 139, Building 424; Site 140, Buildings 427 and 427B; Site 141, Building 429; and Site 142, Building 435 (Source: Adapted from USACE 1984b)

7.11.4 Proposed RI Plan

7.11.4.1 Phase I

A reconnaissance should be conducted to locate signs of contamination, the decontamination pits, and the slurry pipeline on the Site. Geophysical electromagnetic methods should be used if the pits or pipeline cannot be located by surface inspection. If the pits are not covered up, one sediment sample should be collected from each pit bottom to a depth of 0.6 m (2 ft). If the pits are covered up and have been located, one soil boring should be drilled to a depth at least 1.8 m (6 ft) below the bottom of each located pit. Soil samples should be collected from the top, pit bottom, and bottom of each boring. Two sediment samples should be taken to a depth of 0.3 m (1 ft) from the swamp behind the building. Suggested locations are shown in Fig. 7.9. All samples should be analyzed for propellants. If contamination is not indicated, no further action is needed.

7.11.4.2 Phase II

If contamination is found in the Phase I samples, one soil boring should be drilled in each area of contaminated soil or sediment sampling. Groundwater samples may be required to delineate the extent of the contamination, depending on the results.

7.12 SITE 140 — BUILDINGS 427 AND 427B, PROPELLANT PROCESSING

7.12.1 Site History

The Site is located at the intersection of Thirteenth and Fifteenth Avenues, about 210 m (700 ft) southwest of Picatinny Lake (Fig. 7.9). Building 427, built in 1938, was a 584-m^2 (6,285 ft^2) experimental building. It is now a propellant plant. Operations inside the building include extrusion of propellants, coating of propellant grains, rolling of solventless propellant, cutting of propellant, and raw material analyses (Solecki 1989c). During interviews, PTA personnel reported that the materials used in the building included energetic materials (e.g., nitrocellulose, nitroglycerine, and HMX) and solvents (e.g., acetone, ether, and alcohol).

Building 427B, built in 1939, is an 89-m^2 (960-ft^2) propellant plant. It has a corrugated galvanized iron roof and hollow-tile walls.

7.12.2 Geology and Hydrology

The Site is located in the middle of Green Pond Brook valley near the outlet of Picatinny Lake. It is covered with Quaternary deposits of silts, sands, and gravels about 30 m (100 ft) thick. The bedrock below the deposits is either Cambrian Hardyston Quartzite or Leithsville dolomite. A glacial till may be present above the bedrock.

The soil on the Site has been reworked by development of the Site. The material underlying the reworked soil is expected to be sands and gravels. They form a water-table aquifer with a high hydraulic conductivity. The water table is close to surface. Groundwater probably flows west-northwest toward the brook.

7.12.3 Existing Contamination

Two catch tanks were installed inside Bldg. 427. During interviews, PTA personnel reported that they have been used since 1981. Wastes generated from operations are stored on the conductive floor inside the building. The generated wastes consist of 91 kg/yr (200 lb/yr) of rags; 208 L/yr (55 gal/yr) of contaminated alcohol, acetone, ethyl acetate, or ether; 123 kg/yr (270 lb/yr) of scrap propellant; and 27 kg/yr (60 lb/yr) of excess propellant (Solecki 1989c).

PTA personnel reported that Bldg. 427B has an open drain around the building. The drain runs into a concrete-lined pit with pipes coming up in the bottom. It was reported that the building was flushed with a great deal of water in the last few years. The lined pit contains dirt that may be contaminated.

No more information is available to ANL.

7.12.4 Proposed RI Plan

7.12.4.1 Phase I

A field inspection should be conducted around each building to locate signs of contamination. If contaminated areas are visually identified, one surface soil sample should be collected to a depth of 0.3 m (1 ft) from each area outside the buildings.

For Bldg. 427B, two sediment samples should be collected to a depth of 0.3 m (1 ft) in the open drain around the building, and one sediment grab sample from the lined pit. The two sediment samples may be taken from any two inlets of the open drain. For Bldg. 427, one surface soil sample should be taken from each side of the building. The above samples should be analyzed for propellants and explosives. One grab sample should be collected from each catch tank and analyzed for TCL volatiles, acetone, ethyl acetate, TCL semivolatiles, propellants, and explosives. If negative results are found, no further action is needed.

7.12.4.2 Phase II

If contamination is found in the Phase I results, additional groundwater and soil samples would be required. The types and locations of the samples depend on the Phase I results.

7.13 SITE 141 — BUILDING 429, PROPELLANT CRUSHING

7.13.1 Site History

The Site is located in the main valley, on Thirteenth Avenue, about 300 m (1,000 ft) southwest of Picatinny Lake (Fig. 7.9). It contains a small laboratory, Bldg. 429, that has an area of 40 m^2 (432 ft^2) (PTA 1971). The laboratory is used to crush propellant grains for propellant property testing (Solecki 1989c). The building has a catch tank with a screened insert, according to PTA personnel during interviews. The tank has reportedly not been used since 1981.

7.13.2 Geology and Hydrology

The geology and hydrology of the Site are similar to those of Site 140 except that Quarternary deposits about 37 m (120 ft) thick overlie bedrock (Lacombe et al. 1986). Refer to Sec. 7.12 for information.

7.13.3 Existing Contamination

Waste was generated at a rate of 0.45 kg/mo (1 lb/mo) from crushing propellant grains inside the building. The catch tank in the building has not been used since 1981. The contents of the tank are not known. No more information is available to ANL.

7.13.4 Proposed RI Plan

7.13.4.1 Phase I

A field inspection should be conducted around each building to inspect for signs of contamination. If visibly contaminated areas are identified, one surface soil sample should be collected to a depth of 0.3 m (1 ft) from each area outside the buildings. All the samples should be analyzed for propellants.

One sample should be taken from the catch tank inside Bldg. 429 and analyzed for TCL metals, TCL volatiles, TCL semivolatiles, and propellants. If contamination is not found, no further action is needed.

7.13.4.2 Phase II

If contamination is found in the Phase I samples, additional samples are required to determine the extent of the contamination. The types and locations of the samples depend on the results.

7.14 SITE 142 — BUILDING 435, PROPELLANT SOLVENT MIXING

7.14.1 Site History

The Site is located on Thirteenth Avenue, in the central valley, about 245 m (800 ft) southwest of Picatinny Lake (Fig. 7.9). Building 435 is a small one-story building of 40 m^2 (432 ft^2), built in 1918 (PTA 1971). In the early 1950s, it was used for pulverizing operations for the preparation of experimental propellants. Potassium perchlorate and potassium nitrate were stored in the building. The pulverizing operations stopped in 1976 (Foster Wheeler 1988c). According to interviewed PTA personnel, the building is used to mix solvents for propellant production.

A closure plan has been prepared for Bldg. 435 (Foster Wheeler 1988c; Solecki 1989a), which will be closed according to NJDEP hazardous waste regulations because it never had interim status.

7.14.2 Geology and Hydrology

The geology and hydrology of the Site are similar to those of Site 140 except that Quarternary deposits about 37 m (120 ft) thick overlie the bedrock (Lacombe et al. 1986). Refer to Sec. 7.12 for information.

7.14.3 Existing Contamination

During interviews, PTA personnel reported that four to six big mixers in the building were washed. In the building, four 5-gal containers of potassium perchlorate are overpacked in one 85-gal drum and one 55-gal drum (ARDEC undated; Foster Wheeler 1988c). No contamination data were collected for the Site.

7.14.4 Closure Plan

The revised RCRA closure plan for the building (Solecki 1989a; Foster Wheeler 1988c) includes the removal of hazardous wastes. The equipment will be thoroughly washed with hot water, steam-cleaned, removed from the building, flashed off at a burning ground to remove residual contaminants, and then be disposed of as scrap. During the closure, two chip samples and two wash or condensate grab samples will be collected and analyzed for priority pollutant metals (Fig. 7.10).

7.14.5 Proposed RI Plans

The proposed phased sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of the building not be possible, the sampling plan described below may have to be modified.

7.14.5.1 Phase I

A field inspection should be conducted around Bldg. 435 to locate signs of contamination and drain outlets. If contaminated areas are visually identified, one surface soil sample should be collected to a depth of 0.3 m (1 ft) from each area outside the building. Also, one sediment sample should be collected from the outlet of each located building drain and analyzed for propellants, nitrates, chlorides, ethyl acetate, and acetone. These are the potential chemicals expected to be found because of the past activities of the Site.

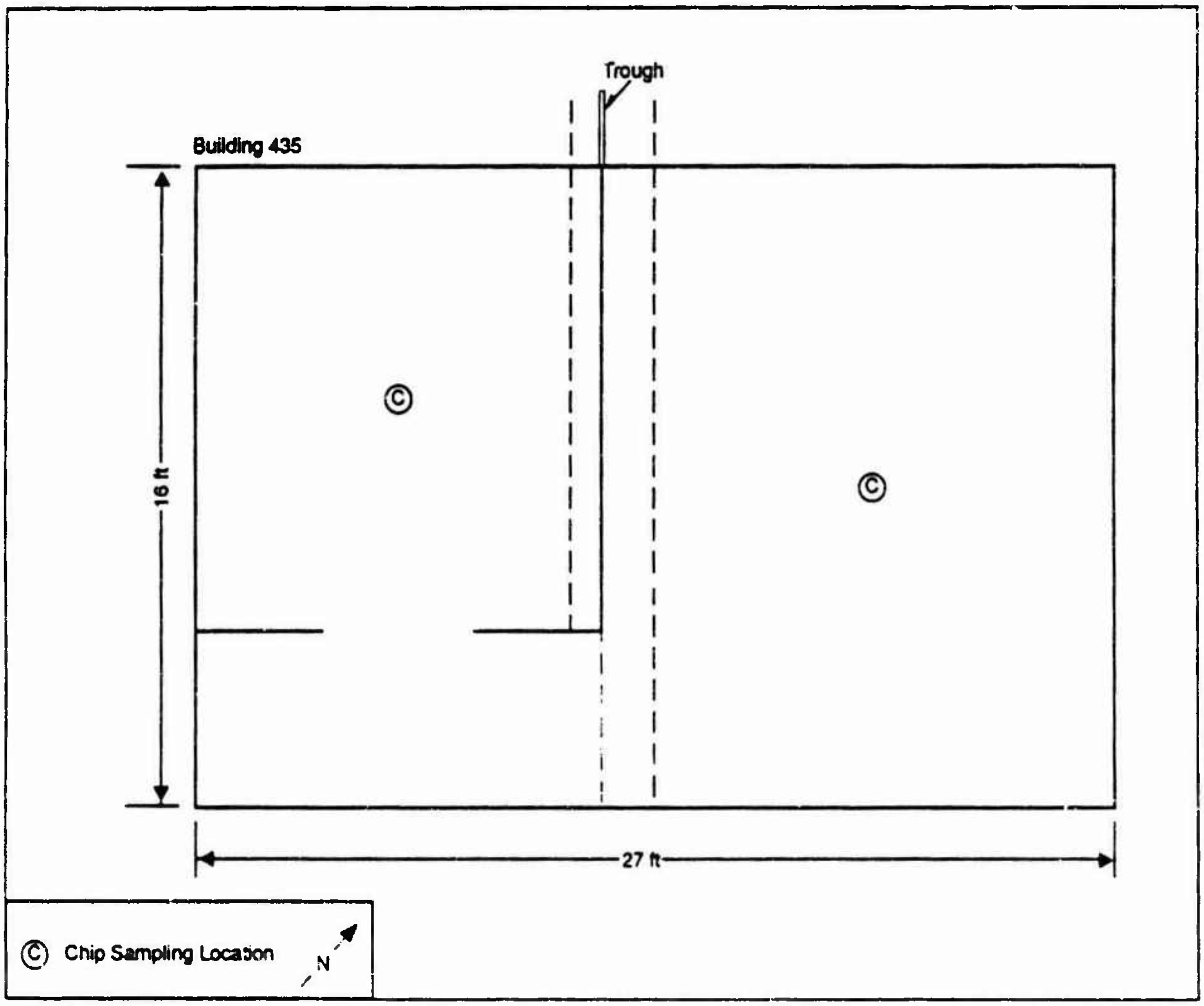

FIGURE 7.10 Closure Sampling Locations for Building 435 (Source: Adapted from Foster Wheeler 1988b)

7.14.5.2 Phase II

If contamination is found in the Phase I samples, additional soil and water samples may be required to determine the extent of the contamination. The types and locations of the samples depend on the results.

7.15 SITE 143 — BUILDING 436, PROPELLANT PROCESSING

7.15.1 Site History

The Site, which includes Bldg. 436, is located on Thirteenth Avenue, in the central valley, about 120 m (400 ft) southwest of Picatinny Lake (Fig. 7.11). The

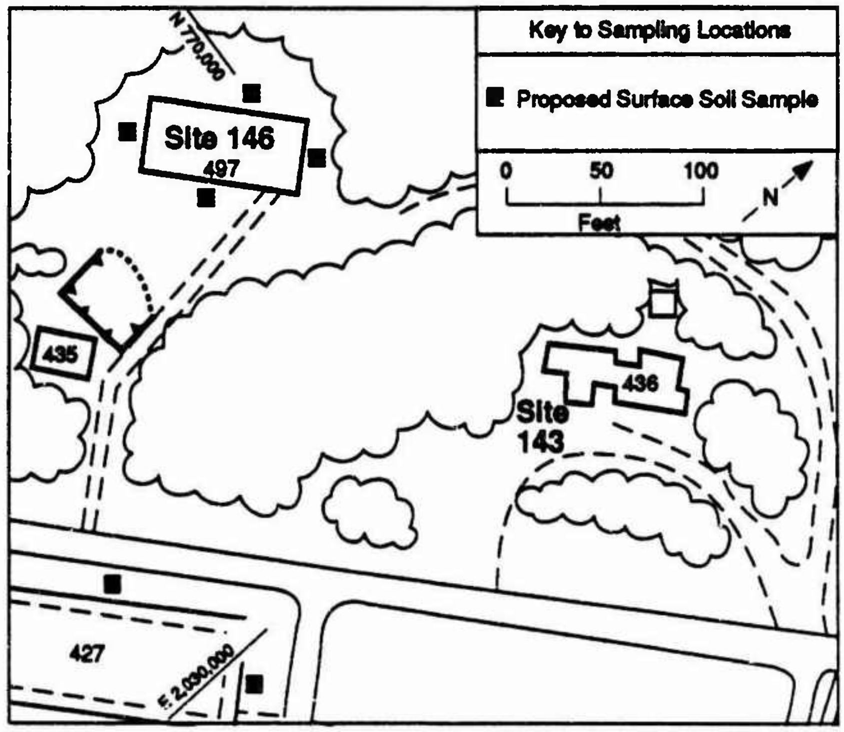

FIGURE 7.11 Layout of Site 143, Building 436, and Site 146, Building 497 (Source: Adapted from USACE 1984b)

building, built in 1948, has a corrugated asphalt-protected metal roof and hollow-tile walls. The building is used as a propellant processing plant.

7.15.2 Geology and Hydrology

The geology and hydrology settings of the Site are similar to those of Site 140. Refer to Sec. 7.12 for information.

7.15.3 Existing Contamination

No contamination data are available for the Site. The waste generated from propellant mixing in the building includes 114 kg/yr (25 lb/yr) of contaminated rags and 946 L/yr (25 gal/yr) of contaminated solvent. The solvent is reused in Bldg. 427. No more information is available to ANL.

7.15.4 Proposed RI Plan

7.15.4.1 Phase I

A field inspection should be conducted inside and around Bldg. 436 to locate signs of contamination and drains. If contaminated areas are visually identified, one surface soil sample should be collected to a depth of 0.3 m (1 ft) from each area outside the building. One sediment sample from the outfall of each drain, if it can be found, should be collected to a depth of 0.3 m (1 ft). All the samples should be analyzed for propellants. If contamination is not found, no further action is needed.

7.15.4.2 Phase II

If contamination is found, additional samples may be required to determine the extent of the contamination. The types and locations of the samples depend on the Phase I results.

7.16 SITE 144 — BUILDING 462, PROPELLANT FINISHING

7.16.1 Site History

Building 462 is located on Eleventh Street, about 180 m (600 ft) southwest of Picatinny Lake (Fig. 7.12). The building, with an area of 664 m^2 (7,143 ft^2), was built in 1942. It has hollow-tile walls and a corrugated asbestos roof. It is used for research and development of energetic materials (PTA 1988b). In the past, it was designated as a solventless propellant finishing plant (PTA 1975).

7.16.2 Geology and Hydrology

Building 462 is situated near an old channel, at the foothill of the unnamed mountain in the southwestern part of PTA. The Site probably was covered by a fluvial deposit of sands and gravels, overlying a glacial till and then either Hardyston Quartzite or Leithsville dolomite. The soil on the Site has been reworked because of land development.

The fluvial deposit probably forms a surface water aquifer. The hydraulic conductivity is estimated as moderate to high. Groundwater probably flows towards the main valley.

7.16.3 Existing Contamination

In Bldg. 462, wastes were generated from research and development of energetic materials. They include 91 kg/mo (200 lb/mo) of contaminated paper towels, rubber

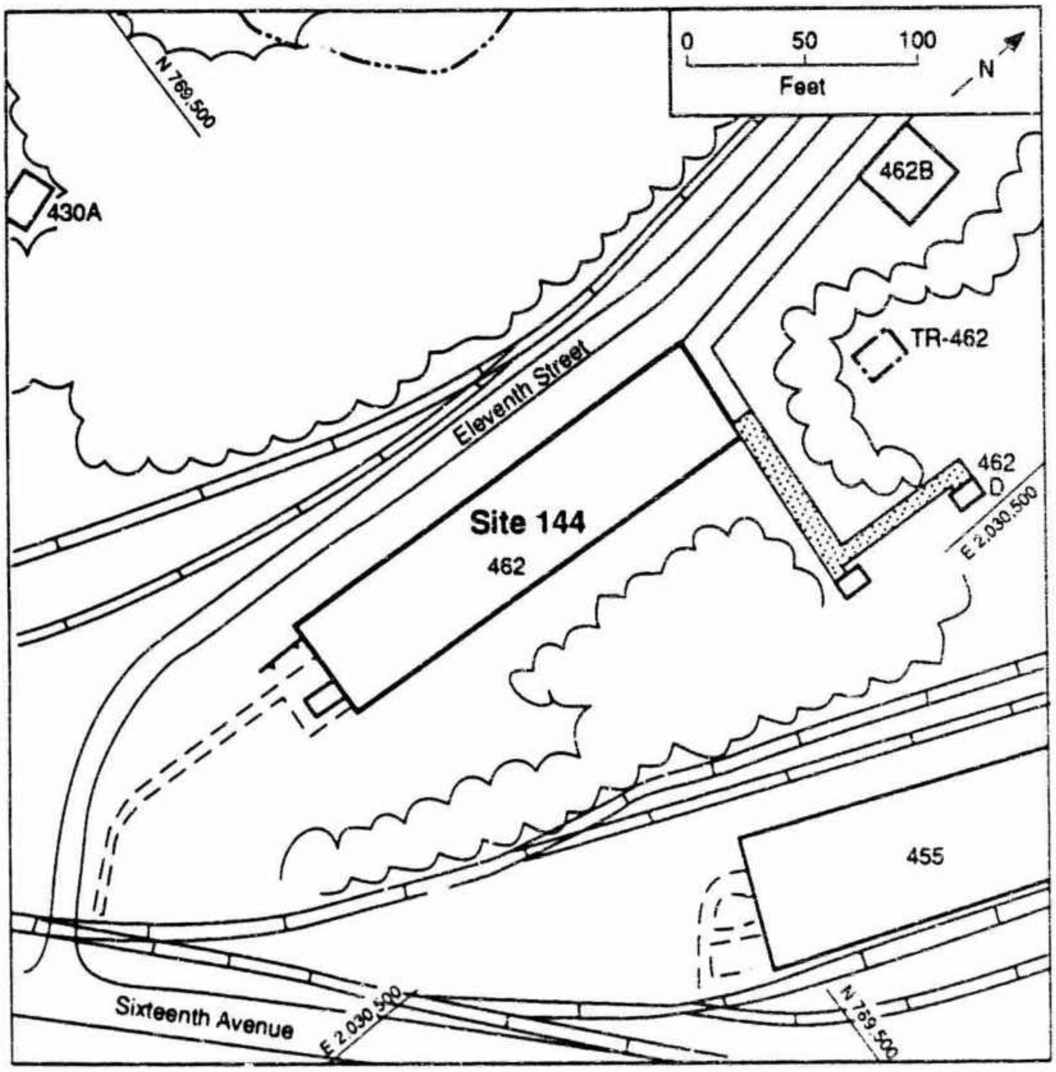

FIGURE 7.12 Layout of Site 144, Propellent Processing at Building 462 (Source: Adapted from USACE 1984b)

gloves, and plastic hardware; 227 kg/yr (50 lb/yr) of scrap propellant and explosive; and 58 L/yr (15 gal/yr) of solvents contaminated with explosives (Solecki 1989c). The wastes were stored in cans placed under water.

7.16.4 Proposed RI Plan

7.16.4.1 Phase I

A visual field inspection should be made to locate signs of contamination outside the building and any drains or drain outfalls. The waste cans should be inspected for leaks. One soil sample should be collected to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the buildings. One sediment sample should be collected from the outfall of each located drain or drain outfall. All the above samples should be analyzed for explosives and propellants. If contamination is not indicated, no further action is needed.

7.16.4.2 Phase II

If contamination is found in the outfalls of any drains, two monitoring wells should be installed in two different areas downgradient of the building and the well sampled quarterly for two quarters. If contamination is found in the soil samples, then additional surface or subsurface soil samples may be needed.

7.17 SITE 145 — BUILDING 477, EXPLOSIVE AND PROPELLANT MIXING AREA

7.17.1 Site History

The Site is located near Green Pond Brook at the intersection of Thirteenth Avenue and Ninth Street (Fig. 7.13). Building 477 was built in 1945. It occupies an area of 467 m^2 (5,032 ft^2).

According to interviewed PTA personnel, Bldg. 477 was used for the mixing and drying of explosives and propellants and the mixing of pyrotechnics. In the 1971 master plan of PTA (PTA 1971), the building is listed as a medium-caliper projectile loading plant. At present, the building is reportedly used as a laboratory.

7.17.2 Geology and Hydrology

The Site is in the middle of Green Pond Brook valley near the outlet of Picatinny Lake. The Quaternary deposits on the Site are about 37 m (120 ft) thick (Lacombe et al. 1986) and underlain by either Hardyston Quartzite or Leithsville dolomite. The deposits probably include sands and gravels near surface, interbedded sands and silts and then a till below.

Soil on the Site belongs to the Carlisle Series (Wingfield 1976). The soil is characterized by a high organic content. Because of low elevation, the soil is poorly drained.

Near-surface sands and gravels form a water-table aquifer. The water table is expected to be very shallow. Groundwater probably flows toward a nearby brook. The hydraulic conductivity of the aquifer is estimated as moderate to high.

7.17.3 Existing Contamination

PTA personnel reported that, in the past, wastewater from hosing down dusts and the cleaning of machines and walls was sand-filtered and discharged. The building was reportedly washed down every day. Small (quart) quantities of dumping behind the building were reported by PTA personnel.

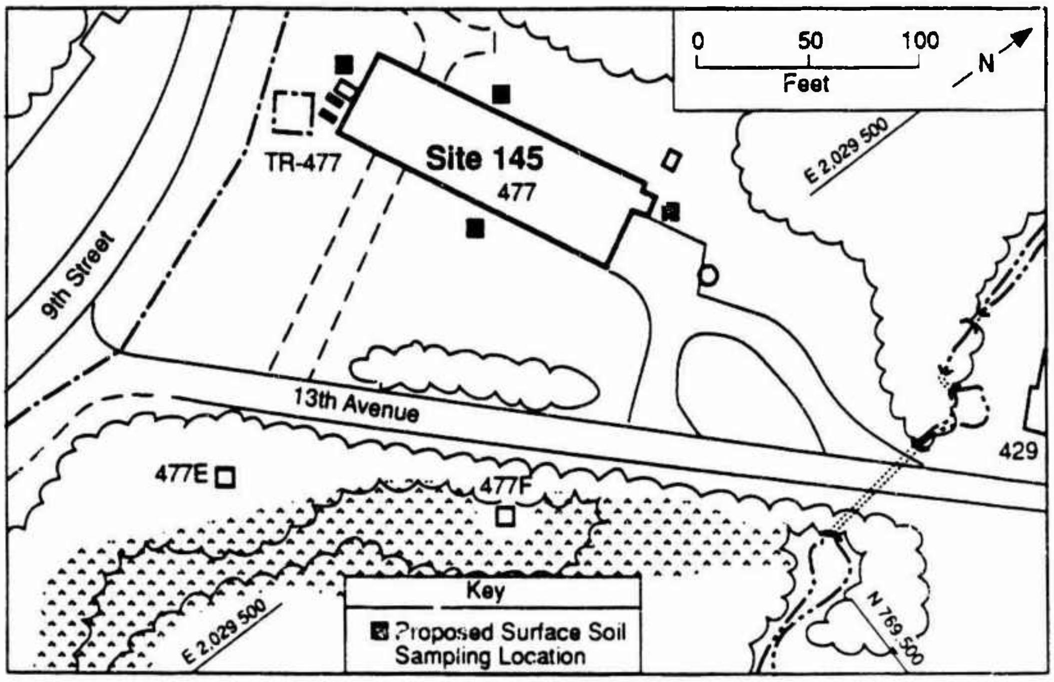

FIGURE 7.13 Layout of Site 145, Propellent Mixing Area at Building 477 (Source: Adapted from USACE 1984b)

Currently, the waste generated in the building from propellant testing includes 45 kg/mo (10 lb/mo) of propellant and 114 kg/mo (25 lb/mo) of residue material (Solecki 1989c).

7.17.4 Proposed RI Plan

7.17.4.1 Phase I

A visual field inspection should be made to locate signs of contamination, the reported dump areas, any sand filters inside or outside the building, drains, and drain outfalls. One soil sample to a depth of 0.3 m (1 ft) should be collected from each visibly contaminated area and each dump area outside the buildings. If the reported sand filter can be located, one sediment sample should be collected from the bottom of the sand filter. Two sediment samples should be collected to a depth of 0.3 m (1 ft) from each drainage area receiving filter effluent. One sediment sample should be collected from the outfall of each drain, if present. One surface soil sample should be collected to a depth of 0.6 m (2 ft) from each side of the building. All samples should be analyzed for explosives, propellants, and TCL metals. If contamination is not indicated, no further action is needed.

7.17.4.2 Phase II

If any of the sediment samples collected from any filter effluent areas or drains shows significant contamination, one well should be installed between the building and the brook. Water samples should be collected quarterly for two quarters and analyzed for contaminants found in the Phase I samples. If the soil samples show significant contamination, additional surface and subsurface soil samplings may be needed.

7.18 SITE 146 — BUILDING 497, POWDER PRESSING

7.18.1 Site History

The Site is located near Green Pond Brook, about 245 m (800 ft) from the outlet of Picatinny Lake (Fig. 7.11). Building 497 has roll roofing and concrete-asbestos board walls. It occupies an area of 190 m^2 (2,044 ft^2) (PTA 1971). The building was built in 1956 for use as a mix house and was listed as a propellant plant in 1971 (PTA 1971). Powder pressing operations are reported by PTA personnel to occur in the building.

7.18.2 Geology and Hydrology

The geology and hydrology settings on the Site are similar to those of Site 95. Refer to Sec. 8.3 for information.

7.18.3 Existing Contamination

There is little information regarding the nature and extent of contamination in the Site, although PTA personnel reported that the building at one time sustained a major explosion. No more information is available to ANL.

7.18.4 Proposed RI Plan

7.18.4.1 Phase I

A field inspection should be conducted to locate signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in) from each side of the building, and, if possible, one soil sample should be collected from each of two locations under the building. Suggested sampling locations are shown in Fig. 7.11. One sediment sample should be taken from each ditch or drain outfall (if any exist) around the building, and also from any drainage area receiving effluent from the building. The soil and sediment samples should be analyzed for propellants. If contamination is not indicated, no further action is needed.

7.18.4.2 Phase II

If significant contamination is found in the Phase I samples, additional sampling to determine the extent of the contamination would be needed. Their locations and types depend on the results.

8 AREA G: DRMO YARD AND SURROUNDINGS

8.1 INTRODUCTION

This Area contains seven Sites located near the DRMO Yard. Soil contamination with petroleum hydrocarbons is likely in this Area, which is located next to Green Pond Brook. Other potential contaminants include metals and PCBs.

8.2 SITE 31 — BUILDINGS 314 AND 314B-314E, DEFENSE REUTILIZATION AND MARKETING OFFICE

8.2.1 Site History

Site 31 is located in the southwestern portion of the Arsenal, north of Farley Avenue, about 25 ft from Green Pond Brook. Figure 8.1 gives the Site location. All materials declared excess are collected at the DRMO and offered for public sale before disposal. Excess materials include a wide variety of items such as vehicles, used batteries, scrap metal, and office equipment. Building 314 is the DRMO office; Bldgs. 314B, C, D, and E are used for storage. Available information dates the operation back to 1955.

Most of the outdoor storage area is around Bldg. 314 and is paved with asphalt. A bermed containment area, which would prevent runoff to surrounding soil, was not observed. In October 1980, a contractor removed ten transformers and six capacitors containing PCBs. Since some of the items leaked, it was necessary to clean the storage yard. The same report states that the cleanup complied with NJDEP regulations (Ludemann et al. 1981).

8.2.2 Geology and Hydrology

The Arsenal has been characterized; however, there is limited information regarding specific geology and hydrology at Site 31. The bedrock formation directly underlying the site is Green Pond Conglomerate.

Soils are classified as the Otisville Series. Otisville soils are deep, gently sloping to steep, excessively drained soils formed in assorted gravelly and sandy outwash deposits that have a high proportion of granitic gneiss coarse fragments.

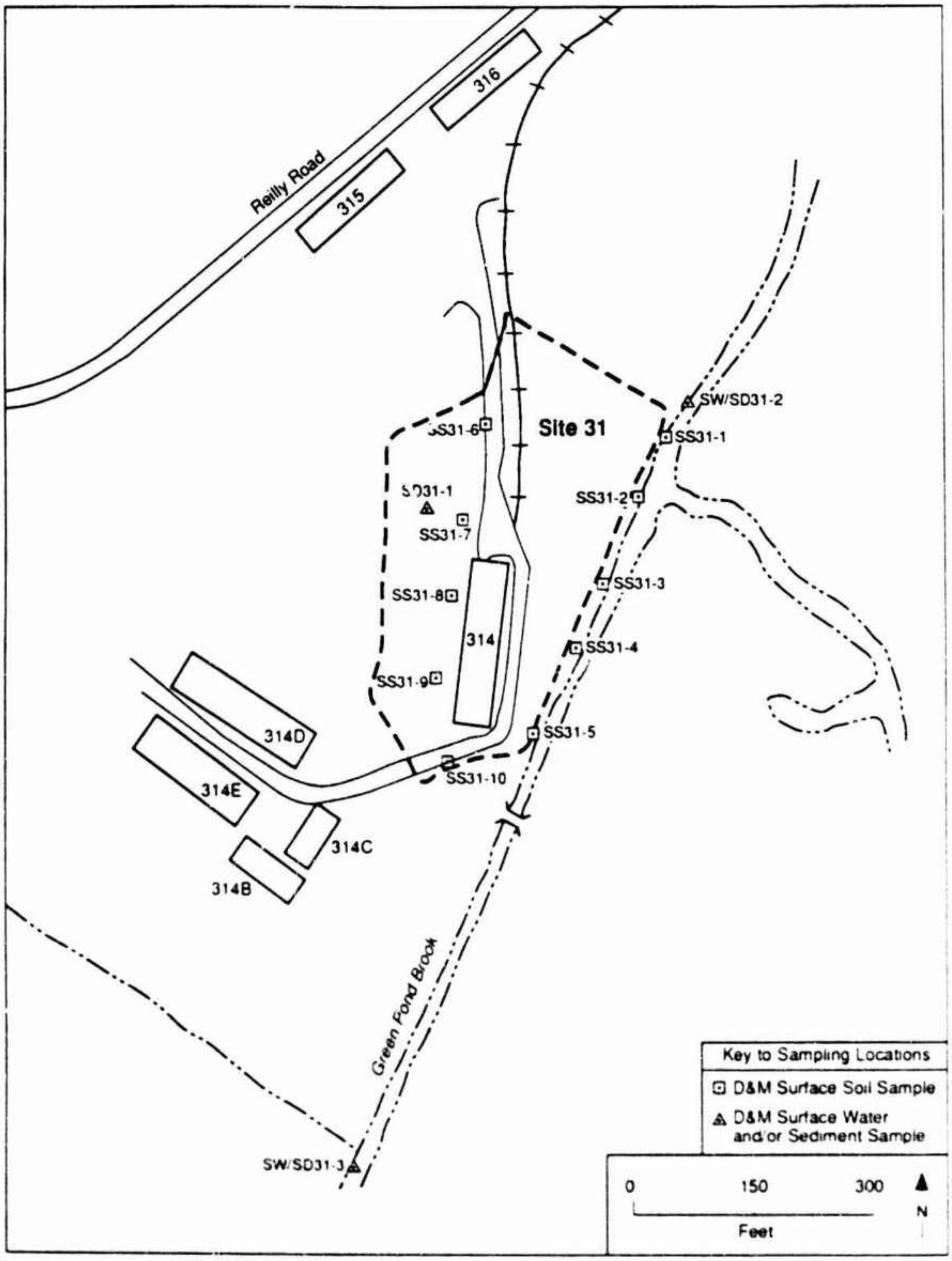

FIGURE 8.1 Layout of Site 31, the Defense Reutilization and Marketing Office at Buildings 314 and 314B-314E (Sources: Adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

8.2.3 Existing Contamination

8.2.3.1 Soil

Observations reveal significant soil discoloration along the section of the site that borders Green Pond Brook. Surface soil samples taken in 1988 showed detectable levels of mercury, arsenic, cadmium, lead, zinc, and PCBs (Dames & Moore 1989). As seen in Fig. 8.1, several sampling locations were along the brook. Table 8.1 contains selected data. Metals appear to be present in higher concentrations in samples 1-5, whereas PCBs are present in seven of the ten samples. Sediment samples contained elevated values for arsenic and lead (Table 8.2).

8.2.3.2 Water

There are no groundwater monitoring wells at this location. Surface water samples were obtained from two locations. The only significant contaminant was TCE (150 ppb) at location SW/SD31-3.

8.2.4 Proposed RI Plan

8.2.4.1 Phase I

The areas surrounding Bldgs. 314B, C, D, and E should be inspected for visible contamination. Surface soil samples 0.15-0.3 m (6-12 in.) should be collected from all stained areas. One surface soil sample should be collected from each area where wastes are loaded and handled. Samples should be screened for TCL compounds. If elevated contaminant levels are found, borings should be taken and analyzed to determine extent.

Soil borings should be drilled to the water table in order to determine the vertical extent of contamination. One boring each should be drilled at sampling sites SS31-1 through SS31-6, and SS31-10. Samples from the borings should be analyzed for all TCL parameters.

8.2.4.2 Phase II

Based on the results from the soil borings, the need for groundwater monitoring wells should be assessed.

TABLE 8.1 Selected Analytical Results for Surface Soil Samples 1-10 from Site 31[a]

Contaminant	Sample Depth (ft)	Concentration in Sample (ppm)									
		1	2	3	4	5	6	7	8	9	10
Arsenic	4.9	18.0	5.82	9.41	2.32	11.9	8.29	8.73	7.88	9.82	4.77
Barium	4.9	1,200	440	390	130	300	86.8	40.3	63.6	59.0	87.1
Beryllium	4.9	0.686	0.536	1.12	-	0.905	0.690	0.745	1.37	2.23	0.451
Cadmium	4.9	86.0	53.0	48.0	8.80	11.0	9.30	1.40	1.70	1.50	2.50
Chromium	4.9	65.0	63.0	24.0	7.90	18.0	-	8.70	4.25	11.0	18.0
Copper	4.9	-	1,100	1,900	330	680	180	34.6	46.7	44.8	>50.0
Lead	4.9	24,000	780	1,500	270	3,400	340	36.0	26.0	54.0	120
Mercury	4.9	1.40	1.50	2.80	1.20	>2.00	2.60	0.190	0.230	-	0.368
Nickel	4.9	-	11.0	-	-	15.5	11.0	14.1	-	18.0	22.7
Zinc	4.9	23,000	1,900	3,200	>400	1,100	226	62.8	59.8	67.2	174
PCB 1248	0.5	-	-	-	-	-	-	-	24.1	-	-
PCB 1254	0.5	1.74	4.61	8.57	11.3	-	6.50	-	-	-	1.92

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Dames & Moore 1989.

TABLE 8.2 Selected Analytical Results (ppm) for Sediment Samples 1-3 from Site 31[a]

Contaminant	Ditch Sample (No. 1)	Creek Samples 2	Creek Samples 3
Arsenic	12.9	5.61	-
Cadmium	5.90	4.70	-
Chromium	>5.00	16.0	-
Copper	180	>50.0	-
Lead	85.0	210	0.594
Nickel	-	23.9	-
Zinc	200	>400	-
Methylene chloride	0.080	0.056	-
Pyrene	-	0.559	-

[a]A hyphen indicates that the contaminant was not detected or was detected in trace amounts.

Source: Dames & Moore 1989.

8.3 SITES 52 AND 95 — PETROLEUM LEAK AREA (BUILDING 305) AND BUILDING 336

8.3.1 Site History

Building 305 is in the southwestern portion of the Arsenal, north of Farley Avenue, near Green Pond Brook. Figure 8.2 shows the Site location. It was built as a maintenance shop in 1948, and at one time was an ice production facility that stored brine. Available information indicates that oil was stored behind the building in 55-gal drums and that diesel fuel was stored in three tanks located in the area. Currently, it is an equipment storage building. The southern part of the building houses refrigeration units for storing photographic film and paper. Ethylene glycol is also stored there in small quantities (Anderson 1988b). Building 305 will be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

There are two primary areas of concern at Bldg. 305: (1) a swampy area of about 150 by 150 ft and (2) the area where a small retention pond was located with an adjacent drainage ditch flowing to Green Pond Brook.

Building 336 is no longer in existence. It was between Bldgs. 151 and 302. During the 1970s, it was a laundry for clothing contaminated with explosives.

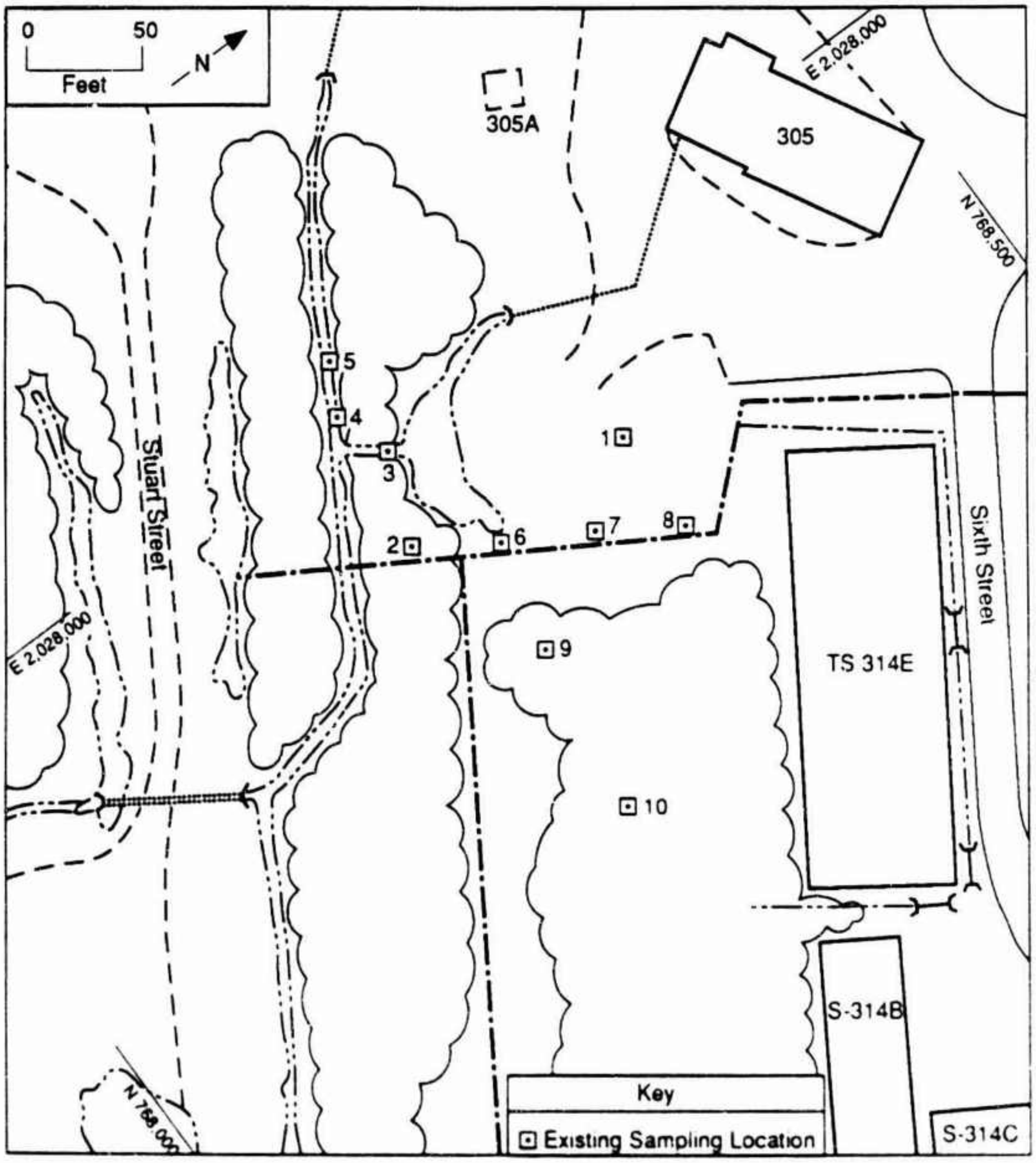

FIGURE 8.2 Layout of Sites 52 and 95, the Petroleum Leak Area (near Building 305) and Building 336 (Source: Adapted from USACE 1984b)

8.3.2 Geology and Hydrology

Picatinny Arsenal has been characterized in several studies, and limited information regarding specific geology and hydrology is available. The Site is about 0.25 mi east of Sites 21 and 37. Formations described for these Sites in Sec. 5.2.2 are also found at Sites 52 and 95 (Vowinkel et al. 1985).

Soils in the area of Bldg. 305 are classified as Otisville. The Otisville Series consists of deep, gently sloping to steep, excessively drained soils formed in assorted gravelly and sandy glacial outwash deposits that have a high proportion of granitic gneiss coarse fragments (Sargent 1988).

8.3.3 Existing Contamination

Reports of Bldg. 336 activities indicate that the wash-water holding tanks were emptied onto the ground and allowed to flow into the swamp and Green Pond Brook. It is also reported that residue from holding tanks was buried on the Site. Since the area is vegetated and swampy, airborne contaminants (i.e., particulates) are not expected.

An Army document reports that contaminated soil near Bldg. 305 was discovered and excavated in 1985 (Anderson 1988b). An EPA document reports that the first discovery was not until February 20, 1986 (Gaven 1986). Soil, surface water, and sediment from this Site were sampled by USATHAMA personnel during 1988. All samples were analyzed for total petroleum hydrocarbons, base-neutral and acid-extractable compounds, and total metals. Table 8.3 summarizes the locations and analytical parameters.

8.3.3.1 Soil

A spill of diesel fuel from one of the tanks was discovered in the swampy area. The spill has been attributed to a stopcock on one of the diesel fuel tanks, which was accidentally left open. The estimated quantity was 400 gal.

The concentration of petroleum hydrocarbons in the soil before removal was 5,972 ppm. Confirmation samples following removal of the top 0.15 m (6 in.) of soil contained 15 ppm petroleum hydrocarbons. The area was filled with crushed stone.

Soil samples taken adjacent to the pond contained 781 ppm petroleum hydrocarbons. As part of the pond cleanup, soil surrounding the pond was removed. Table 8.4 gives selected data from the most recent sampling of the area.

The EPA is drafting guidance for determining cleanup levels for total petroleum hydrocarbons released from underground storage tanks. Until this guidance is available, the EPA Office of the Underground Storage Tank Program has recommended criteria that are reasonable for use except in circumstances where drinking water quality is threatened:

- For TPH concentrations of 10-100 ppm, leave the tank in the ground.
- For TPH concentrations of 100-1,000 ppm, investigate the impact on groundwater and the potential application of MCLs.
- For TPH concentrations of greater than 1,000 ppm, take remedial action.

All of the samples contained sufficiently high levels of TPH to warrant an investigation of any impact on groundwater and the potential application of MCLs. Also, sediment sample SD52-2, taken from a ditch near the Site, contained a TPH concentration (151 ppm) that warrants investigation. Arsenic was the only other contaminant present in the soil at elevated concentrations.

TABLE 8.3 Summary of Sampling at Site 52

Sample[a]	Sample Location	Analytical Parameters
SW/SD52-1	Upstream from in-flow to brook	Petroleum screen, VOC, BNA,[b] metals
SW/SD52-2	In the brook	Petroleum screen, VOC, BNA, metals
SW/SD52-3	Adjacent to pond area	Petroleum screen, VOC, BNA, metals
SO1-5	Former swampy area	Petroleum screen, VOC, BNA, metals
SO1-5	Former pond area	Petroleum screen, VOC, BNA, metals

[a]SW denotes surface water sample, SD denotes sediment sample, and SO denotes surface soil sample. Locations and depths were not given in the source.

[b]Base-neutral and acid-extractable compounds.

Source: Moran 1988.

8.3.3.2 Water

The second area was discovered by the appearance of a black oily substance and red liquid on the surface of the pond. This contamination has been attributed to a wastewater discharge from a former laundry facility and/or waste oil dumped into the pond at least 20 years ago.

The pond water contained benzene, ethylbenzene, toluene, fluorene, phenanthrene, acenaphthene, phthalates, 1,2-DCB, and naphthalene. Samples from Green Pond Brook contained no discernable contamination. A dam was placed between the pond and the drainage ditch to prevent the contaminated water from flowing to Green Pond Brook. The pond was then dewatered, and an oil-water separator and filter system was placed at the outflow of the pond. The most recent surface water sampling showed elevated concentrations of lead (SW52-2, 212 ppb and SW52-3, 1,709.9 ppb) and chromium (SW52-3, 1,250 ppb).

TABLE 8.4 Concentrations (ppm) of TPH and Arsenic in Soil Samples from Site 52

Sample	TPH	Arsenic
S052-1	1,790	13.0
S052-2	1,170	11.0
S052-3	1,250	11.0
S052-4	530	10.0
S052-5	330	9.60
S052-6	136	-
S052-7	280	7.39
S052-8	146	-
S052-9	278	11.0
S052-10	65.0	7.10

Source: Dames & Moore 1989.

8.3.4 Proposed RI Plan

The following recommendations are based on the most recent sampling results, the lack of exact waste stream characterization, and the proximity of Green Pond Brook.

8.3.4.1 Brook Area

Phase I

The results of surface water and sediment sampling in July 1988 need to be addressed further. Results were not given for sample SW/SD52-1. Both the surface water and sediment from sampling location SW/SD52-2 contained elevated levels of contaminants. Therefore, further sampling of the brook is recommended. A hand auger should be used to collect 10 surface 0.15-0.3 m (6-12 in.) soil samples, evenly distributed across the area (if possible). The samples should be analyzed for all TCL parameters except dioxin.

Phase II

If elevated contaminant concentrations are found, soil borings should be drilled to determine the extent of the contamination. Sample SW/SD52-3 was obtained from the former pond area. Further investigation for this area is discussed in the following sections.

8.3.4.2 Swampy Area

Phase I

Based on the results of the soil samples taken in this area (Table 8.4), the extent of contamination should be investigated. Therefore, soil borings are recommended, and soil borings should be drilled to 3 m (10 ft) or groundwater, whichever comes first. They should be placed in the same areas where surface soil samples contained elevated contaminant concentrations and the former location of Bldg. 336. Samples should be obtained from the top, middle, and bottom of each boring and analyzed for TCL volatiles, TCL semivolatiles, TCL metals, and explosives. If contaminants have reached the water table, a minimum of one upgradient and three downgradient monitoring wells should be installed. All wells should be sampled for two quarters for contaminants found in the soil borings. Water levels should be obtained quarterly to establish gradients in the area.

Phase II

If the borings contain significant contaminant concentrations but indicate that contaminants have not reached the water table, the soil should be removed and disposed of in accordance with all applicable regulatory requirements. Immediately following the removal, confirmation samples should be obtained and analyzed for contaminants present in the soil borings. Groundwater monitoring should be continued if significant concentrations are found in the Phase I samples.

8.3.4.3 Former Pond Bed

Phase I

Based on the results of the soil samples taken in this area, the extent of contamination should be investigated. Therefore, soil borings are recommended, and soil borings should be drilled to 3 m (10 ft) or groundwater, whichever comes first. They should be placed in the areas where surface soil samples contained elevated contaminant concentrations. Samples should be obtained from the top, middle, and bottom of each boring and analyzed for TCL volatiles, TCL semivolatiles, and TCL metals.

Phase II

If the results from the Phase I borings show that contaminants have reached the water table, a minimum of one upgradient and three downgradient monitoring wells should be installed. All wells should be sampled quarterly for contaminants found in the soil borings. Water levels should be obtained quarterly to establish gradients in the area. After one year, the sampling parameters should be adjusted to test for contaminants found in the samples.

If the borings contain significant contaminant concentrations but indicate that contaminants have not reached the water table, the soil should be removed and disposed of in accordance with all applicable regulatory requirements. Immediately following the removal, obtain confirmation samples and analyze for contaminants present in the soil borings.

8.4 SITE 96 — BUILDINGS 301 AND 301A

8.4.1 Site History

Buildings 301 and 301A are located north of Farley Avenue near Green Pond Brook in the southwestern portion of PTA. Figure 8.3 shows the Site location. The buildings are northwest of and adjacent to Site 52, the petroleum leak area. According to PTA (1971), they were built in 1943; Bldg. 301 was originally designated as storage and Bldg. 301A as an oil house. Both buildings are made of concrete. Reportedly, hydraulic oil and paint-stripping solvent wastes were stored at each building.

8.4.2 Geology and Hydrology

Although PTA has been characterized in several studies, limited information about specific geology and hydrology at this Site is available. The Site is about 0.25 mi west of Sites 21 and 37. The bedrock formation described for these Sites in Sec. 5.2.2 are also found at this Site (Vowinkel et al. 1985). Groundwater flow is estimated to be southeast toward Green Pond Brook.

Soils in the area a Bldgs. 301 and 301A are classified as Otisville. The Otisville Series consists of deep, excessively drained sandy soil of the glacial uplands and outwash plains. The subsoil and substratum are gravelly loamy sand, gravelly sand, or very gravelly sand (Wingfield 1976; USATHAMA 1976).

8.4.3 Existing Contamination

It has been reported that hydraulic oil, paint stripper, and paint thinner were stored in 55-gal drums behind Bldg. 301. The drums leaked, contaminating the soil, and asphalt was placed over the contaminated areas.

At Bldg. 301A, an area, which is now paved over with asphalt, was saturated with waste oil. In 1986, an investigation and soil removal was conducted at the petroleum leak area near Bldg. 305. Samples taken following the removal contained only 15 ppm TPH. In July 1988, USATHAMA resampled the area south of Bldg. 305 (Fig. 8.2). Analyses showed elevated concentrations of TPH in the soil and metals in the surface water (Sec. 8.3.3) (Moran 1988).

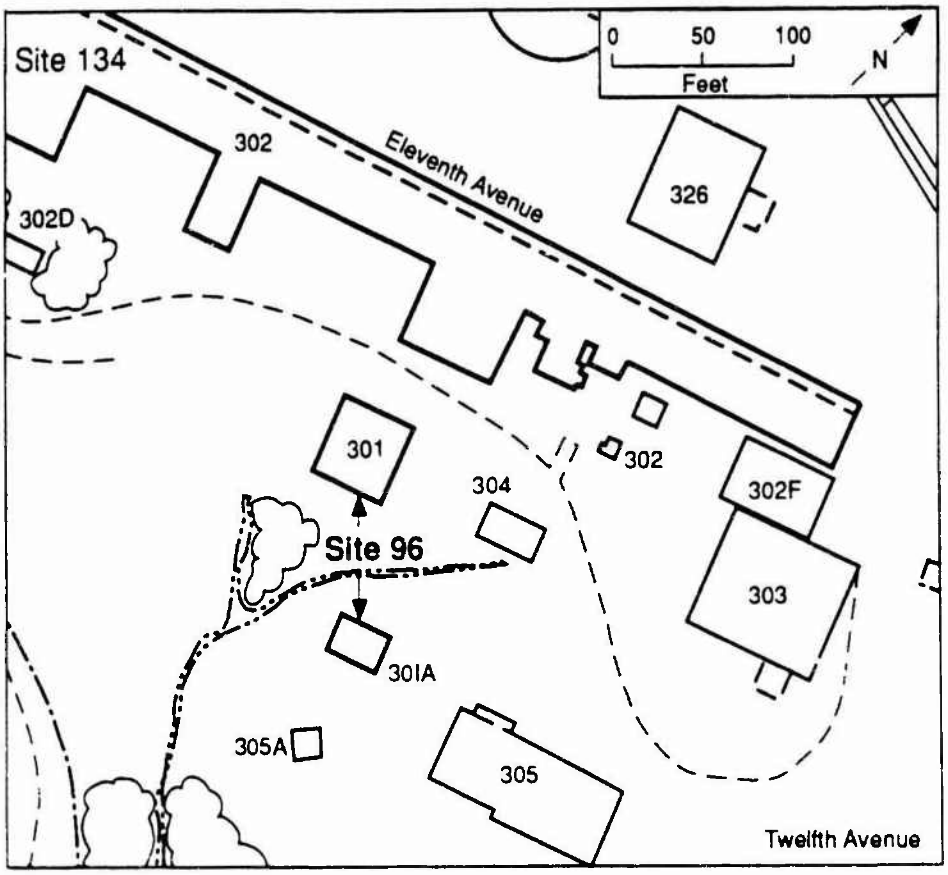

FIGURE 8.3 Layout of Site 96, Buildings 301 and 301A (Source: Adapted from USACE 1984b)

These results and numerous reports that storage of this type was common throughout this area of PTA indicate that there may be another source of contamination. Similar information has been reported for Site 134 (Bldg. 302).

8.4.4 Proposed RI Plan

Activities for this area should be coordinated with those recommended for Sites 52/95 and 134. In order to address the potential for contamination resulting from Site operations, a phased investigation is recommended.

8.4.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas to locate visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area of stained soil.

In addition to the sampling of visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from each side of the perimeter of each building, and three surface soil samples should be collected from this depth in each storage area. If the former storage areas are paved, the samples should be collected by coring through the asphalt.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, and PCBs.

8.4.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Subsurface soil samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

8.5 SITE 101 — BUILDINGS 311 AND 319, GASOLINE STATION AND STORAGE AREA

8.5.1 Site History

Buildings 311 and 319 are located beside one another near Ninth Street, between Reilly Road and Green Pond Brook in the southern part of PTA. The brook is about 200 ft southeast of the buildings. The Site details are given in Fig. 8.4. Building 311 is a small gas station. It was built in 1941. PTA personnel reported that a 10,000-gal tank designed for aboveground use was installed as an underground tank at this Site; there is no method for monitoring the volume of gasoline in the tank.

Building 319 was built in 1909 and has been used to store gasoline. It is commonly referred to as the "upper burning ground," named for its use during the 1950s.

8.5.2 Geology and Hydrology

From the generalized bedrock geology of PTA, it is estimated that the bedrock formations underlying the area are the Leithsville Formation, Hardyston Quartzite, and Precambrian gneiss. Directly underlying the Site is the Leithsville, present mostly as light- to medium-gray, microcrystalline, locally stylolithic rock to a fissile, siliceous to dolomitic micrite that is often weathered to a medium-yellow, silty clay. It contains water-bearing fractures and cavities that usually have moderate yields. Groundwater flow in this area is estimated to be south-southeast toward Green Pond Brook.

Soils in the area are classified as Urban Land. These are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

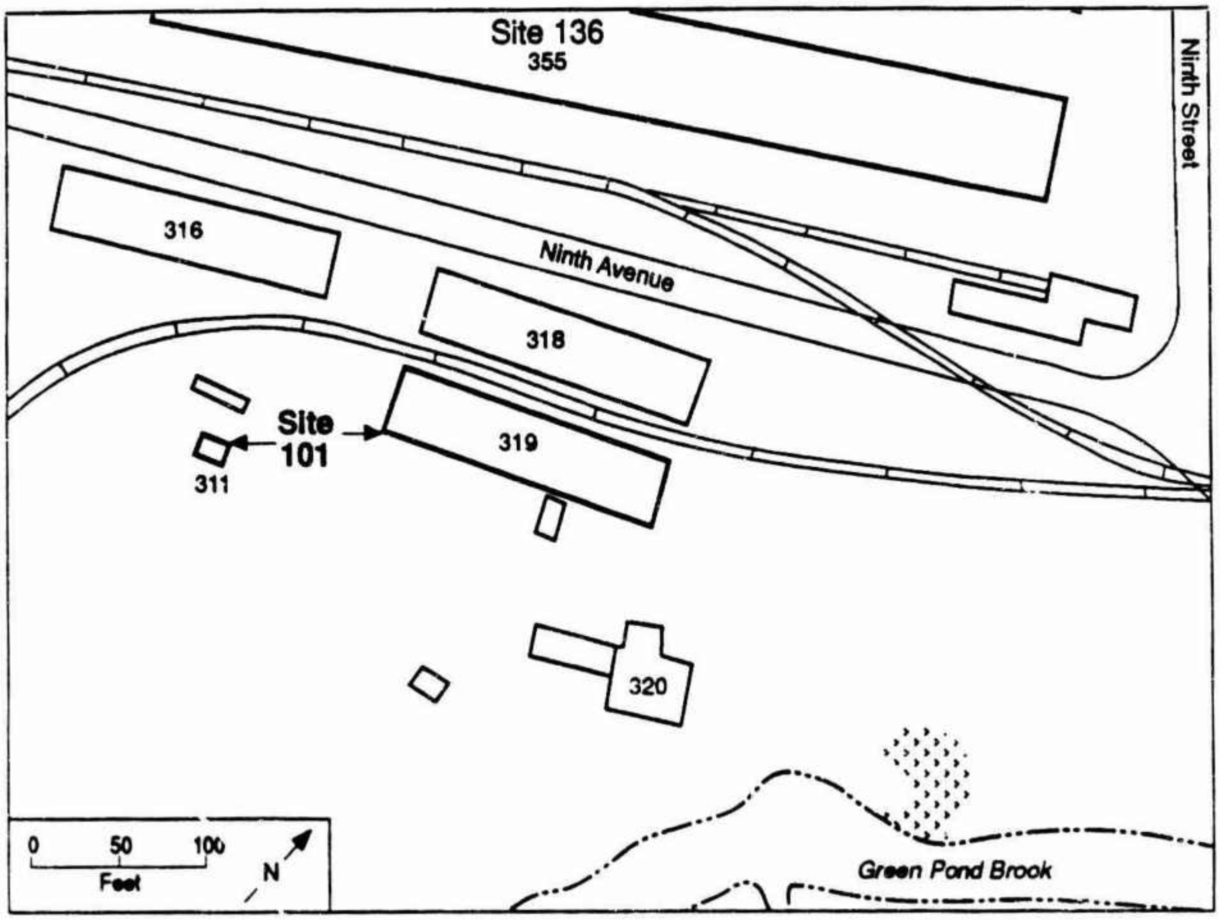

FIGURE 8.4 Layout of Site 101, Buildings 311 and 319, the Gasoline Station and Storage Area (Source: Adapted from USACE 1984b)

8.5.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported several concerns for this area. At Bldg. 311, the tank that contains gasoline is not designed for underground use, has an unstable placement, and has no volume monitoring. Reportedly, unauthorized dumping of a variety of wastes occurred in this area.

The concerns for the Bldg. 319 area are fuel storage and the past burning activities. The extent of these activities and the types of wastes disposed of in this manner are unknown; however, to conservatively approach the characterization of this Site, it can be assumed that activities were similar to those of the lower burning ground (Site 34, Sec. 2.2). The possibility exists that a similar variety of wastes were sent to the Bldg. 319 area.

In addition, these buildings are near a part of PTA (Sites 31, 52/95, 96, and 134) that has shown persistent levels of soil and surface water contamination, indicating that a source investigation is required. Based on available information, this Site is considered to have a moderate to high potential for releasing contaminants. Since the area is vegetated, particulate emissions are not expected.

8.5.4 Proposed RI Plan

Activities for this area should be coordinated with those recommended for Sites 52/95, 96, and 134. In order to address the potential for contamination resulting from Site operations, a phased investigation is recommended.

8.5.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area.

The area around Bldg. 311 should be examined for signs of disposal activities. A geophysical survey should be conducted to locate any disposal pits. If a disposal area is found, at least six surface soil samples between 0.15 and 0.3 m (6 and 12 in.) deep should be collected from the pit area.

In addition to the sampling of visibly contaminated areas and the disposal area (if it is found), at least 10 surface soil samples should be collected from the reported burning ground area.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, and TCL metals.

8.5.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

8.6 SITE 134 — BUILDING 302, SERVICE SHOPS

8.6.1 Site History

Building 302 is located north of Farley Avenue, near Reilly Road in the southwestern portion of PTA. The Site details are shown in Fig. 8.5. It is near Site 52, the petroleum leak area. According to PTA (1971), it was built in 1905 as a maintenance and service shop. A laundry also once existed on the Site, where clothing contaminated with explosives was washed.

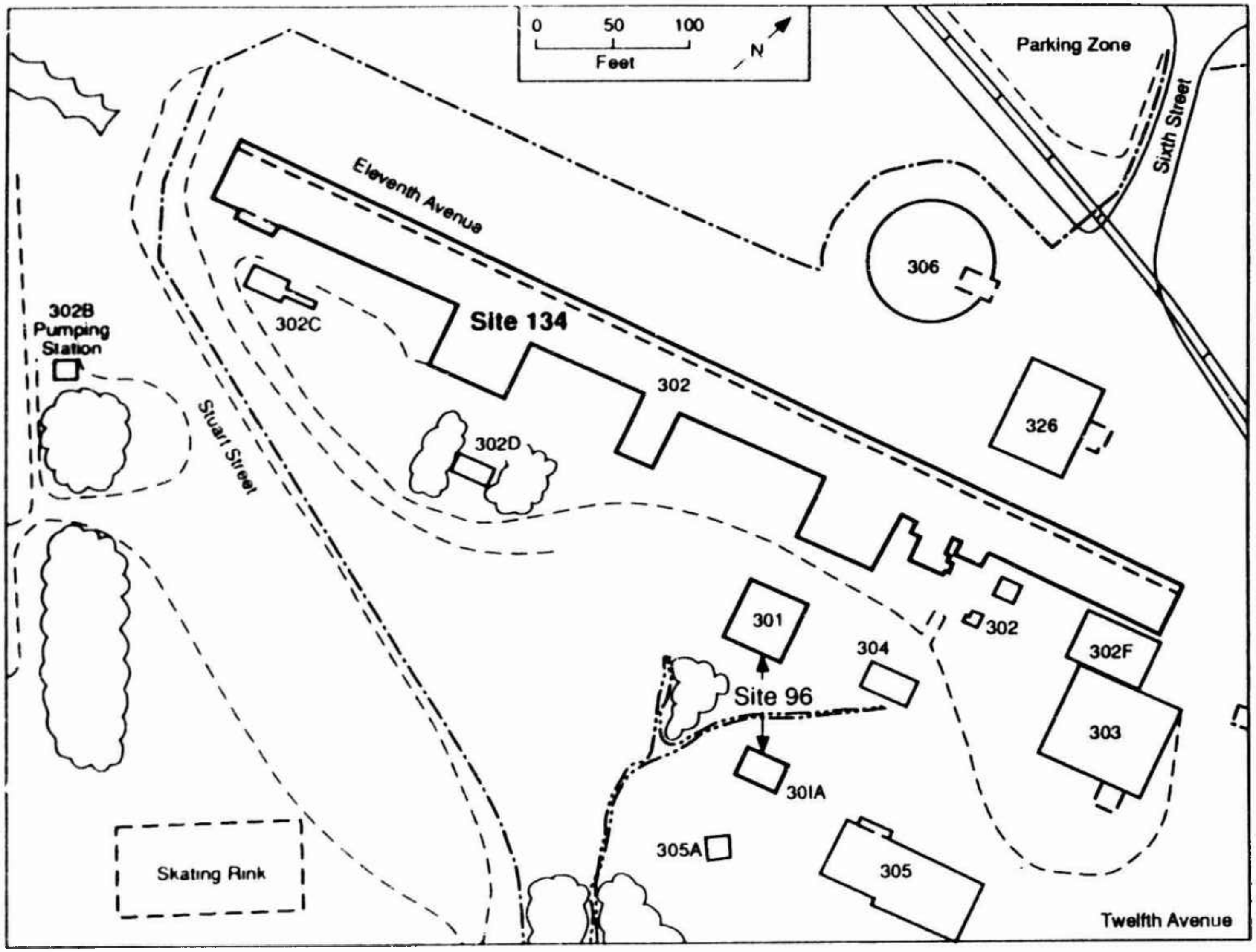

FIGURE 8.5 Layout of Site 134, the Building 302 Service Shops (Source: Adapted from USACE 1984b)

8.6.2 Geology and Hydrology

Although PTA has been characterized in several studies, limited information about specific geology and hydrology at this Site is available. The Site is about 0.25 mi west of Sites 21 and 37. The bedrock formation described for these Sites in Sec. 5.2.2 is also found at this Site (Vowinkel et al. 1985). Groundwater flow is estimated to be southeast toward Green Pond Brook.

Soils in the area of Bldg. 302 are classified as Otisville. The Otisville Series consists of deep, excessively drained sandy soil of the glacial uplands and outwash plains. The subsoil and substratum are gravelly loamy sand, gravelly sand, or very gravelly sand (Wingfield 1976; USATHAMA 1976).

8.6.3 Existing Contamination

During interviews, PTA personnel reported that thirty to fifty 55-gal drums were used to store hydraulic oil, paint stripper, and paint thinner. In addition to leaking drums that contaminated the soil, a disposal pit near Bldg. 302 was used to bury oil and metal parts. The disposal area has been covered with asphalt. It was also reported that two large holding tanks behind the building were used to collect wash-water residue and that they were regularly emptied into the swamp.

Potential contaminants for this Site are hydraulic oil, paint-stripping solvent waste, and explosives-laden wash water. Previous investigations in this area are discussed in Sec. 8.4.3. The proximity of Bldg. 302 to other Sites in this area and the reported operations necessitate further investigation.

8.6.4 Proposed RI Plan

Activities for this area should be coordinated with those recommended for Sites 52/95 and 96. A phased investigation is recommended in order to assess the potential for contamination resulting from past operations.

8.6.4.1 Phase I

A geophysical survey should be conducted to locate the disposal pit. If the pit is found, a hand auger should be used to collect one sample to a depth of 0.6 m (2 ft) at three locations in the pit area. If the pit has been paved over, samples should be collected by coring through the asphalt.

All Site areas should be inspected for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area of stained soil.

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each storage area. If these areas are paved over, samples should be collected by coring through the asphalt.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrate, and nitrite.

8.6.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

8.7 SITE 135 — BUILDING 315, METALLURGY LABORATORY

8.7.1 Site History

Building 315 is located near Eleventh Avenue, between Reilly Road and Green Pond Brook in the southern part of PTA. It was built in 1907. The brook is about 200 ft southeast of the Site. The Site details are given in Figure 8.6. Currently, it houses a metallurgy laboratory and is designated as a satellite waste accumulation area for oily rags and metal cuttings (Solecki 1989c). Waste solvent, waste oil, metal, and corrosives are produced.

8.7.2 Geology and Hydrology

From the generalized bedrock geology of PTA, it is estimated that the bedrock formations underlying the area are the Leithsville Formation, Hardyston Quartzite, and Precambrian gneiss. Directly underlying the Site is the Leithsville, present mostly as light- to medium-gray, microcrystalline, locally stylolithic rock to a fissile, siliceous to dolomitic micrite that is often weathered to a medium-yellow silty clay. It contains water-bearing fractures and cavities that usually have moderate yields. Flow in this area is estimated to be southeast toward Green Pond Brook.

Soils in the area are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

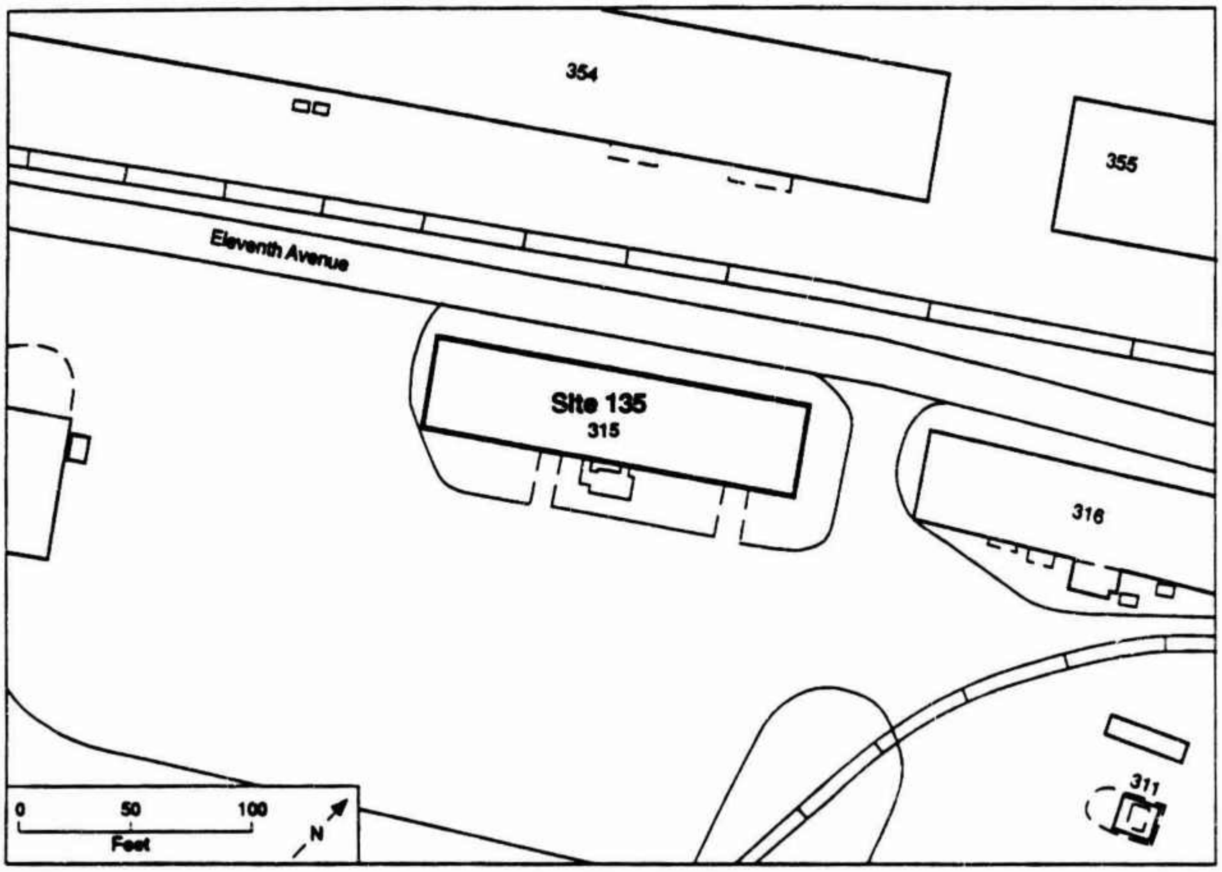

FIGURE 8.6 Layout of Site 135, the Building 315 Metallurgy Laboratory (Source: Adapted from USACE 1984b)

8.7.3 Existing Contamination

No previous investigations have been performed for this Site, and no spills or releases have been reported. Based on available information, this Site is considered to have a low potential for releasing contaminants.

8.7.4 Proposed RI Plan

8.7.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area.

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, explosives, nitrate, and sulfate.

8.7.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of the contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

8.8 SITE 136 — BUILDING 355, METALLURGY LABORATORY

8.8.1 Site History

Building 355 is located near Ninth Street and Reilly Road in the southern part of PTA. The Site details are given in Fig. 8.7. Building 355 was built in 1940. Currently, it houses a metallurgy laboratory and is designated as a satellite waste accumulation area for an estimated 10 gal/yr of corrosive wastes for metal etching (Solecki 1989c). Waste solvent, metals, and corrosives are produced.

8.8.2 Geology and Hydrology

From the generalized bedrock geology of PTA, it is estimated that the bedrock formations underlying the area are the Leithsville Formation, Hardyston Quartzite, and Precambrian gneiss. Directly underlying the Site is the Leithsville, present mostly as light- to medium-gray, microcrystalline, locally stylolithic rock to a fissile, siliceous to dolomitic micrite that is often weathered to a medium-yellow, silty clay. It contains water-bearing fractures and cavities that usually have moderate yields. Flow in this area is estimated to be southeast toward Green Pond Brook.

Soils in the area of Bldg. 355 are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

8.8.3 Existing Contamination

No previous investigations have been performed for this Site, and no spills or releases have been reported. Based on available information, this Site is considered to have a low potential for releasing contaminants.

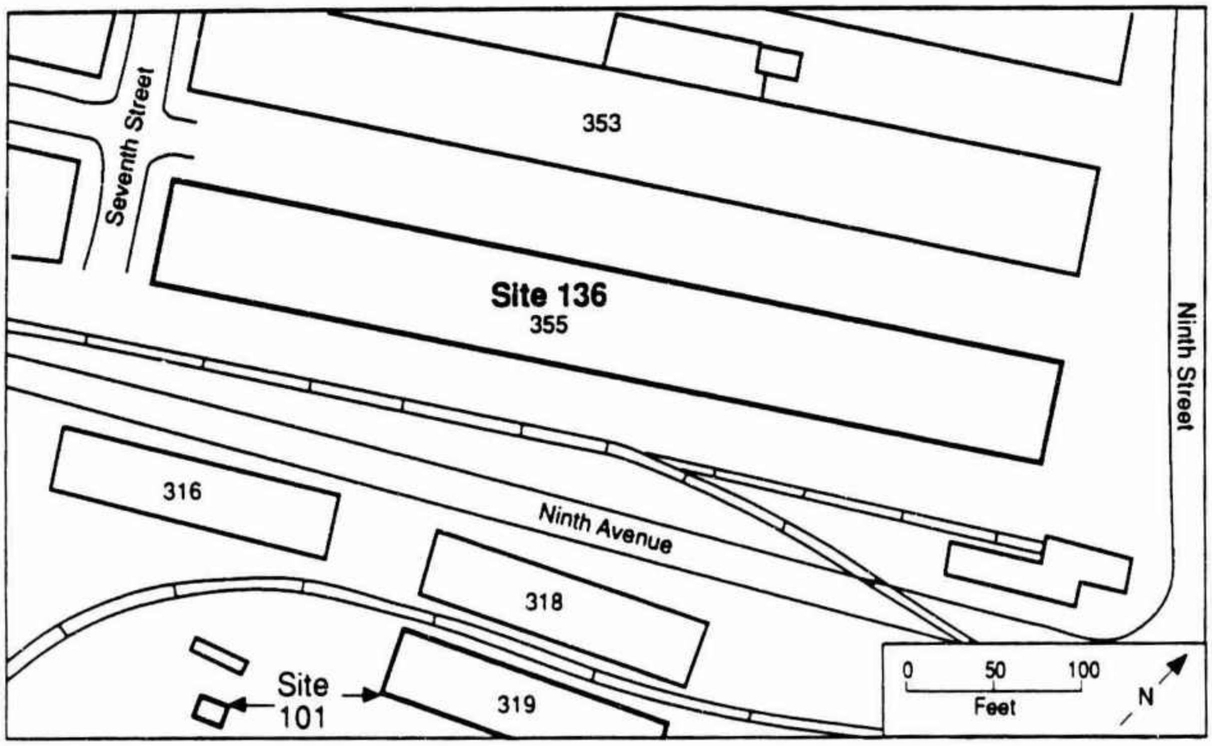

FIGURE 8.7 Layout of Site 136, the Building 355 Metallurgy Laboratory (Source: Adapted from USACE 1984b)

8.8.4 Proposed RI Plan

8.8.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area of stained soil.

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, nitrate, sulfate, and TCL metals.

8.8.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9 AREA H: MUNITIONS ASSEMBLY

9.1 INTRODUCTION

This Area contains 12 Sites located behind a security fence in the west central part of the Arsenal. Bear Swamp Brook flows through the Area. Activities in this Area, which include the assembly of munitions, have resulted in a potential for contamination with explosives and metals.

9.2 SITE 55 — BUILDINGS 221, 223, AND 225, EXPLOSIVES MACHINING FACILITY

9.2.1 Site History

This Site includes Buildings 221, 223, and 225. They are near the southern end of Picatinny Lake. Building 225 received filtered effluent from the melt casting and machining of explosives operations in Bldgs. 230-232. It also received effluent from operations in Bldgs. 221 and 223. The effluent flowed by gravity in metal-lined, wooden collection troughs to a holding tank under the building. The water was then pumped up through a vacuum rotary filter. The effluent was discharged to the nearby swamp via a metal-lined, cement trough, which ran under the road. Bagged sawdust was placed at the end of the trough as a final filter. Details of the building and the discharge system are shown in Fig. 9.1.

A filter bypass existed for cooling water that was considered clean. This was discharged directly to the swamp. In about 1965, discharge to the swamp was discontinued. All of the water was collected in a 4,000-gal holding tank and taken to the Bldg. 809 wastewater treatment plant. All particulates were taken to the burning ground. The transfer between Bldgs. 225 and 232 was being replaced by a hose at the time of the Site visit. Although activity in this area is less frequent, wastewater currently generated is taken to the wastewater treatment plant.

The Bldg. 225 UST will undergo RCRA closure (Foster Wheeler 1988b). The tank will be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

9.2.2 Geology and Hydrology

Site-specific information is limited; however, the overall PTA characterization shows that the bedrock formation directly underlying the Site is Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. It is predominately white quartz and minor gray, green, red, and yellow chert, red shale, and red sandstone cobbles (Sargent 1988).

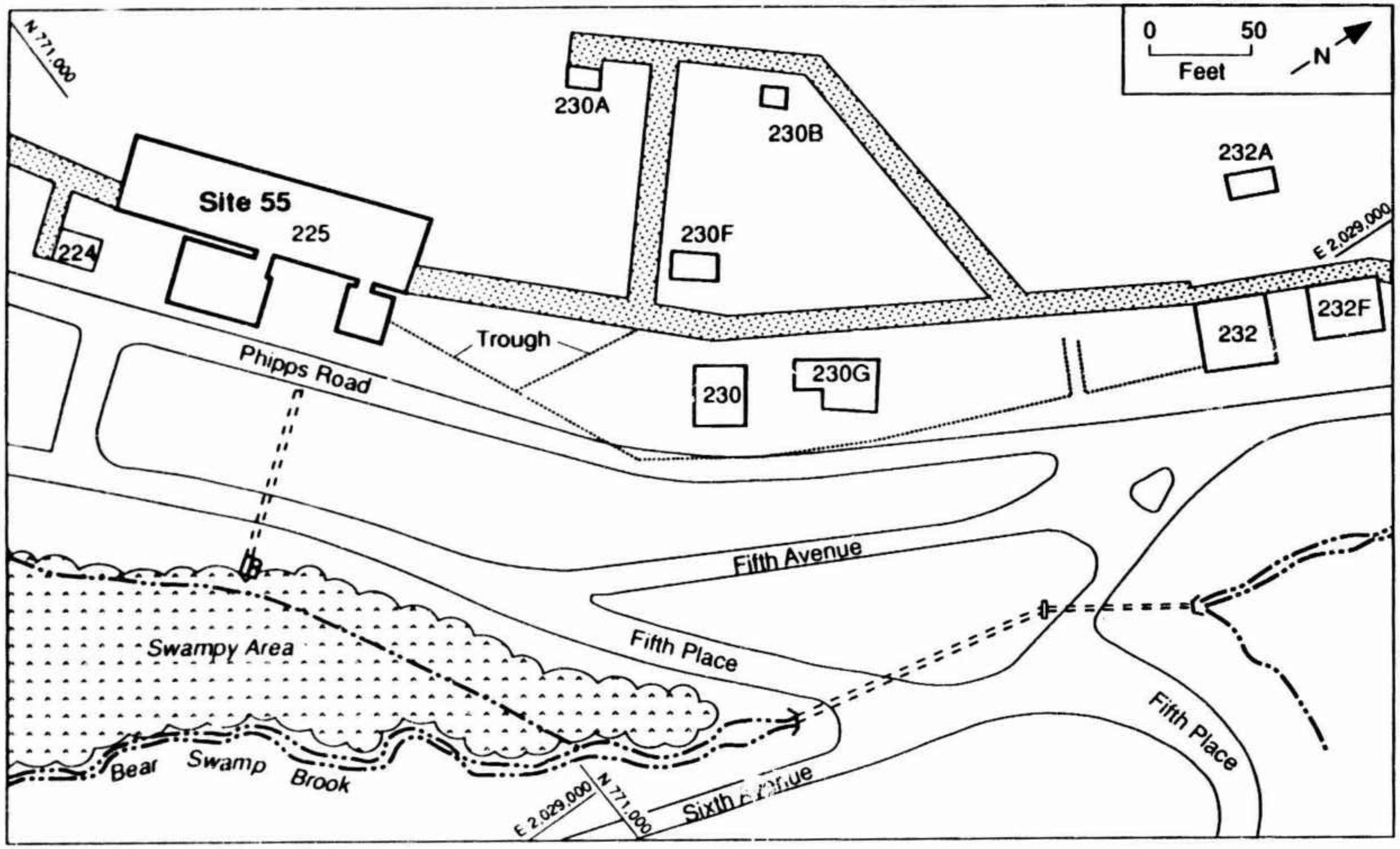

FIGURE 9.1 Layout of Site 55, the Explosives Machining Facility (Source: Adapted from USACE 1984b)

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stony sandy loam. The surface of these soils is covered by stones and a few boulders.

9.2.3 Existing Contamination

Available information regarding contamination is limited. One sample of surface water and sediment was obtained from Bear Swamp Brook by USATHAMA personnel in July 1988. The results showed no significantly elevated contaminants. A previous sampling effort indicated that the soil along the trough and surrounding Bldg. 225 had contamination levels of HMX, TNT, and RDX at the percent level. No information regarding the quality control aspect of this sampling effort was available.

9.2.4 Closure Plan

At closure, contents of the tank in Bldg. 225 will be pumped out and taken to Bldg. 809 (the explosive wastewater treatment plant). The tank and associated piping will be flushed with water, removed, and disposed of in accordance with applicable regulations (Foster Wheeler 1988b).

9.2.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. Should clean closure not be possible, the RI plan will be modified as new data become available.

9.2.5.1 Phase I

In order to confirm the presence or absence of contamination, soil and/or sediment samples should be obtained from the following locations:

- Under the flow trough between Bldgs. 225 and 232 at 3-m (10-ft) intervals.
- Around the perimeter (at least two samples per side) of Bldgs. 221 and 223).
- At least five samples from a 15- by 20-ft area under the outfall to Bear Swamp Brook (one from the middle and one from each corner).

All samples should be analyzed for TCL volatiles, TCL semivolatiles, nitrate, nitrite, and explosives.

9.2.5.2 Phase II

The need for further investigation should be based on the results of these analyses.

9.3 SITE 62 — BUILDING 210

9.3.1 Site History

Building 210 is located adjacent to Bear Swamp Brook and Sixth Street in the southwestern portion of PTA. Figure 9.2 shows the details of the Site. The building is concrete with a basement and fireproof bays that were designed as independent sections. It contained a staging area, a fuze assembly line, and presses.

The fuze assembly line was moved to another location and the building was decontaminated (date unknown). PTA personnel reported that hazardous wastes were stored at the building during the 1960s. According to Foster Wheeler (1988a), Bldg. 210 was used for temporary storage of hazardous wastes, while Bldg. 3100 (hazardous waste storage) was modified to comply with RCRA regulations. Building 210 will be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

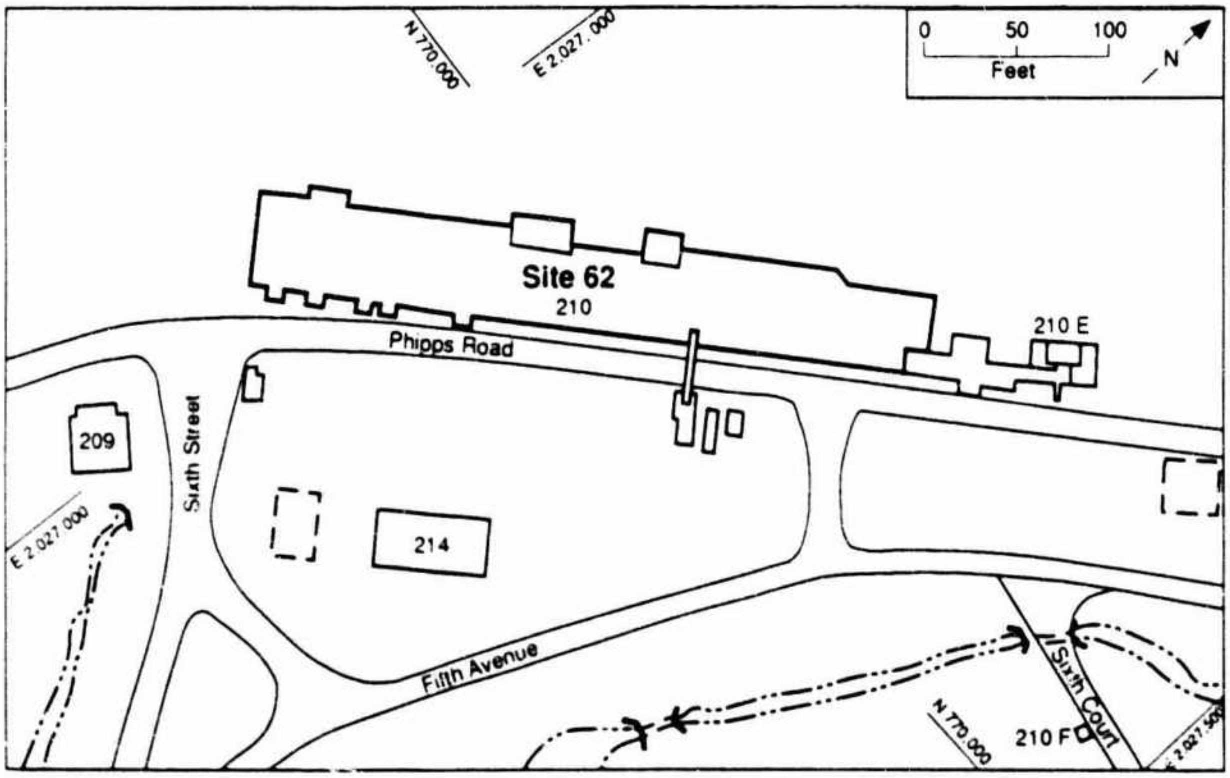

FIGURE 9.2 Layout of Site 62, Building 210 (Source: Adapted from USACE 1984b)

9.3.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is the Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. Its predominant composition is white quartz; minor gray, green, red, and yellow chert; red shale; and red sandstone cobbles. Groundwater in the area probably flows south-southeast toward Bear Swamp and Green Pond Brooks. Well yields from the local aquifer are usually small and are obtained from fractures and joints (Sargent 1988).

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stoney sandy loam. The surface of these soils is covered by stones and a few boulders.

9.3.3 Existing Contamination

No previous investigations are reported for this Site. Potential contaminants include waste solvents, waste oil, waste hydraulic oil, and explosives. During 1989 interviews with ANL staff, PTA personnel described past activities when the fuze line was operational. Black and green powder was washed into drains that emptied outside of the building. Hydraulic oil for the presses was stored in 200-gal reservoirs in the basement. The basement was subject to flooding during heavy rain, and sump pumps would send water containing black powder and hydraulic oil out into the swamp. Items stored during the 1960s included hazardous chemicals, black powders, and hydraulic oils; any leakage and spills were collected in a sump and discharged to Bear Swamp Brook.

According to the current closure plan, during the decontamination of Bldg. 210, all of the floor drains were closed and all visible cracks were sealed before storage began at the building. The described operating practices followed the requirements of a RCRA storage facility. Wastes stored at the building included small quantities of chemicals from PTA laboratories, groundwater from purging monitoring wells, excess photochemicals, paint, unused thinner, and waste oil.

9.3.4 Closure Plan

At closure, all structure and equipment will be decontaminated using a high-pressure jet and suction washing procedure. Following this, sampling will be conducted to ensure that the structure and equipment have been cleaned and that contaminant residues do not exceed the trigger levels contained in the sampling and analysis plan. If needed, the wash procedure will be repeated (Foster Wheeler 1988b).

9.3.5 Proposed RI Plan

In order to address the potential for contamination resulting from daily operation of the fuze assembly line, a phased investigation is recommended. The phased RI sampling plan will be carried out independently of the closure sampling plan. If clean closure is not possible, the RI plan should be modified as new information becomes available.

9.3.5.1 Phase I

The current condition of the Site should be assessed by inspecting all areas to locate visible contamination, drains, and other migration pathways. If visible staining is found, one composite soil sample should be collected from each area of stained soil.

In addition to the sampling of visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area and two surface water and sediment samples should be collected from Bear Swamp Brook at the location of the former outfall from the building.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

9.3.5.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. All boring samples should be analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.4 SITE 64 — BUILDING 241, PRESS LOADING AND DISASSEMBLY PLANT

9.4.1 Site History

Building 241 is located adjacent to Bear Swamp Brook and Sixth Street in the southwestern portion of PTA. Figure 9.3 shows the details of the Site. The building was built in 1919 as an explosives loading plant. In 1942, it was modified and used as a demilling and disassembly plant. A section was renovated in 1975 to serve as a press loading and disassembly area. During March 1981, it was converted to a storehouse for the Facilities and Engineering Division (FED).

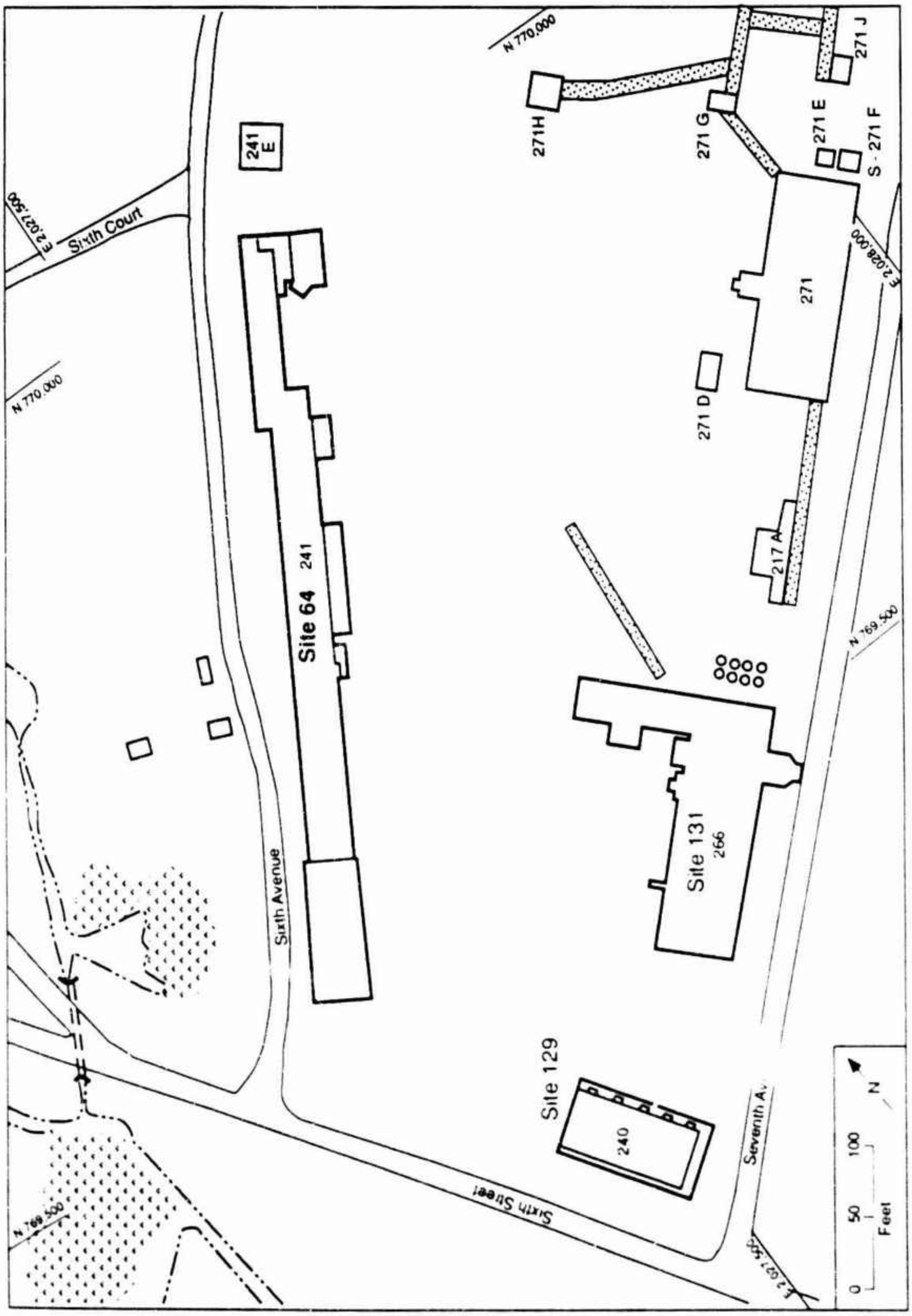

FIGURE 9.3 Layout of Site 64, the Building 241 Press Loading and Disassembly Plant (Source: Adapted from USACE 1984b)

Currently, Bldg. 241 has offices and three separate storage areas containing hay for the archery range, electrical equipment, and general storage. It is scheduled for eventual demolition under TECUP. According to available information, hazardous waste has not been stored in this building since 1980 (Foster Wheeler 1988b).

This Site, which did not have interim status, will undergo RCRA closure in accordance with NJDEP regulations (Foster Wheeler 1988b).

9.4.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is the Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. Its predominant composition is white quartz; minor gray, green, red, and yellow chert; red shale; and red sandstone cobbles. Groundwater in the area probably flows south-southeast toward Bear Swamp and Green Pond Brooks. Well yields from the local aquifer are usually small and are obtained from fractures and joints (Sargent 1988).

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stoney sandy loam. The surface of these soils is covered by stones and a few boulders.

9.4.3 Existing Contamination

Based on the 1980 Part A Permit Application, EPA identified this building as a container storage area and gave it interim status (Gaven 1986); however, it has not been used for storing hazardous waste since 1980 (Foster Wheeler 1988b).

9.4.4 Closure Plan

At closure, any stained soil will be removed and placed into containers for proper disposal at an off-post facility. The soil will be analyzed according to the sampling and analysis plan. The analytic results will be used to determine the type of disposal facility. The remaining soil will be sampled to confirm complete removal. The results will be used to determine the need for further action (Foster Wheeler 1988b).

9.4.5 Proposed RI Plan

In order to address the potential for contamination resulting from site operations, a phased investigation is recommended. The following RI plan will be carried out independently of the closure sampling plan. If clean closure is not possible, the RI plan should be modified as new information becomes available.

9.4.5.1 Phase I

The current condition of the Site should be assessed by inspecting all areas to locate visible contamination, drains, and other migration pathways. If visible staining is found, one composite soil sample should be collected from each area of stained soil.

In addition to the sampling of visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area and two surface water and sediment samples should be collected from Bear Swamp Brook at the location of the former outfall from the building.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

9.4.5.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. All boring samples should be analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.5 SITE 98 — BUILDING 268, MINE ASSEMBLY FACILITY

9.5.1 Site History

Building 268, built in 1941, is located near the intersection of Reilly Road and 8th Street in the southern area of PTA. The location is given in Fig. 9.4. Antipersonnel mines used during Vietnam were assembled at the building. Phosphorus was a component of the mines.

9.5.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is Precambrian gneiss, which has a varying medium- to coarse-grained composition. The predominant facies is biotite, quartz, and oligoclase. Minor facies are characterized by abundant garnet and microperthite, with local sillimanite and graphite. Groundwater occurs in fractures and joints, usually in low yields. Flow in this area is estimated to be south-southeast toward Green Pond Brook.

Soils in the area of Bldg. 268 are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

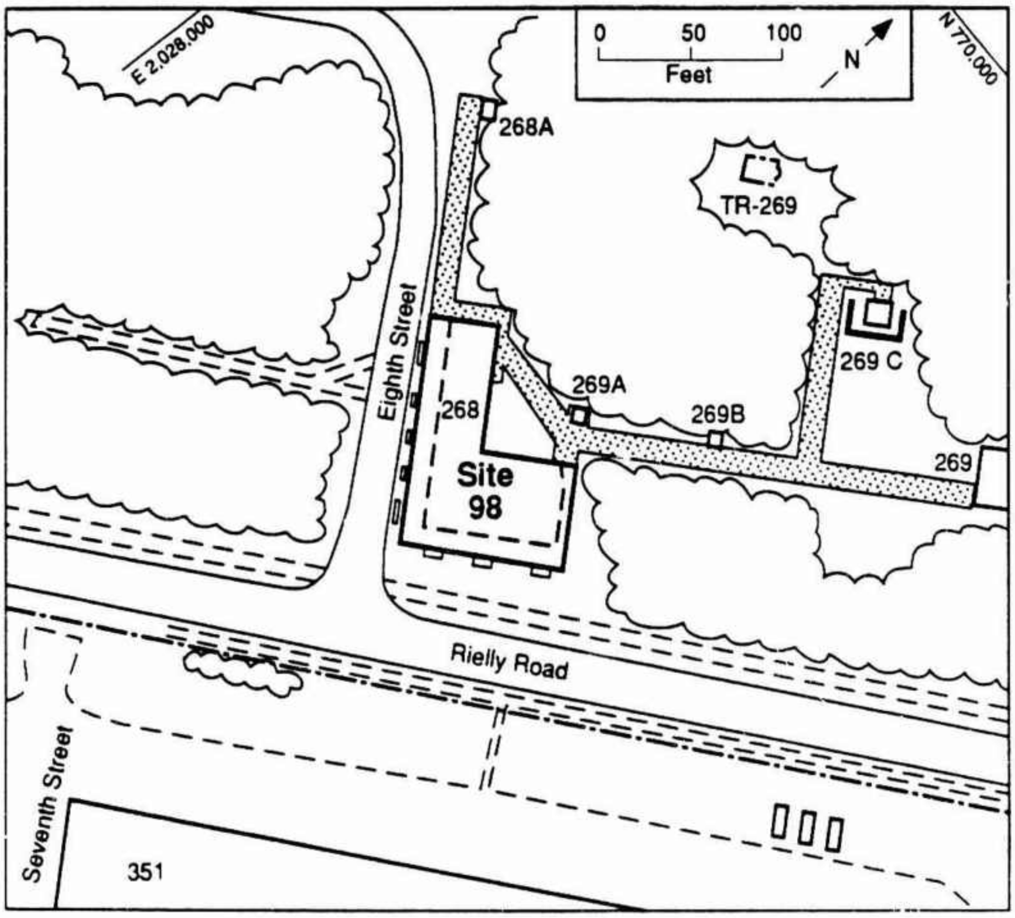

FIGURE 9.4 Layout of Site 98, the Building 268 Mine Assembly Facility (Source: Adapted from USACE 1984b)

9.5.3 Existing Contamination

No previous investigations are reported for this Site. Potential contaminants are explosives and waste solvents. For many of the Sites at PTA, daily cleaning included washing the floors. During interviews, PTA personnel reported that explosive wastes were prevalent on the floor and that the wash water was dumped onto the ground outside the building.

9.5.4 Proposed RI Plan

9.5.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each.

In addition to the sampling of visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, explosives, nitrate, and nitrite.

9.5.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.6 SITE 100 — BUILDING 276, EXPLOSIVES LOADING FACILITY

9.6.1 Site History

Building 276 was located near the intersection of Reilly Road and Tenth Street. The former location is shown in Fig. 9.5. It was built in 1948 as a vacuum house and was used for loading explosives. It was demolished under TECUP.

9.6.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formations underlying the area are the Leithsville Formation, Hardyston Quartzite, and Precambrian gneiss. Directly underlying the Site is the Leithsville, present mostly as light- to medium-gray, microcrystalline, locally styiolithic rock to fissile, siliceous to dolomitic micrite rock that is often weathered to a medium-yellow, silty clay. It contains water-bearing fractures and cavities that usually have moderate yields. Groundwater flow in this area is estimated to be south-southeast toward Green Pond Brook.

Soils in the area of Bldg. 276 are classified as Urban Land. They are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

9.6.3 Existing Contamination

Building 276 was close to Bear Swamp. During interviews, PTA personnel reported that the swamp was used for dumping wastes. Potential contaminants are explosives and oil from the presses that were part of the operation. Since the area is

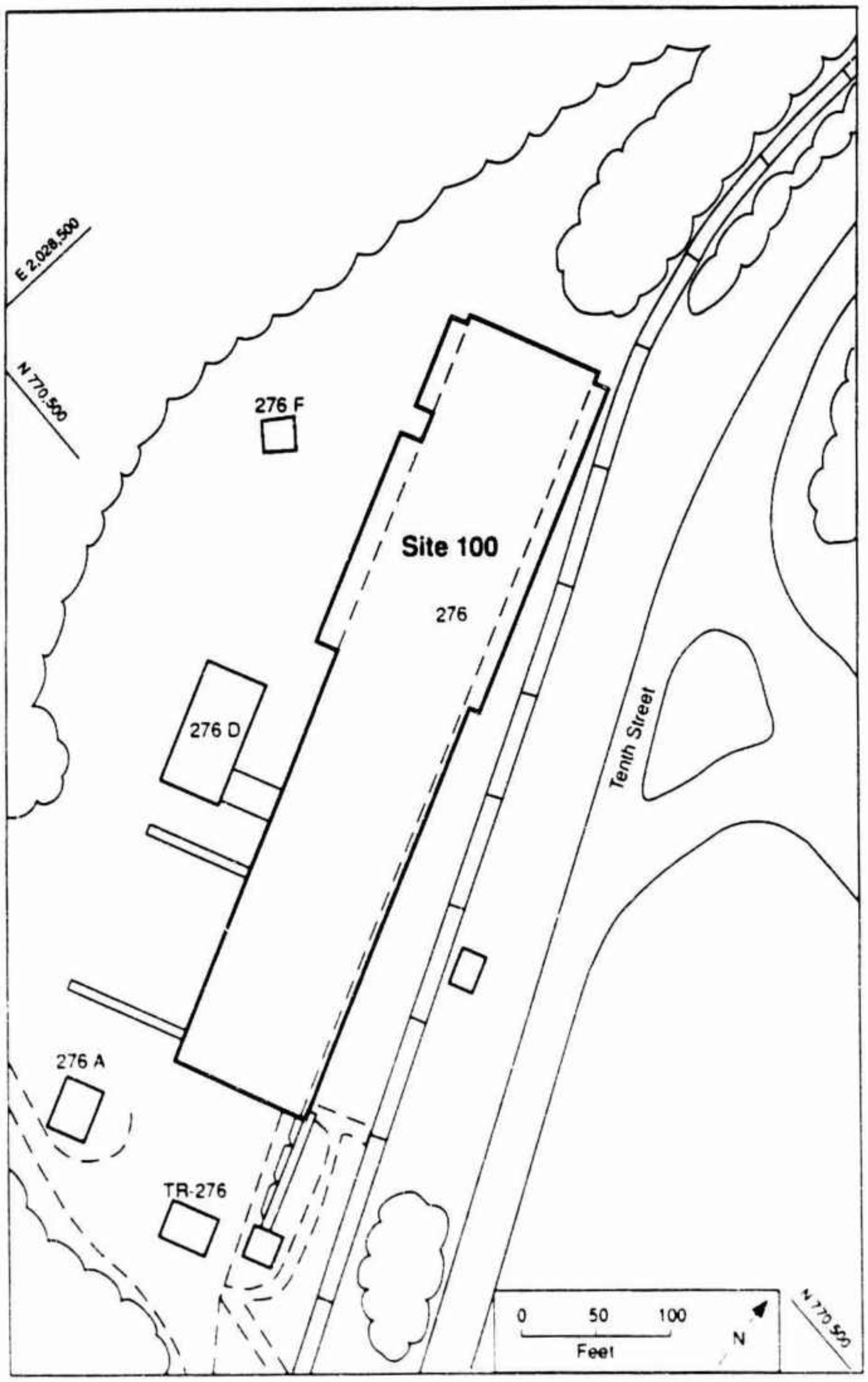

FIGURE 9.5 Layout of Site 100, the Building 276 Explosives Loading Facility (Source: Adapted from USACE 1984b)

vegetated, particulate emissions are not expected. The only previous investigations in this area are those that have been conducted at Bldg. 225 (Site 55). Site 100 has a moderate to high potential for releasing contaminants to soil and surface water.

9.6.4 Proposed RI Plan

Based on available information, a phased investigation is recommended for this building to assess the current condition of the Site and the potential impacts resulting from past operations. Before Phase I activities begin, Division of Engineering and Housing (DEH) records should be reviewed to determine the orientation of the former building and its loading docks and doors.

9.6.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas to locate visible contamination and signs of past disposal. If visible staining is found, one soil sample should be collected from each area of stained soil.

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from 10 locations at the former building location and two surface water and sediment samples should be collected from Bear Swamp. The soil sampling locations should be based on the building plans, and the swamp samples should be collected from areas that were near the building.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, and PCBs.

9.6.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Subsurface soil samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.7 SITE 127 — BUILDING 230

9.7.1 Site History

Building 230 is near the southern end of Picatinny Lake near Bear Swamp (Fig. 9.6). It is part of the melt casting and explosives machining operations. Operations include melting explosives in kettles, pouring molten explosives into molds, and cleaning

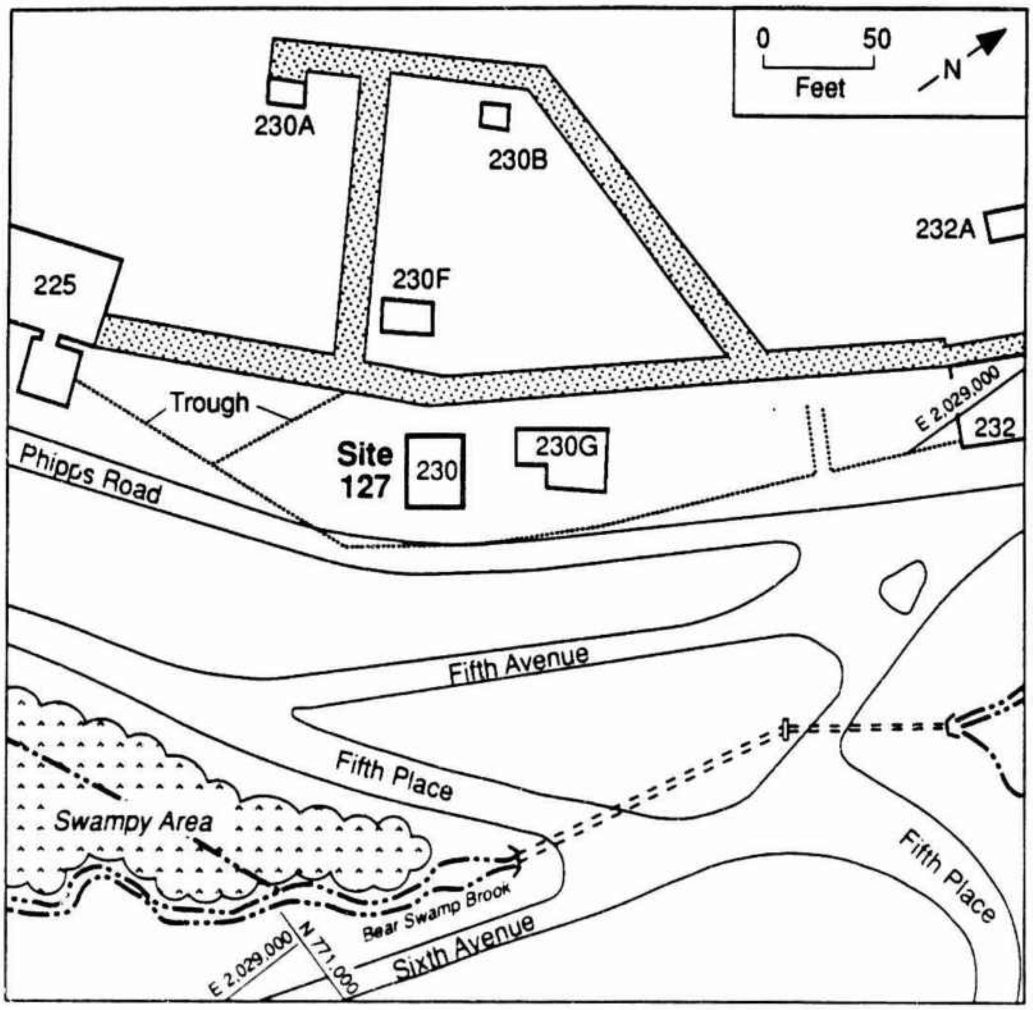

FIGURE 9.6 Layout of Site 127, the Building 230 Satellite Waste Accumulation Area (Source: Adapted from USACE 1984b)

the kettles and equipment with superheated steam. (See Sec. 9.2 for further information about treatment of the effluent from this process.) Reportedly, waste volumes at this Site are estimated to be about 200 lb/mo of composition B and octol.

9.7.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. Its predominant composition is white quartz; minor gray, green, red, and yellow chert; red shale, and red sandstone cobbles. Groundwater in the area probably flows south-southeast toward Green Pond Brook. Well yields from the local aquifer are usually small and are obtained from fractures and joints (Sargent 1988).

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stoney sandy loam. The surface of these soils is covered by stones and a few boulders.

9.7.3 Existing Contamination

Previous investigations of this area, most recently in July 1988, have been limited. One sample of surface water and sediment from Bear Swamp Brook contained no significantly elevated contaminants (Moran 1988). Area soil samples collected in 1987 by the PTA environmental office contained percent concentrations of HMX, TNT, and RDX. Information regarding the methods or quality controls for the 1987 effort is not available. Based on the operating history and available sampling information, this Site has a high to moderate potential for releasing contaminants.

9.7.4 Proposed RI Plan

Activities for this Site should be coordinated with those recommended for Sites 55, 62, 128, and 130. A phased investigation is recommended in order to assess the potential for contamination resulting from past operations.

9.7.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area.

In addition to the sampling of visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area, and one surface soil sample should be collected from each side of the building.

All samples should be analyzed for explosives, nitrate, and nitrite.

9.7.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.8 SITE 128 — BUILDINGS 235 AND 236, EXPLOSIVES PRESSING PLANTS

9.8.1 Site History

Buildings 235 and 236 are near the southern end of Picatinny Lake near Bear Swamp (Fig. 9.7). They are part of the melt casting and explosives machining operations. Both of these buildings were used for explosives pressing. Reportedly, scrap explosives and explosively contaminated materials have been stored in Bldg. 236. (See Sec. 9.2 for further information about treatment of the effluent from this process.)

9.8.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. Its predominant composition is white quartz; minor gray, green, red, and yellow chert; red shale; and red sandstone cobbles. Groundwater in the area probably flows south-southeast toward Green Pond Brook. Well yields from the local aquifer are usually small and are obtained from fractures and joints (Sargent 1988).

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stoney sandy loam. The surface of these soils is covered by stones and a few boulders.

9.8.3 Existing Contamination

Previous investigations of this area, most recently in July 1988, have been limited. One sample of surface water and sediment from Bear Swamp Brook contained no significantly elevated contaminants (Moran 1988). Area soil samples obtained in 1987 by the PTA environmental office contained percent concentrations of HMX, TNT, and RDX. Information regarding the methods or quality controls for the 1987 effort is not available. Based on the operating history and available sampling information, this Site has a high to moderate potential for releasing contaminants.

9.8.4 Proposed RI Plan

Activities for this Site should be coordinated with those recommended for Sites 55, 62, 127, and 130. A phased investigation is recommended in order to assess the potential for contamination resulting from past operations.

9.8.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area of stained soil.

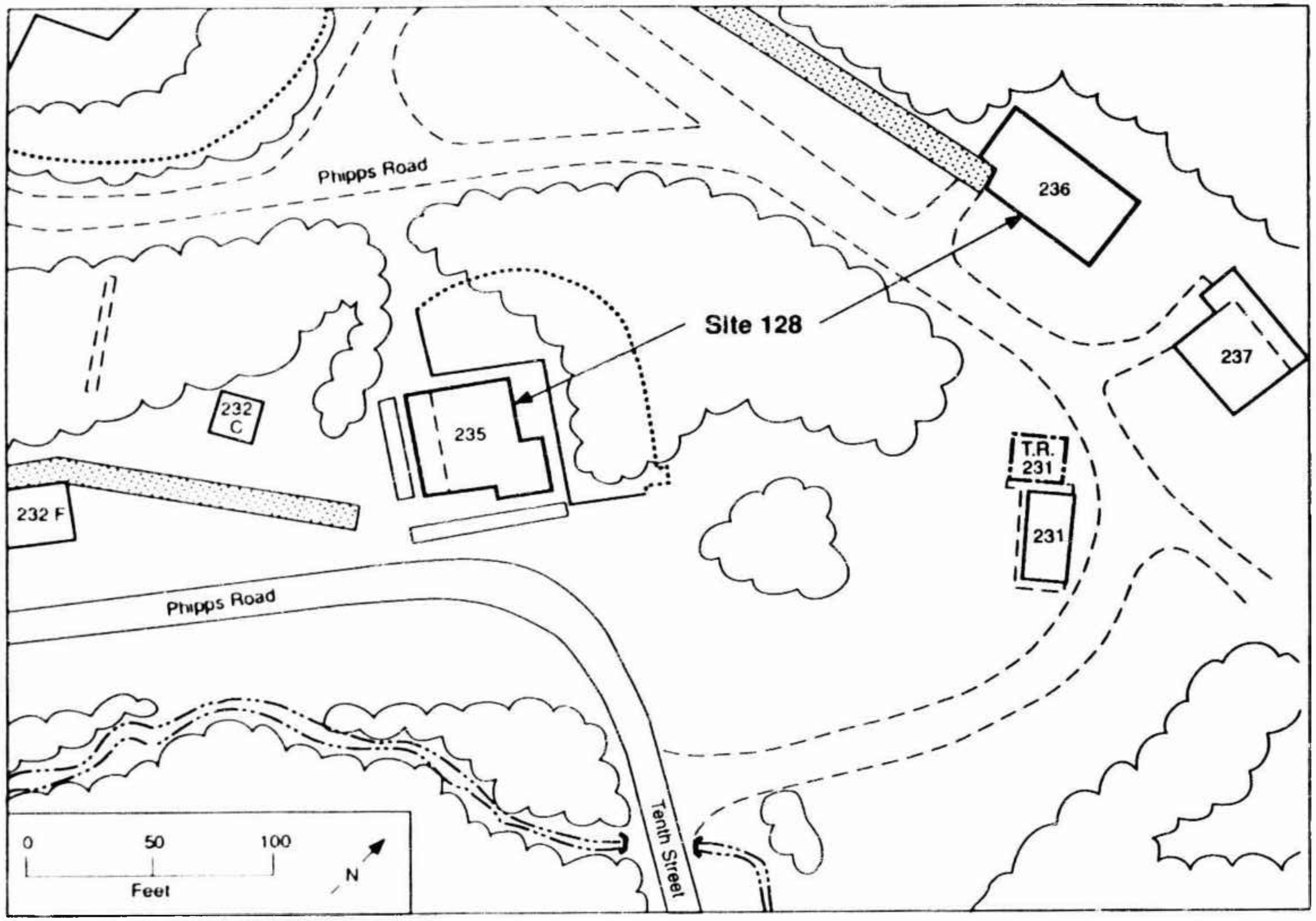

FIGURE 9.7 Layout of Site 128, the Explosives Processing Plants at Buildings 235 and 236 (Source: Adapted from USACE 1984b)

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area, and one surface soil sample should be collected from each side of the building.

All samples should be analyzed for explosives, nitrate, and nitrite.

9.8.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.9 SITE 129 — BUILDING 240

9.9.1 Site History

Building 240 is located near Seventh Avenue and Sixth Street in the southwestern portion of PTA. It was built in 1942 as a change house. Figure 9.8 shows the details of the Site. It is near an area of PTA where detonators and initiators were loaded.

9.9.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is the Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. Its predominant composition is white quartz; minor gray, green, red, and yellow chert; red shale; and red sandstone cobbles. Groundwater in the area probably flows south-southeast toward Green Pond Brook. Well yields from the local aquifer are usually small and are obtained from fractures and joints (Sargent 1988).

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stoney sandy loam. The surface of these soils is covered by stones and a few boulders.

9.9.3 Existing Contamination

During interviews, PTA personnel reported that dioxin was stored in Bldg. 240 in the late 1960s. No information is available to confirm this report. There are no previous investigations of this Site, and dioxin is the only potential contaminant known.

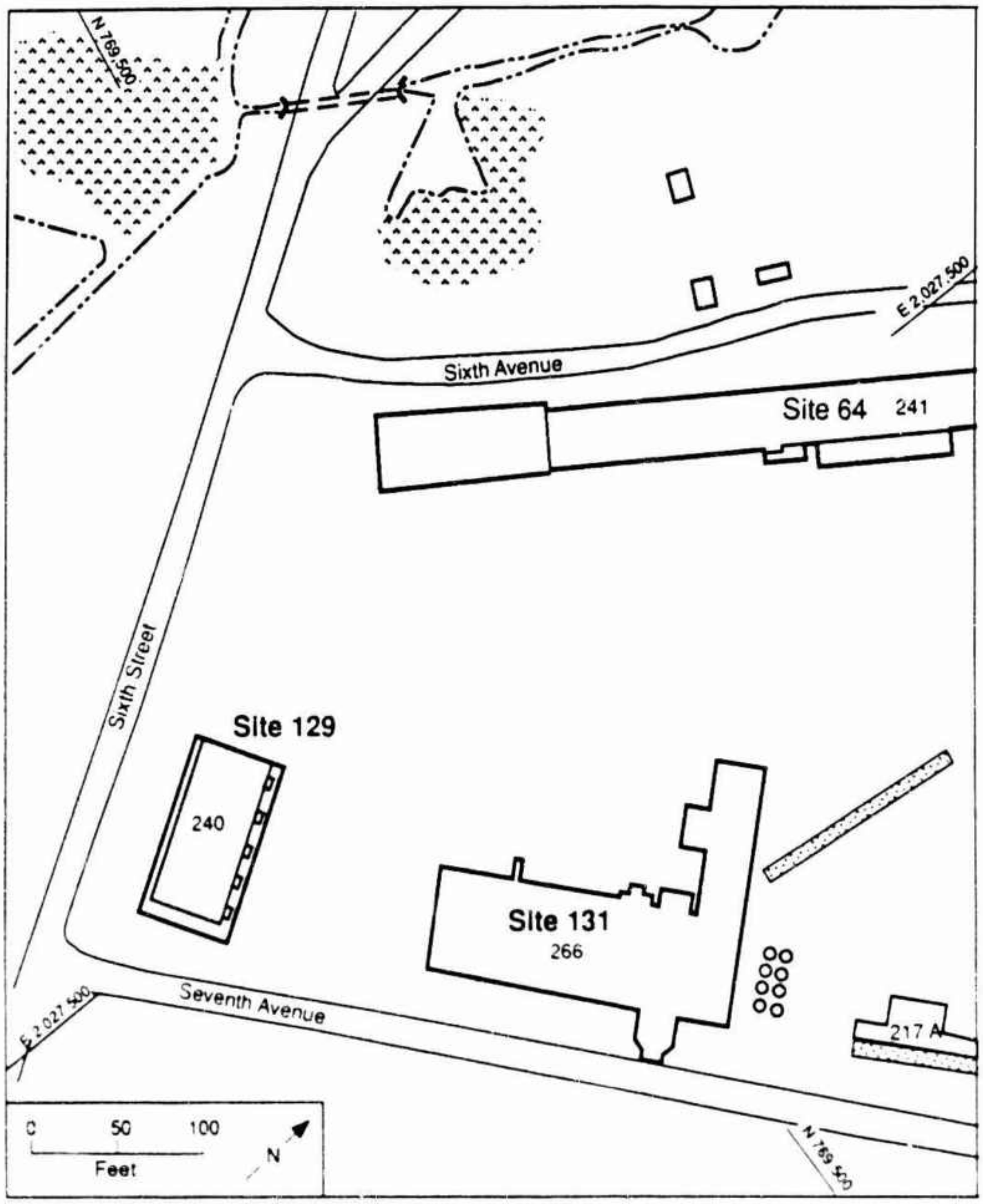

FIGURE 9.8 Layout of Site 129, Building 240, and Site 131, Building 266 (Source: Adapted from USACE 1984b)

9.9.4 Proposed RI Plan

9.9.4.1 Phase I

PTA records should be searched, and knowledgeable personnel should be interviewed for information regarding past and current uses of Bldg. 240. All Areas in and near the building should be inspected for visible contamination, drains, and other migration pathways. A sampling plan should be implemented if warranted by the findings of the search for additional information and the Site inspection.

9.9.4.2 Phase II

If contamination is found in the Phase I sampling results, the sampling effort should be expanded to determine the extent of contamination.

9.10 SITE 130 — BUILDING 252, POWDER PRESSING AND PELLETING FACILITY

9.10.1 Site History

Building 252 is near the southern end of Picatinny Lake near Bear Swamp Brook (Fig. 9.9). It is part of the melt casting and explosives machining operations. Operations included powder pressing and pelleting. (See Sec. 9.2 for further information about treatment of the effluent from this process.) Reportedly, when the floors were washed, the water was discharged to Bear Swamp.

9.10.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is the Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. Its predominant composition is white quartz; minor gray, green, red, and yellow chert; red shale, and red sandstone cobbles. Groundwater in the area probably flows south-southeast toward Green Pond Brook. Well yields from the local aquifer are usually small and are obtained from fractures and joints (Sargent 1986).

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stoney sandy loam. The surface of these soils is covered by stones and a few boulders.

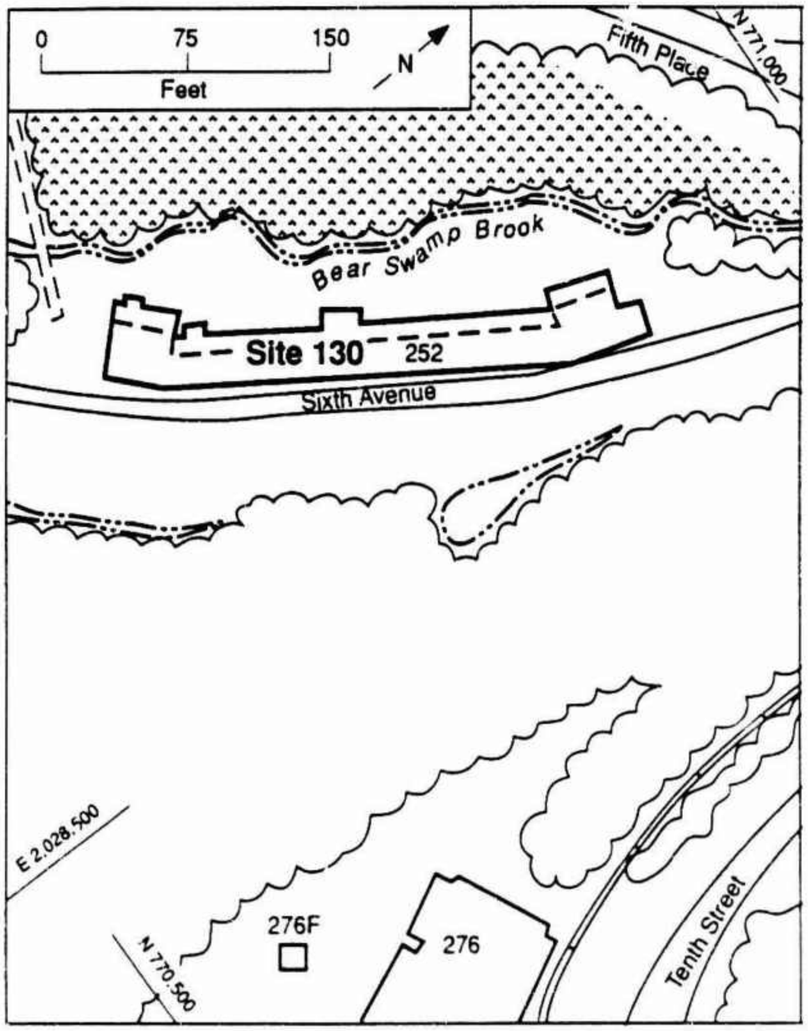

FIGURE 9.9 Layout of Site 130, the Building 252 Powder Pressing and Pelleting Facility (Source: Adapted from USACE 1984b)

9.10.3 Existing Contamination

Previous investigations of this area, most recently in July 1988 (Moran 1988), have been limited. One sample of surface water and sediment from Bear Swamp Brook contained no significantly elevated contaminants. Area soil samples obtained in 1987 by the PTA environmental office contained percent concentrations of HMX, TNT, and RDX. Information regarding the methods or quality controls for the 1987 effort is not available. Based on the operating history and available sampling information, this Site has a high to moderate potential for releasing contaminants.

9.10.4 Proposed RI Plan

Activities for this Site should be coordinated with those recommended for Sites 55, 62, 127, and 128. A phased investigation is recommended in order to assess the potential for contamination resulting from past operations.

9.10.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area of stained soil.

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area and one surface soil sample should be collected from each side of the building.

All samples should be analyzed for explosives, propellants, nitrate, and nitrite.

9.10.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.11 SITE 131 — BUILDING 266, ORDNANCE MANUFACTURING FACILITY

9.11.1 Site History

Building 266 is located near Seventh Avenue and Sixth Street in the southwestern portion of PTA. It was built in 1903 as an ordnance facility. Figure 9.8 shows the details of the Site. It is near an area of PTA where detonators and initiators were loaded. The building is used as a less-than-90-day storage area for about 0.5 lb/yr trichloroethylene, 7 gal/yr oil rags, and 6 gal/yr waste oil generated from degreasing operations. The wastes are stored in a steel cabinet (Solecki 1989c).

9.11.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is the Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. Its predominant composition is white quartz; minor gray, green, red, and yellow chert; red shale, and red sandstone cobbles. Groundwater in the area probably flows south-southeast toward Green Pond Brook. Well yields from the local aquifer are usually small and are obtained from fractures and joints (Sargent 1988).

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stoney sandy loam. The surface of these soils is covered by stones and a few boulders.

9.11.3 Existing Contamination

There have been no previous investigations of this Site. Oil from a compressor was spilled on the soil surrounding the building, and some of the contaminated soil was removed (Solecki 1989c). Based on past operations and the location of the spill, there is a moderate to high potential for contaminant release.

9.11.4 Proposed RI Plan

Activities for this Site should be coordinated with those recommended for Sites 64, 129, and 132. A phased investigation is recommended in order to assess the potential for contamination resulting from past operations.

9.11.4.1 Phase I

The current condition of the Site should be assessed by inspecting all areas in and near the building for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area.

In addition to sampling visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

9.11.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.12 SITE 132 — BUILDINGS 271 AND 271I-271N, LOADING FACILITY FOR DETONATORS AND INITIATORS

9.12.1 Site History

Buildings 271 and 271I through 271N are located near Seventh Avenue and Eighth Street in the southwestern portion of PTA. Building 271 was built in 1905 as a detonator loading facility. Buildings 271I through 271N were constructed at various times during the 1940s and housed detonator production. Figure 9.10 shows the details of the buildings.

Lead azide primers were produced in Bldg. 271I and then taken to Bldg. 271 for use in manufacturing. According to PTA personnel, Bldg. 271I has been used more recently to store miscellaneous waste chemicals, including alcohol, antimony sulfide, barium nitrate, barium peroxide, ceric ammonium nitrate, gasoline, lead dioxide, manganese dioxide, explosive B, and various unknown chemicals.

Building 271I is scheduled for demolition under TECUP. A closure plan has been prepared for this Site (Foster Wheeler 1988a). Because it did not have interim status, it will be closed in accordance with New Jersey hazardous waste regulations.

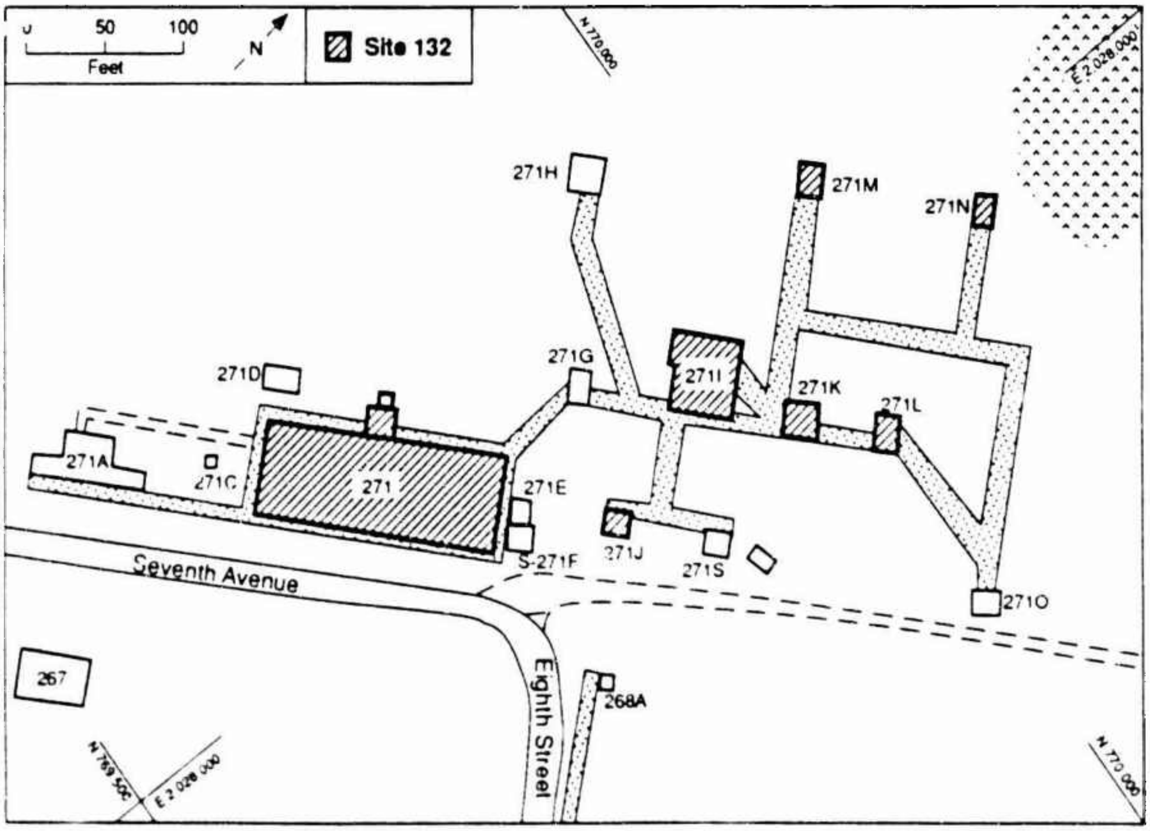

FIGURE 9.10 Layout of Site 132, the Loading Facility for Detonators and Initiators at Buildings 271 and 271I-271N (Source: Adapted from USACE 1984b)

9.12.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is the Green Pond Conglomerate, an Upper Silurian gray and reddish-gray sandstone conglomerate. Its predominant composition is white quartz; minor gray, green, red, and yellow chert; red shale, and red sandstone cobbles. Groundwater in the area probably flows south-southeast toward Green Pond Brook. Well yields from the local aquifer are usually small and are obtained from fractures and joints (Sargent 1988).

The soils of this Site have been classified as the Rockaway Series. These consist of deep, gently sloping to very steep, well-drained soils. The gentler slopes are occupied by the Rockaway very stoney sandy loam. The surface of these soils is covered by stones and a few boulders.

9.12.3 Existing Contamination

It has been reported that much of the operation in Bldg. 271 involved loose powder components. This powder would have been deposited on the floors and working areas, requiring cleanup. Since there was no collection system for explosive wash water, the standard method of disposal was dumping it onto the ground. Based on reports of standard operating procedures, this Site is considered to have a moderate to high potential for releasing contaminants.

9.12.4 Closure Plan

At closure, the building will be sealed off prior to decontamination. All equipment and appropriate structures will be decontaminated by washing with hot water and steam. Confirmation samples will be collected from all surfaces. If necessary, cleaning will be repeated (Foster Wheeler 1988a).

9.12.5 Proposed RI Plan

In order to address the potential contamination that may have resulted from past operations, a phased investigation is recommended. The following RI sampling plan will be carried out independently of implementation of the closure sampling plan. If clean closure is not possible, the RI plan will be modified as new information becomes available.

9.12.5.1 Phase I

The current condition of the Site should be assessed by inspecting all building interiors and areas around the buildings for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area.

In addition to the sampling of visibly contaminated areas, one surface soil sample should be collected between 0.15 and 0.3 m (6 and 12 in.) deep from three locations at each loading and handling area, and one surface soil sample should be collected from each side of each building.

All samples should be analyzed for explosives, propellants, nitrate, nitrite, and TCL metals.

9.12.5.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

9.13 SITE 151 — BUILDING 600, CHANGE HOUSE

9.13.1 Site History

Building 600 is located just east of Tenth Street near the north boundary of PTA (Fig. 9.11). The building is approximately 6,300 ft^2 in area. During interviews, PTA personnel reported that hand grenades, rockets, mines, and explosives were tested in the 600 Area until about 1978. Material was reportedly placed on the ground and fired. Additional information on past activities at this Site is not available.

9.13.2 Geology and Hydrology

Building 600 is located approximately 1,460 ft west of the south end of Picatinny Lake. The ground surface slopes west toward Bear Swamp Brook. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overlie Precambrian gneiss, which is not exposed at PTA.

The soils at Site 151 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Because detailed hydrogeological information is not available, it is uncertain whether groundwater flows toward Bear Swamp Brook or Green Pond Brook. Surface water is expected to flow toward Bear Swamp Brook.

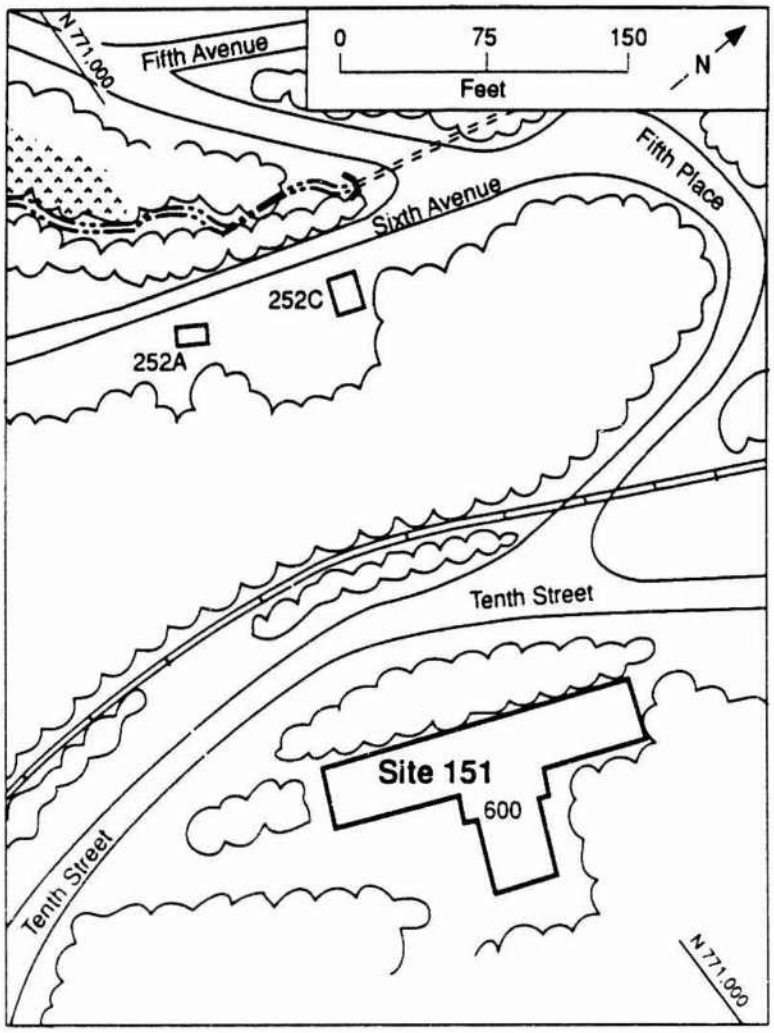

FIGURE 9.11 Layout of Site 151, the Change House at Building 600 (Source: Adapted from USACE 1984b)

9.13.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the site, and past activities have not been well documented. Possible explosive contaminants include TNT, Composition B, RDX, TKOL, Composition A5, and C4. The reported firing of munitions and explosives on the ground would be expected to contaminate the soil.

9.13.4 Proposed RI Plan

9.13.4.1 Phase I

The area around Bldg. 600 should be visually inspected to locate stained soil and other signs of contamination. One surface soil sample should be collected to a depth of

0.15 m (6 in.) from the center of each visibly contaminated area around the building. In addition, one surface soil sample should be collected to a depth of 0.15 m (6 in.) from each side of Bldg. 600. All samples should be analyzed for propellants and explosives.

9.13.4.2 Phase II

If contamination is found, additional sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from each boring and analyzed for contaminants identified during Phase I.

10 AREA I: AROUND PICATINNY LAKE

10.1 INTRODUCTION

This Area is quite large and includes 35 Sites located close to the shore on both sides of Picatinny Lake. The lake is also a Site. Activities in the Area include explosives manufacture and storage, shell washout, and other munitions related activities. Picatinny Lake is used for recreation and serves as an alternate water supply for the Arsenal.

10.2 SITE 16 — GUNCOTTON LINE

10.2.1 Site History

The guncotton line is near the southern end of Picatinny Lake. It is either an abandoned sanitary sewer line or storm drain that received an accidental discharge of nitrocellulose (guncotton). The pipeline is about 2,500 ft long, runs from a pit near Bldg. 554 and past Bldg. 506 (the main power plant), and ends in the vicinity of Building 424E. Figure 10.1 illustrates the layout of the line. By examining the manholes and catch basins across the area, 80% of the line has been traced out by PTA personnel. The only portion of the guncotton line that has not been fully accounted for is the short distance under the former coal pile near the main power plant.

10.2.2 Geology and Hydrology

Site-specific information is limited. Available information indicates that sections of the guncotton line are located over different units. The formation directly underlying the western section of the line is Hardyston quartzite. This is a fine- to medium-grained, thin- to medium-bedded feldspathic quartzite of Lower Cambrian Age. It is interbedded with arkose, quartz-pebble conglomerate, and silty shale or phyullite. The eastern end of the line is over Precambrian gneiss (Vowinkel et al. 1985).

Soils in this area are classified as Urban Land. These soils are mostly well-drained, deep sandy, gravelly, or stony material of glacial deposits (Sargent 1988).

10.2.3 Existing Contamination

There are no groundwater monitoring wells in the areas along the length of the line. Available information did not include any sampling or characterizations of possible contamination in the area. The presence of underground utilities and the nature of the guncotton line have strictly limited the amount of characterization possible.

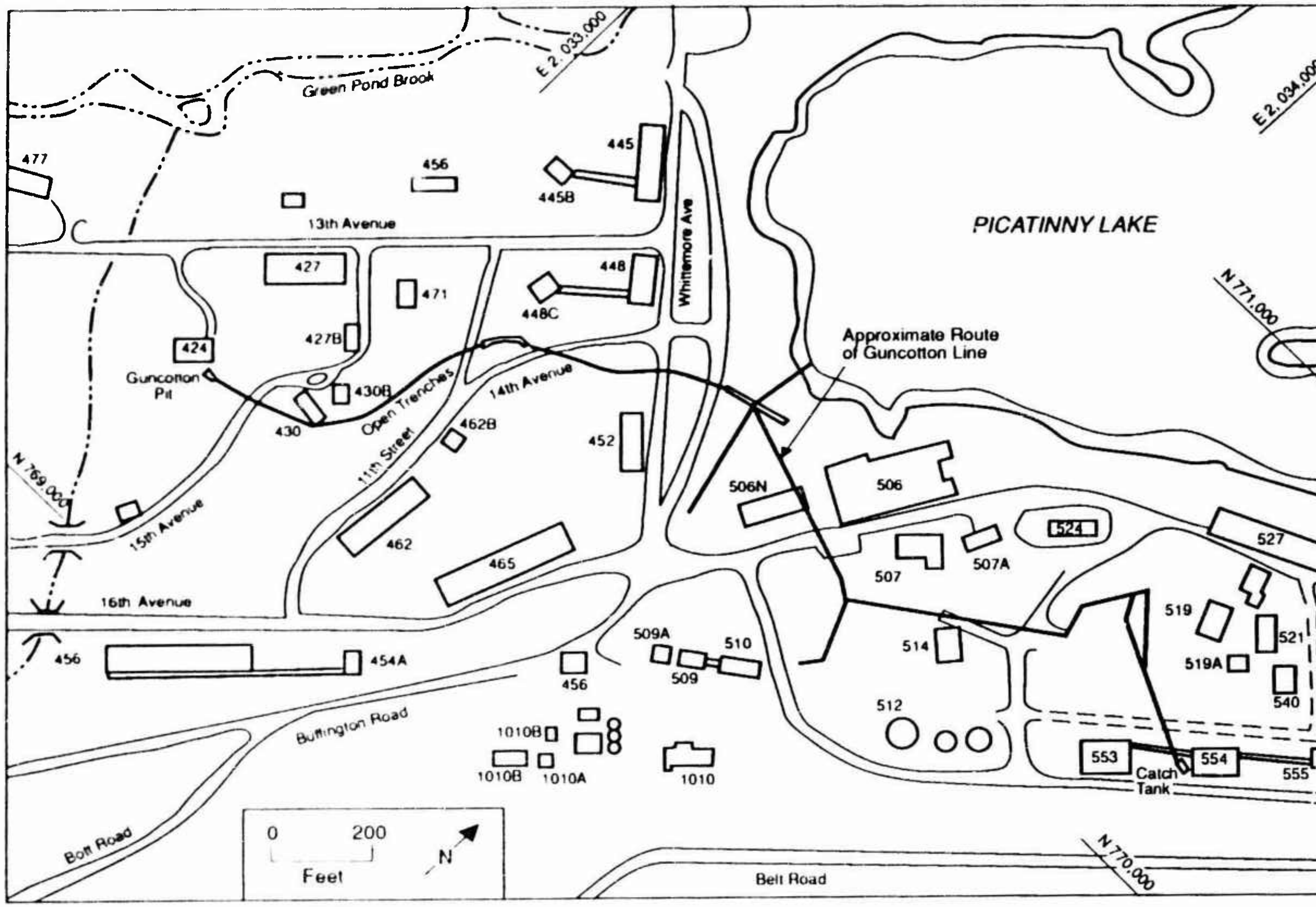

FIGURE 10.1 Layout of Site 16, the Guncotton Line (Sources: Map adapted from USACE 1984a; site layout based on Snyder 1988)

10.2.4 Proposed RI Plan

ARDEC personnel have traced the guncotton line and are familiar with its location. These individuals should be involved in any characterization or decisions regarding the disposition of the line.

The location of 80% of the length of the guncotton line is known. The location of the remainder of the line should be identified by dye tracer tests. The integrity of the line should also be assessed.

A method for removal of the explosives has been developed by the Picatinny Site Safety Office. These procedures should be reviewed for the feasibility of removing the guncotton line. At such time that excavation begins, soil samples should be obtained and analyzed for explosives.

10.3 SITE 30 — BUILDING 3045, FLUOROCHEMICALS STORAGE

10.3.1 Site History

Site 30, the fluorochemicals storage area, is located on West Tower Road near Picatinny Lake. The Site consists of a 6.1 by 4.6 m (20 by 15 ft) bunker, Bldg. 3045, constructed of concrete and built partly into the hillside. The roof is covered with earth and has a roof vent. The gas cylinder storage area, 4.1 by 1.1 m (13.5 by 3.5 ft), was in the center of the building. The area consisted of metal stanchions and a U-shaped trench covered with a grating. Presumably, the trench was used to catch any spills. Figure 10.2 gives some details of the Site surroundings, and Fig. 10.3 gives details of the interior of Bldg. 3045. The building was originally built in 1918 to serve as an ammunition magazine. Information on the year when chemicals were first stored in the building is not available (Foster Wheeler 1988a; Anderson 1988b).

Rocket propellant fuels were stored in the building during the 1960s. These materials, which were stored in cylinders, and trifluorodibromine,* a liquid stored in 55-gal drums, were in the building at the time of cleanup in November 1982. No accidents, spills, or leaking cylinders, which had deteriorated, were reported during the period of material storage. A 1969 report quoted in Anderson (1988b) stated that the area had a 50% degree of contamination.

An inventory of fluorochemicals stored in Bldg. 3045 from May 1966 to the date of cleanup in November 1982 is given in Table 10.1. At room temperature, chlorine trifluoride and perchloral fluoride are gases and bromine pentafluoride is a liquid (Weast 1976). All the chemicals in the inventory are hazardous. The exteriors of the two cylinders with unknown contents were rusted to an extent so that only the manufacturer's

*No chemical with this name is listed in the *Handbook of Chemistry and Physics* (Weast 1976). The chemical is probably bromine trifluoride, which is a liquid at room temperature (Weast 1976) and is listed in Young (1969) as a contaminant of Bldg. 3045.

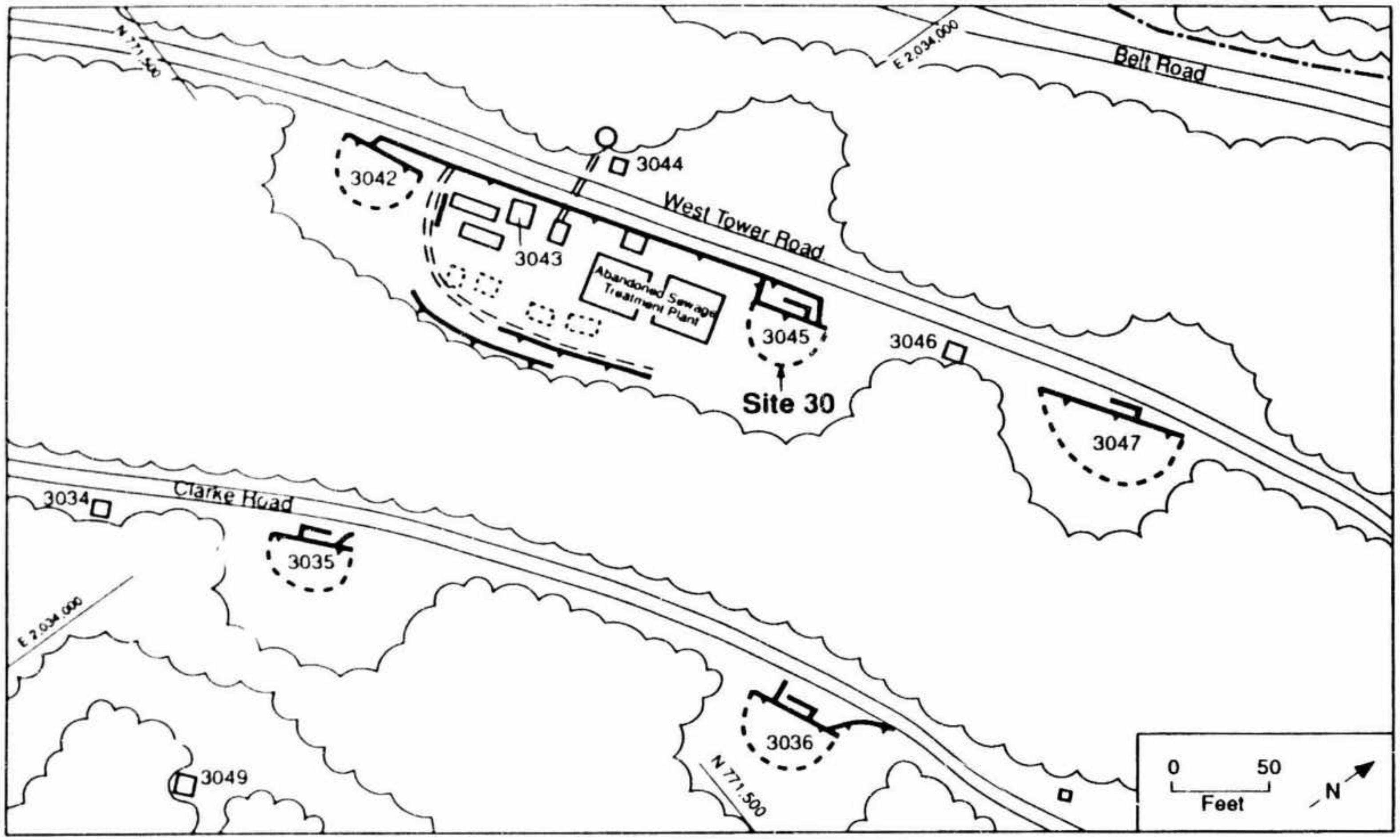

FIGURE 10.2 Details of Site 30, Fluorochemicals Storage (Building 3045) (Source: Adapted from USACE 1984b)

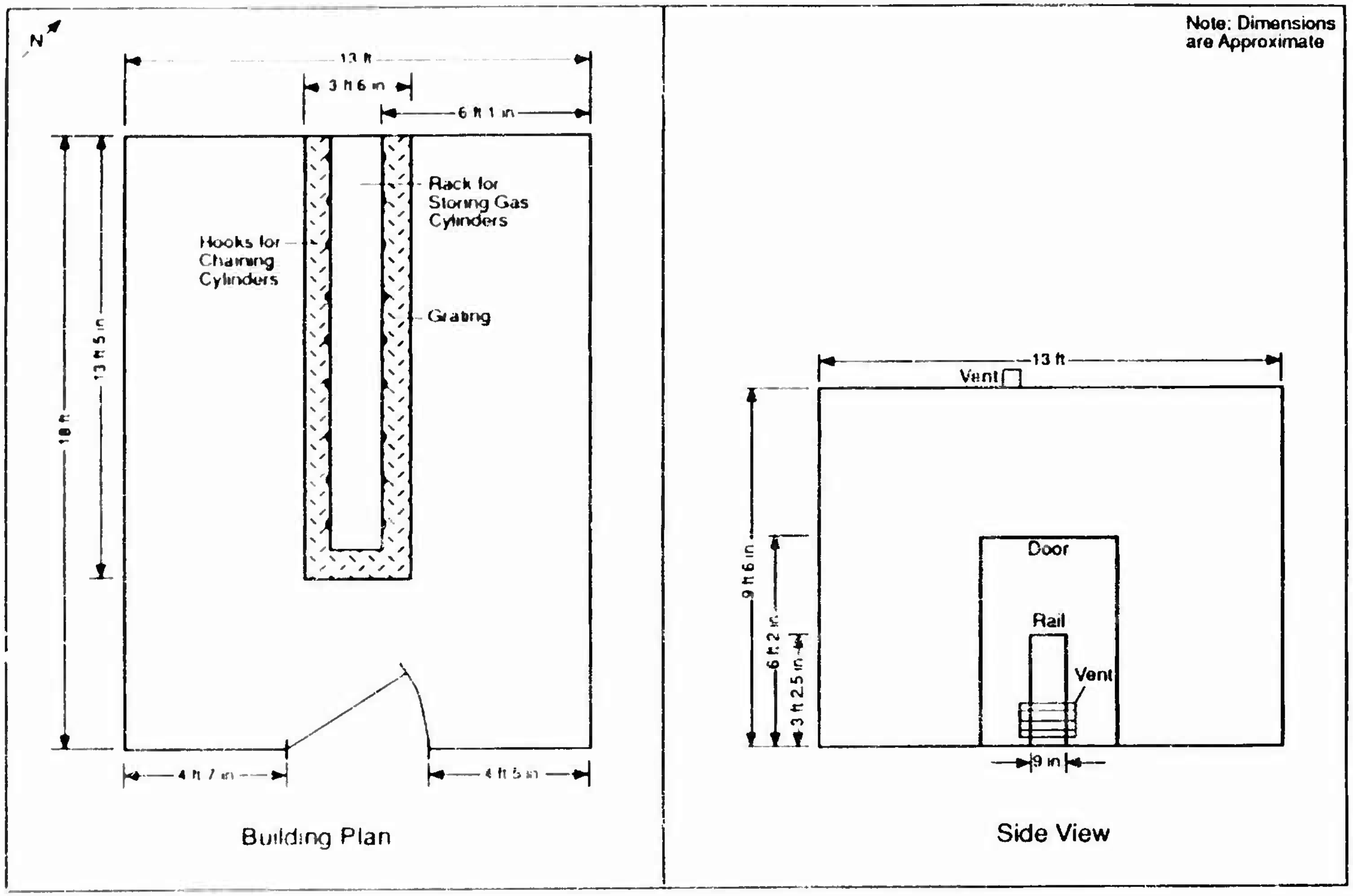

FIGURE 10.3 Floor Plan and Side View of Building 3045 (Source: Adapted from Foster Wheeler 1988a)

TABLE 10.1 Fluorochemicals in Building 3045 before the November 1982 Cleanup

Cylinder Contents	Cylinder Size (in.)[a]	Manufacturer
Chlorine trifluoride	10 x 48	General Chemical
Chlorine trifluoride	10 x 48	General Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride	10 x 48	Allied Chemical
Chlorine trifluoride (empty)	10 x 48	Allied Chemical
Chlorine trifluoride (empty)	10 x 48	Allied Chemical
Chlorine trifluoride (empty)	10 x 48	Allied Chemical
Chlorine trifluoride (empty)	10 x 48	Allied Chemical
Chlorine trifluoride (empty)	10 x 48	Allied Chemical
Perchloral fluoride	10 x 48	Pennsalt
Bromine pentafluoride	10 x 48	Unknown
Bromine pentafluoride	10 x 48	Unknown
Halox[b] 48-0114-37-02-13	10 x 48	Pennsalt
Halox	10 x 48	Pennsalt
Halox (medium)	6 x 23	Pennsalt
Halox	6 x 23	Pennsalt
Halox	6 x 23	Pennsalt
Halox	6 x 23	Pennsalt
Halox	6 x 23	Pennsalt
Unknown	6 x 18	Matheson
Unknown	6 x 18	Matheson

[a]Diameter by height.

[b]Halox is a mixture of perchloral fluoride and chlorine trifluoride.

Source: Anderson 1988b; Crane 1982.

stencil was legible. Presumably, they contained fluorochemicals (Foster Wheeler 1988a; Anderson 1988b). It is reported that the cylinders have not been tested during storage in the building since the middle or late 1960s (Anderson 1988b).

At present, the building is empty (Reibel 1988). Site cleanup and closure was done in November 1982 without submission of closure plans or NJDEP approval (Gaven 1986). Recently, RCRA closure plans have been prepared for closure of Bldg. 3045 under interim status (Foster Wheeler 1988a, 1989; Solecki 1989a).

10.3.2 Geology and Hydrology

The geologic strata at the Site consist of Precambrian gneiss overlain by unconsolidated glacial till. In this area, which a gentle slope along the eastern side of the valley, till thickness ranges from 3 to 8 m (10 to 25 ft) (Dames & Moore 1989). Surface soils in the area belong to the Rockaway Series. These are characterized as moderately well drained upland soils. The subsoil is commonly a gravel loam or a gravelly sandy loam. The lower part is a dense fragipan over which water tends to move laterally (USATHAMA 1976). Surface runoff would be expected to follow the Site slope to the northwest toward Picatinny Lake. The depth to groundwater at the Site is unknown.

10.3.3 Existing Contamination

No data are available on existing or past contamination of soil, surface water runoff, or groundwater at the Site.

10.3.4 Closure Plan

Revised RCRA closure plans for Bldg. 3045, which has interim status, consist of sealing off the building and then washing the floors and walls with detergent and rinsing with clean water. Two rinsate samples and two chip samples from the cleaned floor will then be collected and analyzed for priority pollutant metals (Foster Wheeler 1988a, Solecki 1989a).

10.3.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, then the proposed RI sampling plan may have to be modified.

10.3.5.1 Phase I

Four surface soil samples should be collected to a depth of 0.15 m (6 in.) with one sample collected each of the two sides of the building, one sample by the doorway, and one sample on the roof by the vent (this sample is not needed if there is no soil on the roof by the vent). Samples should be analyzed for chloride, fluoride, bromide, nitrate, nitrite, TCL metals, TCL semivolatiles, TCL volatiles, and herbicides. The herbicides are included because selective weed control was applied to the embankment of each earth-covered magazine to suppress woody growth (Rigassio 1975). The other parameters are included because rocket propellants were reported to have been stored in the building (Sec. 6.1). Also, it is not known what was stored in the magazine from the time of construction (in 1918) through 1966, when the inventory listed in Table 10.1 was started. Additional surface soil samples should be taken in areas of possible spills or soil staining if such areas are found by field inspection.

The four surface soil samples described above should be collected because they complement the sampling described in the closure plans, which sample the building floor and rinsate only.

10.3.5.2 Phase II

No further sampling is needed if the soil samples show no significant contamination. If significant contamination is found in the soil samples, then additional soil samples may be needed to determine the nature and extent of the contamination. Soil borings may be needed to determine the depth of soil contamination. Two monitoring wells (one upgradient of the building and one downgradient) may also be needed to determine if the groundwater in the area is contaminated. The analytical parameters for the Phase II water and soil samples, if any, depend on the results of the Phase I soil sampling program.

10.4 SITE 32 — STORAGE TANKS AT BUILDING 553

10.4.1 Site History

Site 32 is located between 21st Ave. and Bott Rd. (Fig. 10.4). The Site consists of 11 elevated aboveground storage tanks. These unused storage tanks are in an open-sided building with a concrete berm around the underlying gravel pad. The facility was constructed during World War II (1942) and was one of the important facilities for explosive manufacturing at PTA (PTA 1988b). Nine of the tanks are horizontal, cylindrical, steel tanks and two are rectangular with one made of concrete and the other made of steel construction. The tanks were used to store alcohol, diesel fuel, or mixed solvents for manufacture of nitrocellulose (guncotton). The contents were piped to Bldg. 519 where manufacturing took place. An abandoned railroad bed that was used to supply the tanks lies alongside of the building. Piping that was used to transfer the contents to Bldg. 519 lies outside of this structure (PTA 1988b).

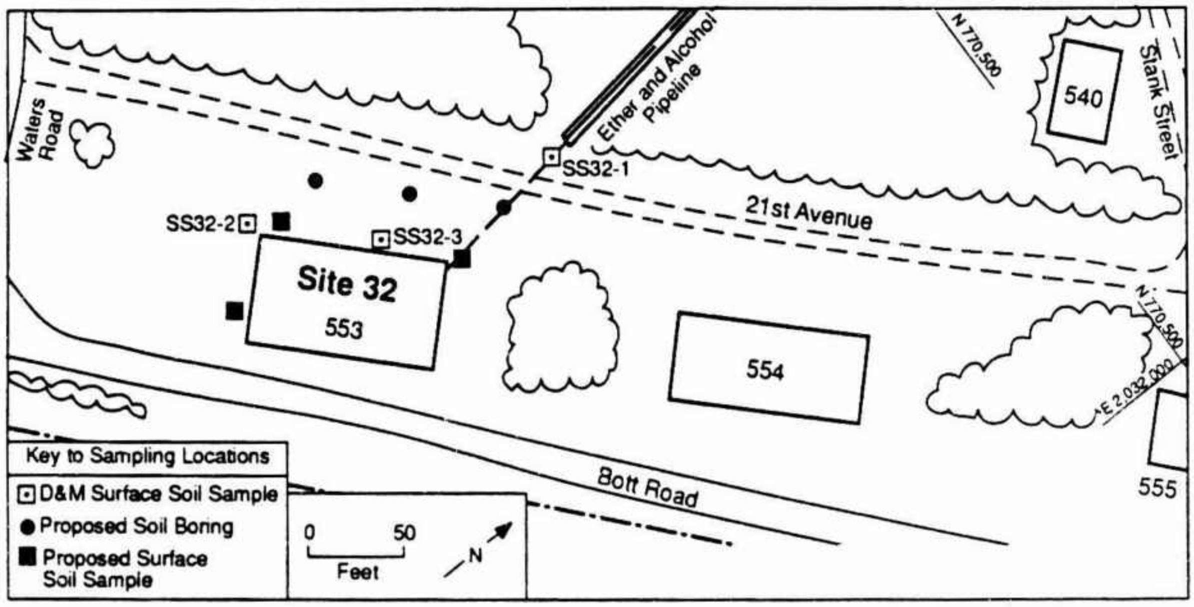

FIGURE 10.4 Layout of Site 32, the Storage Tanks at Building 553 (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

While the previous contents of the remaining tanks are unknown, identification markings on the various tanks indicated their contents were as follows (PTA 1988b):

Tank 1 - diesel fuel

Tanks 2 and 9 - alcohol

Tanks 3, 4, and 8 - ether

Tank 5 - ether layer

Tank 6 - water layer

Tank 7 - spent alcohol

Tanks 10 and 11 (rectangular) - not labeled.

At present, the tanks appear to be in good shape and are disconnected. Except for Tank 7, which contains about 1,200 gal spent alcohol, and Tank 10, which contains about 1,700 gal possibly of spent ether and alcohol, the tanks are empty (Foster Wheeler 1988b). A request has been submitted to TECUP to have the tanks removed and the building demolished (PTA 1988b).

According to Foster Wheeler (1988b), three of the tanks stored hazardous waste, two stored undetermined substances under the nomenclature "Water Layer" (assumed to be hazardous), and six stored hazardous raw materials. All the chemicals were associated with nitrocellulose production. Usage of the tanks was stopped before 1980.

RCRA closure plans have been prepared for Site 32 (Foster Wheeler 1988b). The Site is to be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

10.4.2 Geology and Hydrology

Site 32 is located about 198 m (650 ft) east of Picatinny Lake on glacial till at an approximate elevation of 230 m (770 ft) above MSL. No groundwater monitoring wells have been drilled in the vicinity of this Site, nor are there any surface water bodies in the immediate area. Bedrock should be Precambrian gneiss.

Soils in the area have been mapped as Urban Land (undivided) (Eby 1976). Unlike other areas in Morris County, Eby (1976) did not subdivide the Urban Land mapping unit at PTA. Based on his description of these units elsewhere, this unit consists of areas that are either paved or built upon. The soils in the remaining open spaces have been reworked to the extent that the original profile cannot be recognized. The characteristics of the materials are variable. For the most part, these units are well-drained, deep sandy, gravelly, or stony material of assorted glacial deposits (Eby 1976).

10.4.3 Existing Contamination

The extent of any contamination, if it exists, is unknown. A leaking valve on tank 10 was discovered on September 9, 1988. The amount of liquid that had leaked onto the floor is not known. Potential contaminants include ether, alcohol, and nitrocellulose. Flash tests on the leaking liquid showed it to be insensitive to flashing (Gabel 1990).

To evaluate the Site, Dames & Moore (1989) collected three soil samples from around the perimeter of the structure. Sampling locations are shown in Fig. 10.4. Analysis of the samples for VOCs gave the results summarized in Table 10.2. Methylene chloride, acetone, and two unknowns were the only organics detected. It is not known if these positive results represent contamination at the Site or result from use of these chemicals in the laboratory QA/QC procedures for sample bottle washing.

10.4.4 Closure Plan

Revised RCRA closure plans for this Site include collecting air and liquid samples from each tank and flushing and steam cleaning the tanks. After cleaning, the tanks will be removed, flashed off at the burning grounds and scrapped. One steam condensate grab sample will be collected from each tank. The samples will be analyzed for nitrates, VOCs (liquid samples only), and priority pollutant metals (condensate samples only). No soil samples will be collected (Foster Wheeler 1988b; Solecki 1989a).

TABLE 10.2 Selected VOC Concentrations in Soil Samples from Site 32 (ppb)

Parameter	SS32-1	SS32-2	SS32-3
Methylene chloride	42.6	30.4	47.6
Acetone	5.7	7.6	9.5
Unknown 520	-	6.1	-
Unknown 592	-	4.6	6.3[a]

[a]Identified as "alkane" in the source. Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989; York 1989d.

10.4.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, the proposed RI plan may have to be modified as new data become available.

10.4.5.1 Phase I

Fourteen surface soil samples should be collected over a depth interval of 0.15-0.3 m (6-12 in.); one sample should be collected under each tank's filling or discharge areas, and three samples should also be collected along the northwest side of the storage building and near the pipeline. Suggested sampling locations for the three samples are shown on Fig. 10.4.

Three or more surface soil samples should be collected at any points under the ether alcohol pipeline that show visual evidence of contamination or (if no visible contamination is present) at points below joints or valves in the pipeline.

The samples should be analyzed for TCL volatiles, TCL semivolatiles, nitrocellulose, nitrate, and nitrite over a depth interval of 0.15-0.3 m (6-12 in.).

10.4.5.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate its source and extent. To accomplish this, it may be necessary to resample all locations indicating contamination, collect additional surface soil samples, and drill soil borings. It is not possible at this time to accurately define the number of surface soil samples or soil borings that would be needed. However, the number should be sufficient to fully define the contaminated areas.

All samples collected during Phase II should be analyzed for significant parameters identified during the Phase I investigation.

10.5 SITE 33 — STORAGE TANKS AT BUILDING 527A

10.5.1 Site History

Two presently unused aboveground storage tanks are located in a cement-lined pit with a gravel base along Babbitt Road (Fig. 10.5). The surrounding buildings have been demolished, but the tanks appeared to be in good shape. One of the tanks has a 19,680-L (5,200-gal) capacity and the other is a 4,070-L (1,075-gal) steel tank. At present, the smaller and larger tanks contain about 2,300 L (600 gal) and 6,100 L (1,600 gal) of liquid, which is probably spent alcohol contaminated with nitrocellulose.

RCRA closure plans have been prepared for Site 33 (Foster Wheeler 1988b). The tanks are to be closed in accordance with New Jersey hazardous waste regulations because they never had interim status.

10.5.2 Geology and Hydrology

The Site is located about 15 m (50 ft) from the southeast shore of Picatinny Lake on glacial till. Bedrock, which is not exposed, should be Precambrian gneiss.

Detailed geohydrological information about this Site or area is not available as no wells have been drilled in the area.

Eby (1976) mapped the soils in the area as being Urban Land (undivided). Based on his description of these units elsewhere, this unit generally consists mostly of areas that are either paved or built upon. The soils in the remaining open spaces have been reworked to the extent that the original profile cannot be recognized. The characteristics of the materials are variable. For the most part these units are well drained, deep sandy, gravelly, or stony material of assorted glacial deposits (Eby 1976).

10.5.3 Existing Contamination

The extent of any surface or groundwater contamination, if present is not known. There have been no reported spills or leaks from the tanks.

Dames & Moore (1989) collected three soil samples from around the Site. Soil sample SS33-1 was collected under the open accessway through the top of one of the tanks, while samples SS33-2 and -3 were collected beneath the piping connected to the tanks. The samples were analyzed for explosives.

Explosives detected in one or more samples are listed in Table 10.3 along with the measured concentrations. Concentration levels of these constituents vary between

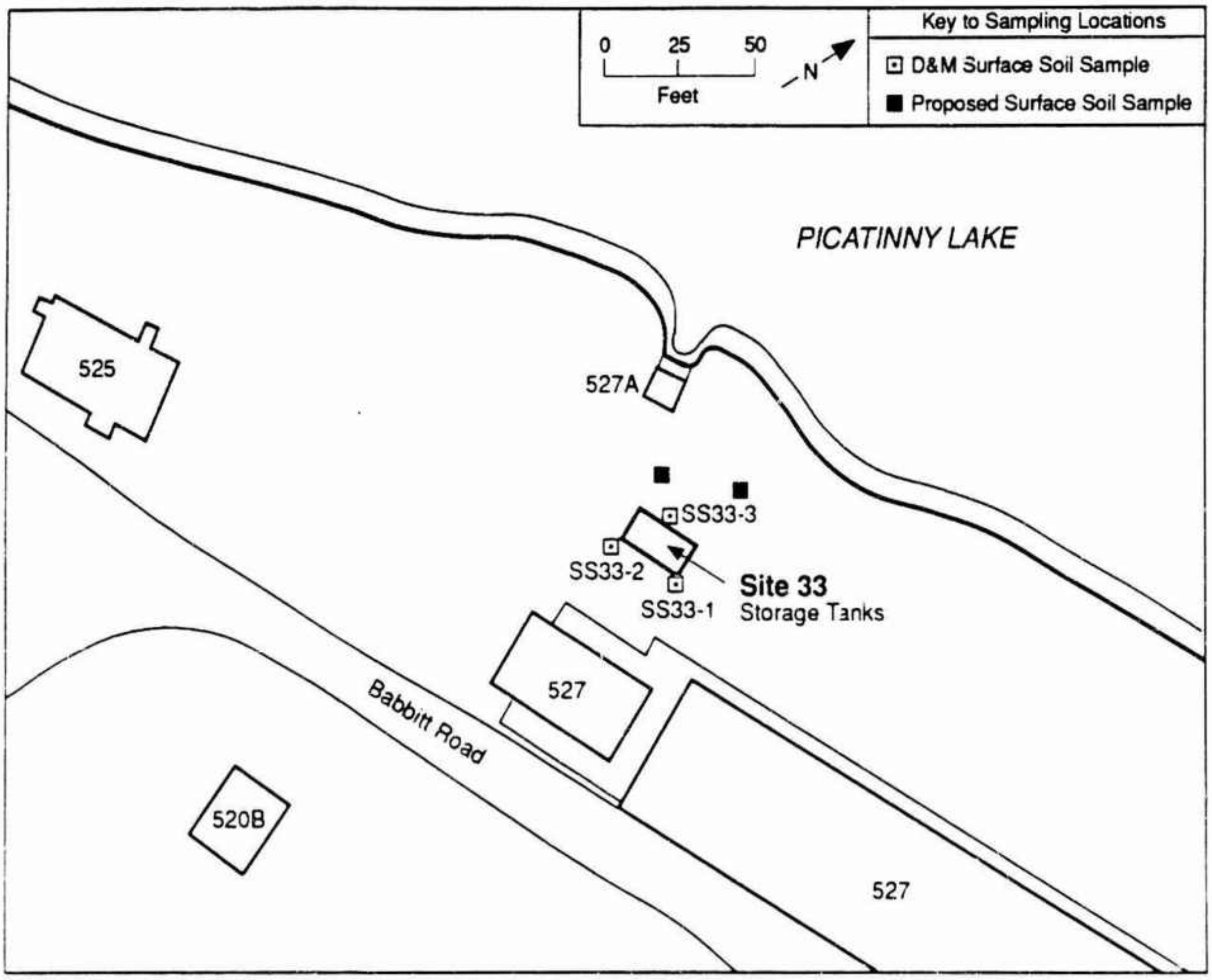

FIGURE 10.5 Layout of Site 33, the Storage Tanks at Building 527A (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

TABLE 10.3 Selected Explosives Concentrations in Soil Samples from Site 33 (ppm)[a]

Explosive	SS33-1	SS33-2	SS33-3
Tetryl	BDL	BDL	5.39
2,4-Dinitrotoluene	15.9	BDL	57.0
Nitroglycerin	3.33	BDL	19.0

[a]BDL means below detection limit. Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

the three sample locations with 2,4-dinitrotoluene having the highest concentration levels (up to 57 ppm). Soil sample SS33-3 contained measurable amounts of tetryl (5.4 ppm), 24DNT (57 ppm), and nitroglycerin (19 ppm). The source of the explosive contamination is not known with certainty. However, it probably comes from drippings and leaks from the tanks, valves, and piping.

During 1989 interviews with ANL staff, PTA personnel reported that wash water from chemical containers was dumped into swampy areas near the Site and that composition B was found in the gills of fish. A newspaper article also reported the presence of traces of explosives in 1983 in fish from Green Pond Brook (Orlandini 1987). However, a 1983 study of explosives in fish taken from Picatinny Lake, the Northwestern Basin, and Pond 3119 showed no explosives detected at detection levels of 300 ppm for 24DNT, 26DNT, and TNT and 300 or 30 ppm for RDX. The study also noted that levels of RDX detected in fish appeared to be a result of interference in the laboratory analysis procedure (USAEHA 1984a).

10.5.4 Closure Plan

Revised RCRA closure plans for the tanks include collecting air and liquid samples from each tank, flushing and steam cleaning the tanks, and flashing and scrapping them. Two steam condensate grab samples will be collected from the tanks and eight soil samples will be collected from under the tanks. The samples will be analyzed for nitrates, VOCs (soil and liquid samples only), priority pollutant metals (soil and condensate samples only), and, if necessary, EP toxicity for metals (soil samples only) (Foster Wheeler 1988b; Solecki 1989a).

Sixteen soil samples will be collected from two depths (0-6 in. and 6-12 in.) at four locations around each of the two tanks. The eight 0- to 6-in. samples should be analyzed for priority pollutant metals, nitrates, and if needed, EP toxicity (metals). The eight 6- to 12-in. samples should be analyzed for VOCs (Foster Wheeler 1989; Solecki 1989a).

10.5.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, the proposed RI plan may be modified as new data become available.

10.5.5.1 Phase I

Two soil samples should be collected to a depth of 0.15-0.3 m (6-12 in.) from a location halfway between Bldg. 527A and Picatinny Lake. (Collection of soil samples from the area between Bldg. 527 and 527A is included in the RI plan for Site 148 [see Sec. 10.28.5].) Suggested sampling locations are shown in Fig. 10.5.

The soil samples should be analyzed for TCL volatiles and explosives. The Site history does not warrant analyses for semivolatiles.

10.5.5.2 Phase II

If significant contamination is found in the surface soil samples, additional surface soil samples should be collected to determine the areal extent of contamination. If warranted by the surface soil analyses, one soil boring should be drilled in each significantly contaminated area. If contamination is found at depth, groundwater monitoring wells may be needed.

All soil samples should be analyzed for parameters determined to be significant by the Phase I results. Water samples should be collected from any installed wells and analyzed for the same parameters and the macroparameters.

10.6 SITE 40 — BUILDINGS 809 AND 810, EXPLOSIVES MANUFACTURING WASTEWATER TREATMENT FACILITY

10.6.1 Site History

Site 40, which consists of Bldgs. 809 and 810, is located on the western shore of Picatinny Lake. Details of the Site are shown in Fig. 10.6. Buildings 809 and 810 were built in 1944 and 1930, respectively. The exteriors of both buildings -- including roofs, exterior doors, walkways, and ramps -- need repair and the escape chute of Bldg. 810 is rusty and has loose sheet-metal plates. Minor repairs are needed in the interiors of the buildings (Zarra et al. undated).

Building 810 was used to melt-load large projectiles (90-mm, 105-mm, 155-mm, and 8-in. diameters). Powder was loaded into funnel-shaped kettles, melted by steam heating, and then poured into projectiles. After loading, the projectiles were placed in a hot-water shroud for controlled cooling. Explosives vapors generated by the loading process were vacuumed into a Rotoclone where they were removed by scrubbing. Components of the powder loaded into the projectiles include TNT, RDX, HMX, pentaerythritol tetranitrate (PETN), and aluminum powder (Anderson 1988b).

Initially, the projectile loading was done by hand. In 1970, an automated loading process was installed. In 1983 and 1985, other changes were made to further automate the process, including the use of computer-operated, remote-controlled operations using television cameras. No major spills were reported as occurring in or near Bldg. 810. Occasional minor spills of TNT were reported during interviews with PTA personnel familiar with the process. A 5,670-L (1,500-gal) aboveground tank for holding contaminated wastewater (red water) resulting from the loading operations is located outside the building. The tank seems to be in fair condition (Anderson 1988b).

Building 809 was used as a facility for washing explosives out of large-caliber projectiles. Steam or hot water under pressure was injected into the projectile through a pipe inserted through its nose. The contaminated explosive-containing water (red water) passed into settling troughs, then into sawdust-filled bags to filter out suspended particles, and then into a leaching pool filled with sawdust bags. The system was cleaned

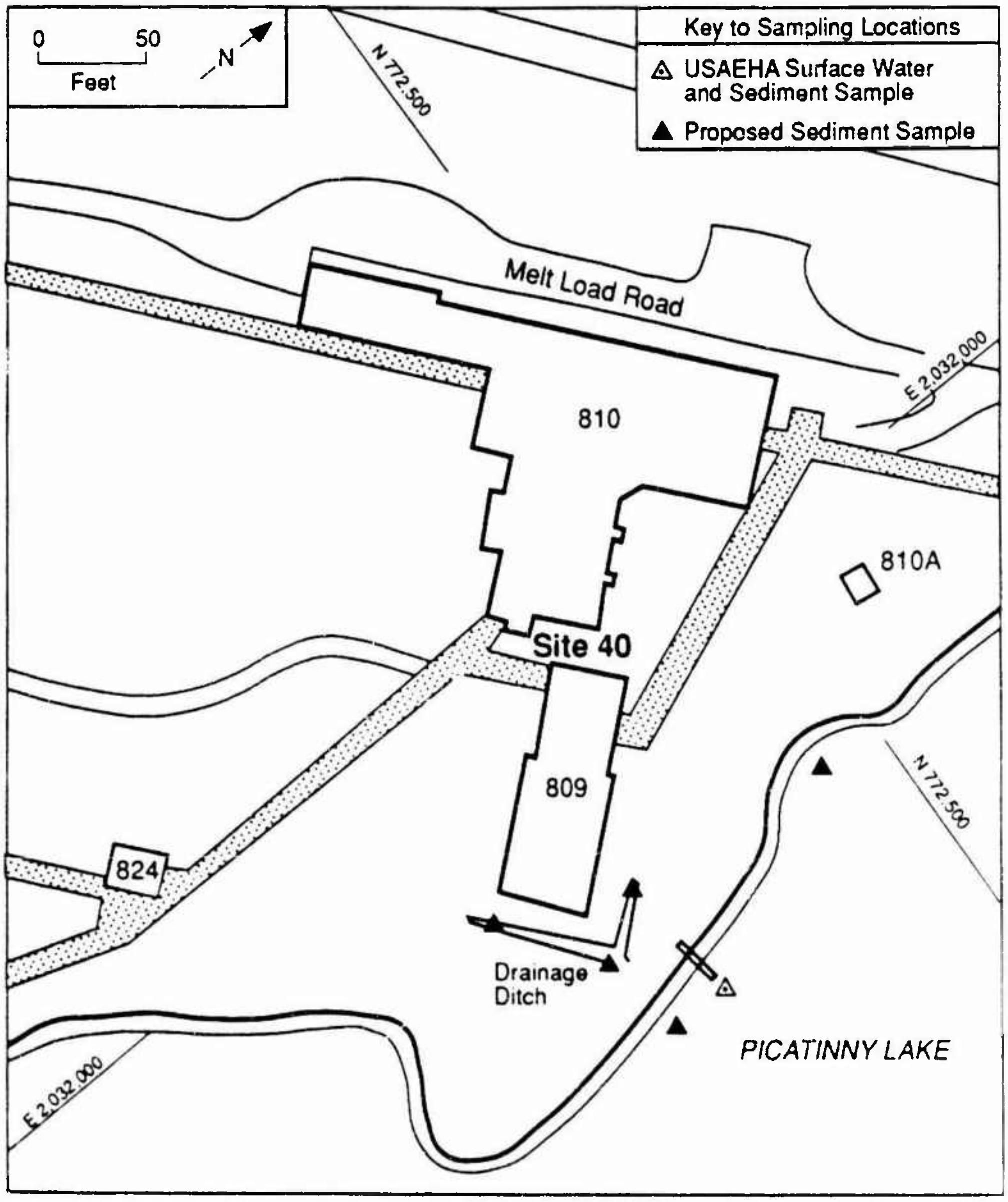

FIGURE 10.6 Details of Site 40, Explosives Manufacturing Wastewater Treatment Facility at Buildings 809 and 810 (Sources: Map adapted from USACE 1984b; sampling location from York 1989b)

by removing all residues and used sawdust bags to the burning ground for disposal. Water from the leaching pool was taken in 55-gal drums to the burning ground, where the water was evaporated and the remaining residues burned (Anderson 1988b).

Before 1970, the washout operations were done by hand. In 1970, an automatic washout, filtering, and cleaning system was installed. The automatic washout system did not work well and was not used after the trial runs. At present, the reduced level of operations at the facility makes washout by hand a feasible operation. The automatic filtering and cleaning systems were and are still being used. These systems treat red water by passing it through stainless steel baffle tanks, through several cooling towers, into a series of filtering trays containing sawdust and sheets of fiberglass insulation, and then into a 151,000-L (40,000-gal) holding tank. Red water from the holding tank is passed through diatomaceous earth filters and activated charcoal filters and is then discharged into Picatinny Lake. Discharges occur infrequently as the system is not used much. Prior to 1970, discharges from the leach pool into Lake Picatinny have occurred occasionally from the time the washout operations began.

ARDEC employees reported that wastewater from the washout operation went into a holding tank and then spilled out onto the ground and into the lake. Suspected contamination of the soil and lake bottom with composition B (a mixture of TNT and RDX) was also reported. Red water from operations in Bldgs. 225, 230, and 810 is also brought over to a 1,900 L (500-gal) holding tank at Bldg. 809 before being treated and discharged to Picatinny Lake (Anonymous undated; Anderson 1988b; Gaven 1986). During 1989 interviews with ANL staff, PTA personnel reported the possible existence of a pit between Bldgs. 809 and 810 that received wastewater discharges.

Discharges into Picatinny Lake from Bldg. 809 were allowed under the NJPDES permit (No. NJ0002500) up to June 30, 1988. The permit issued in 1985 requires that, after June 30, 1988, the Bldg. 809 wastewater treatment plant be connected to the Rockaway Valley Regional Sewer Authority wastewater treatment plant. The permit also allowed discharges of treated red water up to a daily average of 37,800 L (10,000 gal) into Picatinny Lake. The permit requires daily monitoring of pH, total suspended solids (TSS), oil and grease, chemical oxygen demand (COD), TOC, and toxicity (bioassay).

PTA has also filed a Part A RCRA application to obtain interim status and allow existing facilities, such as the wastewater treatment plant in Bldg. 809, to continue operation until a final hazardous waste permit is obtained. In 1987, operations in Bldg. 809 generated 91 kg/yr (200 lb/yr) of hazardous waste K044 (wastewater treatment sludges from explosives operations), 18 kg/yr of hazardous waste K045 (spent carbon from the treatment of explosives wastewater), and no hazardous waste K047 (pink-red water from TNT operations [40 CFR 261]). In 198[illegible], the corresponding amounts were 455 kg/yr (1,000 lb/yr) of waste K044, 227 kg/yr (500 lb/yr) of waste K045, and 227,000 kg/yr (500,000 lb/yr) of waste K047. (This includes pink-red water from TNT operations at several buildings, which is brought to Bldg. 809 for treatment.) ARDEC hopes to exempt the Bldg. 809 operations from RCRA permitting by having it treated as an industrial waste management facility (IWMF). A permit is needed to dispose of the K044 and K045 wastes at the burning ground (ARDEC 1988).

RCRA interim status closure plans have been prepared for the Bldg. 809 pit storage reservoir, which accumulated pink-red water (waste K047). The 130,000-L (34,600-gal) pit is part of the explosives wastewater treatment plant located in Bldgs. 809 and 810. All wastewaters generated from shell loading and unloading operations are treated in the plant. In the past, accumulated wastes in the pit were transferred off the Site for disposal in a hazardous waste facility. Treated wastewater in the pit reservoir was pumped periodically into tank trucks for disposal off the Site. This truck loading area south of Bldg. 809 did not have secondary containment. Closure is required because PTA does not intend to dispose of hazardous waste from the pit reservoir. The closure is scheduled to be a clean closure (Foster Wheeler 1988b).

RCRA closure plans have also been prepared for the 5,670-L (1,500-gal) holding tank located between Bldg. 810 and Picatinny Lake. Even though the tank will remain in operation and an exemption is claimed, the plans are required because no information is available to document storage times in the past for hazardous waste. The tank, which was installed in 1973 on a concrete pad with no curbing for secondary containment, will be upgraded to qualify for 90-day storage status (Foster Wheeler 1988c).

A January 1989 summary of satellite storage areas notes that 45.4 kg/mo (100 lb/mo) of composition B and octol (a mixture of TNT and HMX) are generated from steamout operations in Bldg. 809 and 454 kg/mo (1,000 lb/mo) of TNT, composition B, octol, and cyclotol (a mixture of TNT and RDX) are generated from explosives loading operations in Bldg. 810. Both are stored temporarily inside the buildings on concrete floors (Solecki 1989c).

10.6.2 Geology and Hydrology

The geology of the general area indicates that bedrock under the Site, the Leithsville Formation of Cambrian age, consists of a sequence of carbonates, principally dolomite, with thin beds of quartzite, sandstone, and shale. This is overlain by about 5 m of till (Lacombe et al. 1986; Dames & Moore 1989). If Picatinny Lake is the surface water expression of the groundwater table then the water table is quite close to the surface at the Site.

Surface soils at the Site belong to the Rockaway Series. These are characterized as deep moderately well drained acidic upland soils underlain by a gravelly loam or a sandy gravelly loam. The lower part of the subsoil consists of a dense fragipan over which water tends to move laterally. Permeability of the soils ranges from 1.5 to 5.0 cm/h (0.6 to 2.0 in./h) (USATHAMA 1976).

10.6.3 Existing Contamination

No data exist on contamination of soils or groundwater at the Site. One sediment and one surface water sample were collected in July 1985 at the location shown in Fig. 10.6 and analyzed for explosives. None were detected in either sample (York 1989a, 1989b).

10.6.4 Closure Plan

The revised RCRA closure plans for the pit reservoir in Bldg. 809 include repeated steam cleaning of the floor around the pit until the condensate is colorless and collecting wipe samples from two locations on the cleaned floor and analyzing for nitrates and EP toxicity (metals). The reservoir will not be cleaned because it will continue to be used for storage. Five surface soil samples will be collected to a depth of 0.15 m (6 in.) at locations shown in Fig. 10.7 and analyzed for nitrates, priority pollutant metals, and EP toxicity (metals). Samples will be collected at the same locations from a depth of 0.15-0.30 m (6-12 in.) and analyzed for VOCs (Foster Wheeler 1988b, 1989; Solecki 1989a).

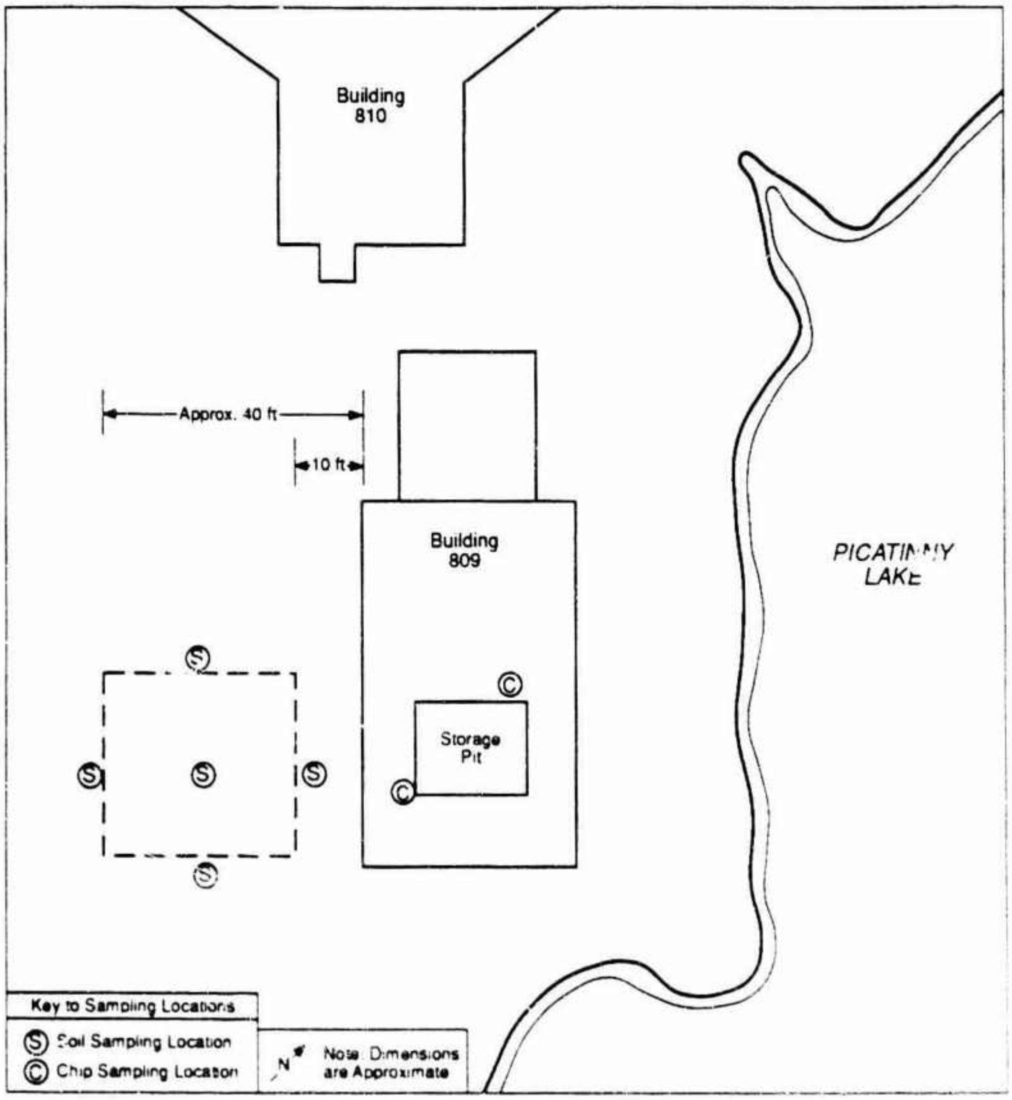

FIGURE 10.7 Soil and Chip Sampling Locations Given in the Closure Plans for Buildings 809 and 810 (Source: Adapted from Foster Wheeler 1989)

The revised RCRA closure plans for the holding tank outside Bldg. 810 include removal of the tank contents to the explosives wastewater treatment plant in Bldg. 809 and thorough decontamination of the tank. Surface soil samples will be collected to a depth of 0.15 m (6 in.) at the four locations shown in Fig. 10.8 and analyzed for priority pollutant metals, EP toxicity (metals), and nitrates. Samples will be collected from the same locations over a depth interval of 0.15-0.30 m (6-12 in.) and analyzed for VOCs (Foster Wheeler 1988c, 1989; Solecki 1989a).

10.6.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure of either the pit reservoir in Bldg. 809 or the holding tank outside Bldg. 810 is not possible, the proposed RI plan may have to be modified as additional data become available.

10.6.5.1 Phase I

In addition to the sampling recommended in the closure plans and revisions, six soil samples should be collected to a depth of 0.15 m (6 in.) and analyzed for herbicides, explosives, TCL metals, nitrate, and nitrite. Locations of five of the samples (three in the drainage ditch and two along the lake shore) are shown in Figure 10.6. An additional sample should be collected from sediments within the drainage pipe draining into the lake. Herbicide sampling is recommended because of the application of herbicides to control weeds in the area; the other parameters are based on the operations carried out in the buildings.

Additional surface soil samples should be collected in areas of soil disturbance, soil staining, or possible spills. Special attention should be paid to the area between Bldgs. 809 and 810, where the possible existence of a pit was reported during interviews with PTA personnel. Any additional samples collected should be analyzed for the same parameters as for the sediment samples.

10.6.5.2 Phase II

Additional sampling will depend on the results of the Phase I soil and sediment sampling program. If significant contamination is found, then additional surface soil samples would be needed to determine the areal extent of the contamination. Soil borings would also be needed to determine the depth of the contamination. The parameters to be analyzed would be determined by those found at significant levels in the sediment and soil samples taken in Phase I.

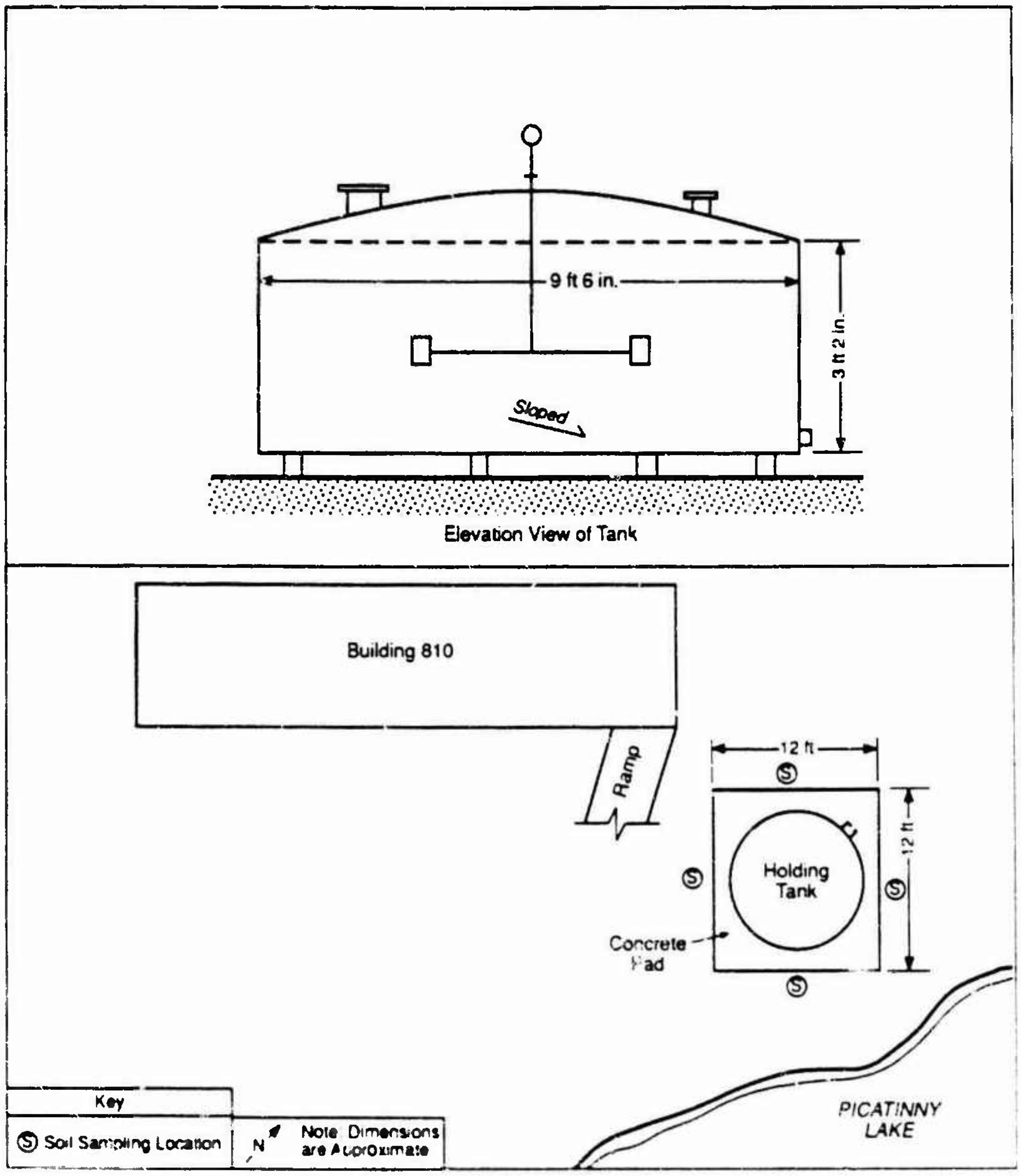

FIGURE 10.8 Closure Sampling Locations Around the Building 810 Holding Tank (Source: Adapted from Foster Wheeler 1988a)

10.7 SITE 46 — BUILDING 507, 90-DAY WASTE ACCUMULATION AREA

10.7.1 Site History

Site 46 is located on Babbit Road near the southeastern shore of Picatinny Lake. The Site map is given in Fig. 10.9. Building 507 was constructed in 1929. The size of the building is 14 by 23 m (45 by 75 ft). The foundation and floor are concrete with 8-in. hollow tile walls and a built-up roll roof of tongue-and-groove planking (Anderson 1988b).

Building 507 has been used as a garage for the storage and maintenance of train engines. The waste oil resulting from the maintenance operations was collected in 55-gal drums and stored in a shed located east of the building. Spent solvent and raw material solvents used for engine maintenance were also stored in this shed. The shed is about 20 ft square (Fig. 10.9).

Building 507 is currently used by the line crew for storing power-line trucks. The hazardous waste generating operation ceased September 1987, thereby eliminating the need to continue waste storage in the shed. Building 507 is to be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

10.7.2 Geology and Hydrology

Site 46 is situated in the southern portion of the valley near the south corner the Picatinny Lake. The vicinity's topography is relatively flat. Soils are classified as Urban Land, which is usually well-drained, deep sandy, graveily, or stone material of glacial deposits. However, the soils in the area have been reworked during development so that the original soil profile may be unrecognizable (Wingfield 1976).

There are no soil borings directly associated with Site 46. However, based on the hydrogeological characteristics of PTA, three aquifers may be found in the study area. The water-table aquifer is primarily within the top 35 ft of the land surface. Underlying the water-table aquifer is the confining bed, which is 150 ft thick in some areas. The bed is discontinuous and leaky. A confined glacial aquifer of about 30 ft underlies the confined bed (Harte et al. 1986).

The groundwater in the area flows northwest toward Picatinny Lake, based on the surface topographic contour.

10.7.3 Existing Contamination

Generation and handling of waste oils and solvents may have resulted in soil contamination at the Site. However, there have been no data concerning the soil, surface, and groundwater contamination. Some oil spills have been reported (Anderson 1988b). For example, in 1981 there was a 5,500-gal oil spill at Bldg. 506, which is about 125 ft from Bldg. 507.

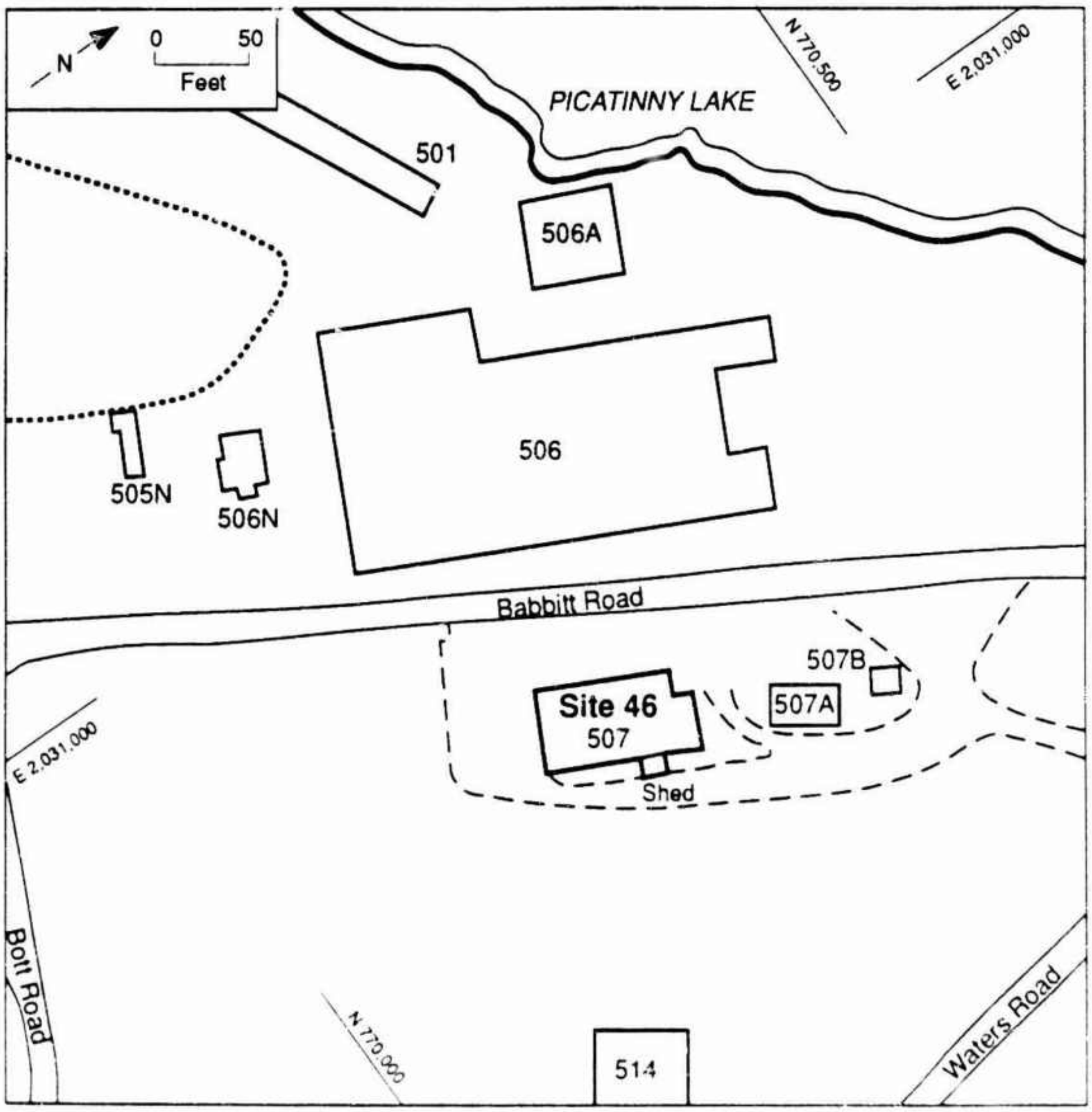

FIGURE 10.9 Layout of Site 46, the 90-Day Waste Accumulation Area at Building 507 (Source: Adapted from USACE 1984b)

10.7.4 Closure Plan

As mentioned in Sec. 10.7.1, this Site will be closed in accordance with New Jersey hazardous waste regulations. The revised closure plan includes removing hazardous wastes from the shed to Bldg. 3100 and then disposing of them at a permitted hazardous waste disposal facility. The shed will be sealed off and cleaned with high-pressure steam (Foster Wheeler 1989). Following the steam cleaning, two wash or condensate grab samples will be collected and analyzed for TPH, VOCs, and EP toxicity for metals, and two chip samples will be taken and analyzed for priority pollutant metals. The chip sampling locations are shown in Fig. 10.10.

To determine whether previous use of the Site has caused soil contamination, a soil sample will be taken immediately outside the exit door and two other samples will be

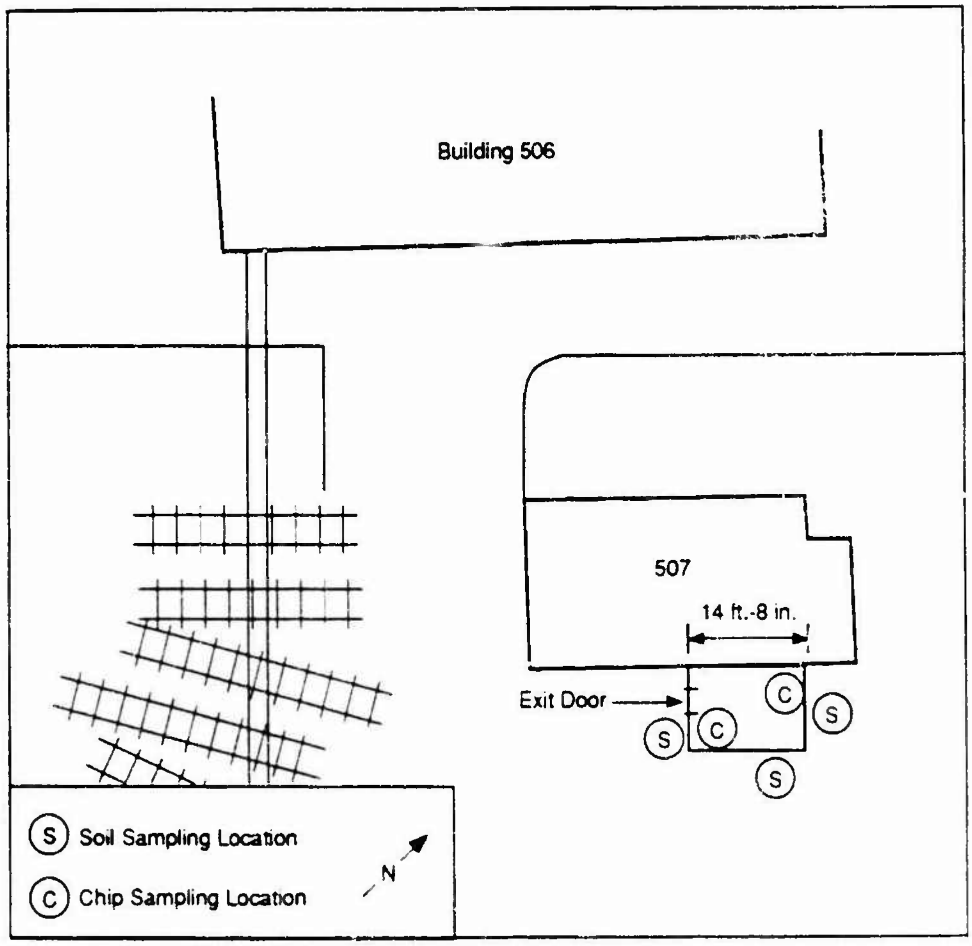

FIGURE 10.10 Closure Plan Sampling for Building 507 (Source: Adapted from Foster Wheeler 1989)

taken at the rear of the shed (see Fig. 10.10). These samples will be collected at a depth of 1 ft and analyzed for TPH, VOCs, priority pollutant metals, and, if necessary, EP toxicity for metals.

If an area is found to be contaminated, soil borings will be drilled and additional surface and subsurface soil samples will be collected to determine the extent of contamination. Contaminated soil will be excavated and properly disposed of.

10.7.5 Proposed RI Plan

No additional activities are proposed for the Site unless the soils are contaminated, in which case surface water and groundwater monitoring would be needed. Should clean closure not be possible, additional actions should be planned as new data become available.

10.8 SITE 47 — BUILDINGS 3005 AND 3006, 90-DAY AND SATELLITE WASTE ACCUMULATION AREAS

10.8.1 Site History

Building 3005, located between Main and South Office Roads (Fig. 10.11), was built in 1941 as a heavy equipment maintenance facility (PTA 1988b). For a number of years, waste oil and transmission fluid were stored outside. A covered pavilion on a concrete slab has been constructed to house the waste materials (PTA 1988b). This area is a designated 90-day waste accumulation area for oil, hydraulic fluid, solvents, grease, and degreasers (Solecki 1989c). Foster Wheeler (1988b) reported that the only wastes generated from on-site operations at Bldg. 3005 are used lube oils and hydraulic fluids. The waste oils are placed in 55-gal drums and stored on pallets behind the building. Typically, empty, original drums are used to store waste oil (Foster Wheeler 1988b). The drums are picked up by DRMO for off-post disposal.

Building 3006, located along South Office Road, northeast of Bldg. 3005, is a designated satellite accumulation area where wastes -- waste motor oil, oily rags, and contaminated speedy-dry — are temporarily stored inside the building (Solecki 1989c).

RCRA closure plans have been prepared for Bldg. 3005. Closure will include transferral of hazardous waste in the building or outside on pallets to Bldg. 3100 for storage prior to disposal (Foster Wheeler 1988b). Building 3005 is to be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

10.8.2 Geology and Hydrology

Site 47 is located about 350 m (1,150 ft) southeast of Picatinny Lake at an elevation of 260 m (840 ft) above MSL. The surface of the land slopes to the northwest toward Picatinny Lake. Geological conditions consist of glacial till overlying Precambrian gneiss bedrock. No test wells have been drilled in or near the Site; therefore, thickness of the glacial till is unknown. There are no streams, creeks, or lakes in the area.

Eby (1976) mapped the soils in the area as being Urban Land (undivided). Eby (1976) did not subdivide the Urban Land mapping unit at PTA. This unit consists mostly of areas that are either paved or built upon (Eby 1976). The soils in the remaining open spaces have been reworked to the extent that the original profile cannot be recognized. The characteristics of the materials are variable. For the most part, these units are well-drained deep sandy, gravelly, or stony material of assorted glacial deposits (Eby 1976).

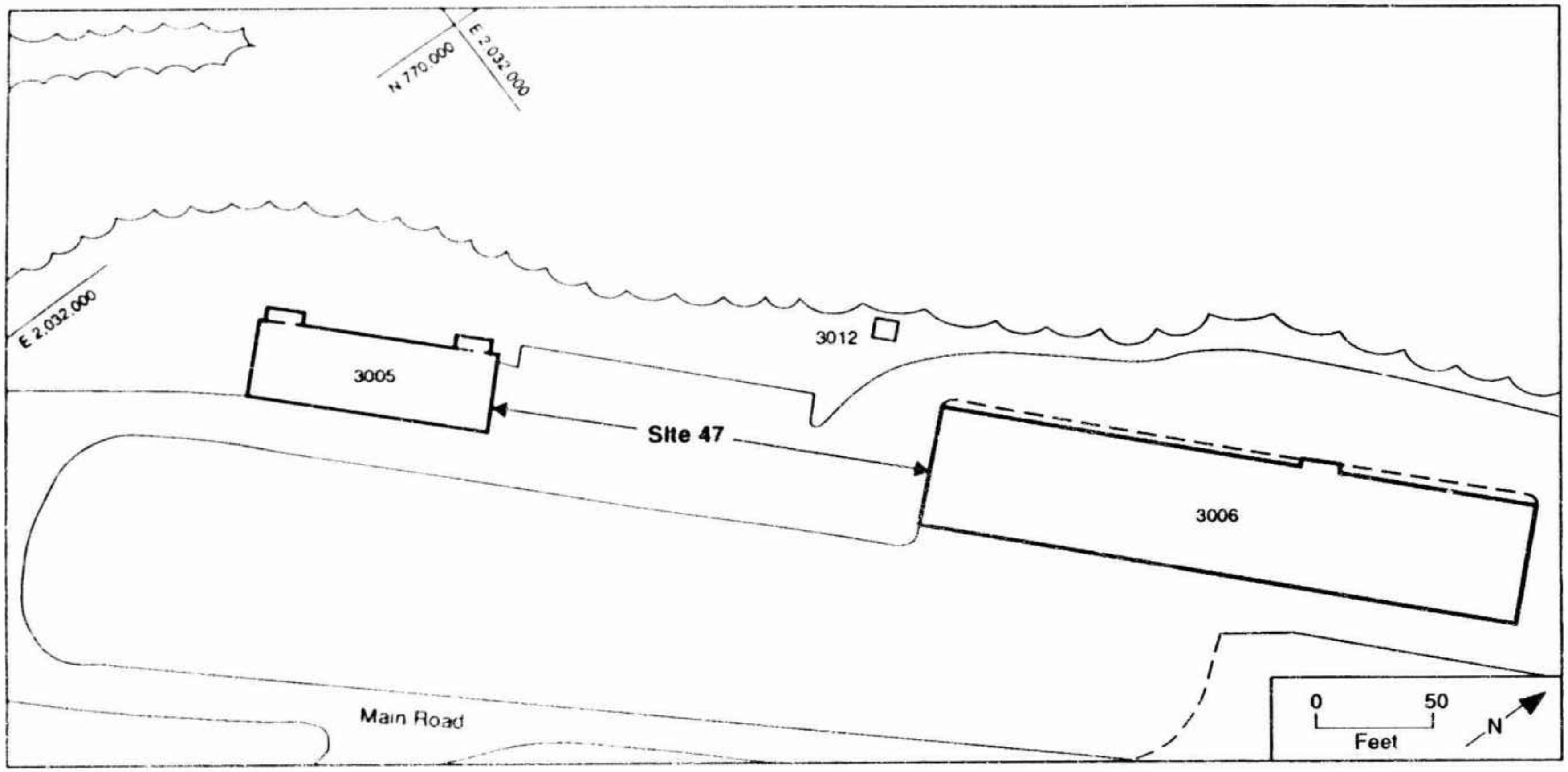

FIGURE 10.11 Layout of Buildings 3005 and 3006 at Site 47 (Source: Adapted from USACE 1984b)

10.8.3 Existing Contamination

Soil or water contamination has not been documented or determined. Surveys or soil borings to prove the extent of any soil or water contamination have not been conducted at this Site. There have been no reported spills or leaks of the waste oil. PTA (1988b) reported that the waste oil, some of which may have been PCB contaminated, and transmission fluid may have leaked, contaminating the soil in the area. The contaminated soil along the bank where the drums were stored probably comprises about 15 yd^3 of material (PTA 1988b).

Waste stored at Bldg. 3005 includes about 55 gal/mo of waste motor oil, 55 gal/mo of oily rags, contaminated speedy-dry, and aerosol paint spray cans.

During 1989 interviews with the ANL staff, PTA personnel reported that in the past used engine oil was disposed of by pouring it down the hill.

10.8.4 Closure Plan

Revised RCRA closure plans for Bldg. 3005 include collection of soil samples from two different depths (0-6 in. and 6-12 in.) from one location under the pallet storage area. The shallower sample is to be analyzed for priority pollutant metals and the deeper sample for EP toxicity (metals), VOCs, and PHC (Foster Wheeler 1988b; Solecki 1989a).

10.8.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, the proposed RI plan may need to be modified as new data become available.

10.8.5.1 Phase I

The areas around both buildings should be visually inspected to locate any signs of contamination. One surface soil sample should be collected to a depth of 0.15-0.3 m (6-12 in.) from each area of obvious soil discoloration, disturbance, or other indicators of possible contamination. If no visible contamination is found, three or more samples should be collected from around the edge of the storage area behind Bldg. 3005.

All Phase I samples should be analyzed for PCBs, oil and grease, TCL volatiles, and TCL semivolatiles.

10.8.5.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate its source and extent. To accomplish this, it may be necessary to collect additional surface soil samples and drill soil borings. It is not possible at this time to accurately define the number of surface soil samples or soil borings that would be needed. However, the number should be sufficient to fully define the contaminated areas. All samples collected during Phase II should be analyzed for significant parameters identified during the Phase I investigation.

10.9 SITE 50 — BUILDINGS 519 AND 519A, STILL HOUSE AND HAZARDOUS WASTE TANK STORAGE AREA

10.9.1 Site History

Buildings 519 and 519A are located south of Picatinny Lake, west of 21st Avenue, and about 30 m (100 ft) west-northwest of Site 32 (Fig. 10.12). Little is known about present and past activities at Bldg. 519, a still house. Ether and alcohol used to be stored in the building. Building 519A contains an inactive 3,800-gal storage tank that was used to store spent alcohol prior to off-site disposal (Gaven 1986).

Building 519 is scheduled to be destroyed under TECUP, and the tank at Bldg. 519A is scheduled for decontamination and closure.

10.9.2 Geology and Hydrology

The Site is located east of the south end of Picatinny Lake on glacial till of unknown thickness, which overlies Precambrian gneiss bedrock. The land surface slopes to the west toward Picatinny Lake. There are no streams, creek, or ponds in the immediate vicinity.

Soils in the area have been mapped as Urban Land (undivided) (Eby 1976). Unlike other areas in Morris County, Eby (1976) did not subdivide the Urban Land mapping unit at PTA. Based on his description of these units elsewhere, this unit consists of areas that are either paved or built upon. The soils in the remaining open spaces have been reworked to the extent that the original profile cannot be recognized. The characteristics of the materials are variable. For the most part these units are well-drained deep sandy, gravelly, or stony material of assorted glacial deposits (Eby 1976).

10.9.3 Existing Contamination

During 1989 interviews, PTA personnel reported that some leakage of the stored chemicals occurred at Bldg. 519. No spills or leaks were reported for Bldg. 519A. The possible existence of sumps or weirs into which liquids were decanted was also reported.

10.9.4 Closure Plan

Revised RCRA closure plans have been prepared for Bldg. 519A. Because the tanks that stored alcohol have already been removed, closure activities are limited to a

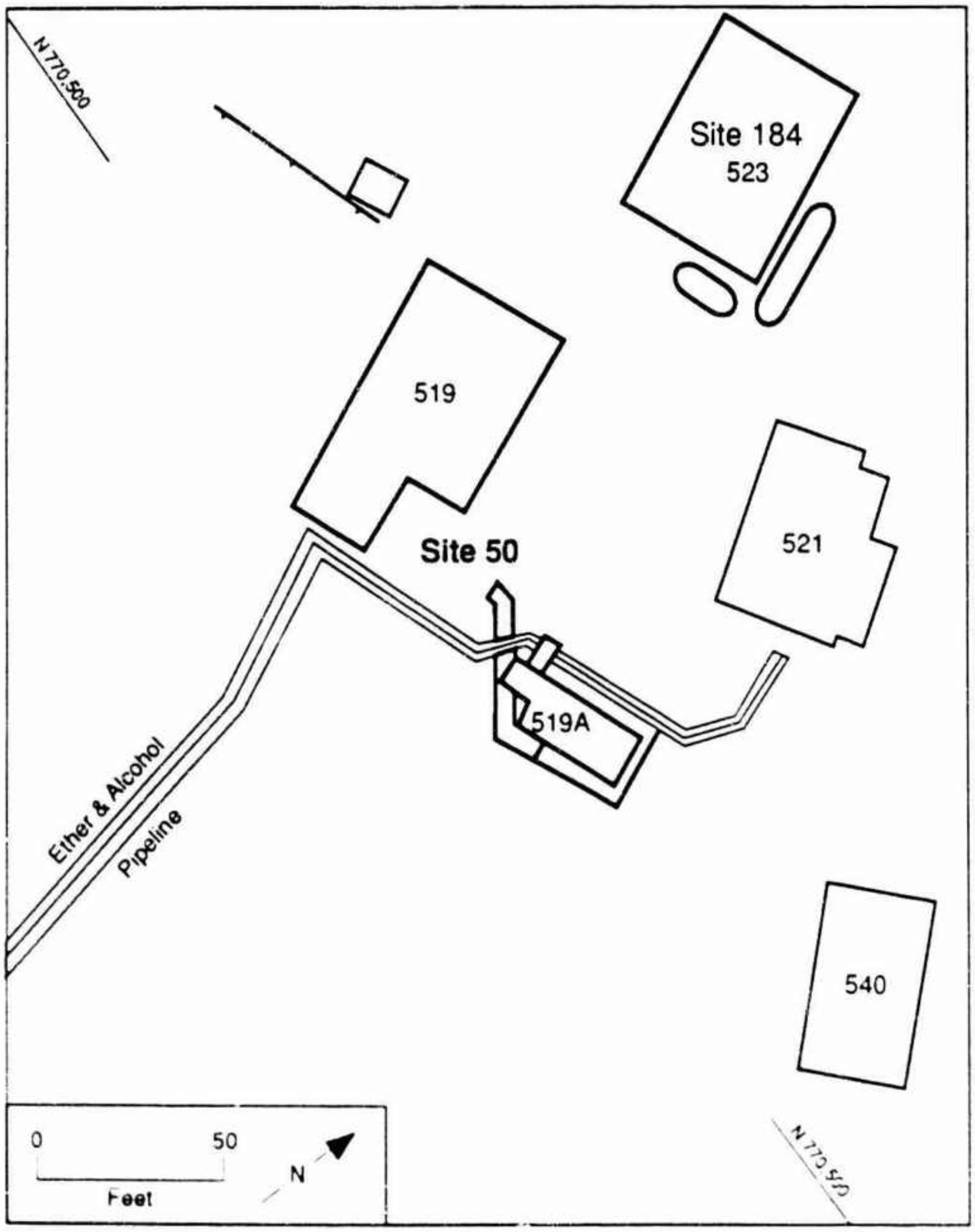

FIGURE 10.12 Layout of Site 50, the Still House and Hazardous Waste Tank Storage Area at Buildings 519 and 519A (Source: Adapted from USACE 1984b)

collecting a total of 12 soil samples at two depths (0-6 in. and 6-12 in.) from six locations in the area where the tank was located. The samples will be analyzed for priority pollutant metals, nitrates, and, if necessary, EP toxicity for metals (0-6 in. samples only) and VOCs (6-12 in. samples only) (Foster Wheeler 1989; Solecki 1989a).

10.9.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, the proposed RI plan may have to be modified as new data become available.

10.9.5.1 Phase I

The area around Bldgs. 519 and 519A should be inspected for soil staining or other signs of visible contamination. Any sumps or weirs inside or outside each building should be located.

In addition to the samples collected in the closure sampling plan, one surface soil sample should be collected to a depth of 0.3 m (12 in.) from each side of Bldg. 519 for a total of four samples. One sample should also be collected from each located area of visible contamination. One sediment sample should be collected from each located sump or weir. All samples should be analyzed for explosives, TCL metals, TCL volatiles, and TCL semivolatiles.

10.9.5.2 Phase II

If the Phase I soil samples show significant contamination, additional surface soil samples and soil borings may be needed. Groundwater monitoring wells may be needed if the soil borings show significant subsurface contamination.

10.10 SITE 53 — PICATINNY LAKE

10.10.1 Site History

Picatinny Lake, which is located in about the center of PTA, was formed in the 1880s by damming up Green Pond Brook. The lake has an area of about 43 ha (108 acres), an average depth of 1.9-2 m (6-7 ft), and contains about 624,000,000 L (165,000,000 gal) of water. Water flows into the lake from Lake Denmark and Green Pond Lake through Green Pond Brook. Water flows out of the lake over a spillway into Green Pond Brook. The brook flows about 6.4 km (4 mi) through PTA and into the Rockaway River. The river flows into the Boonton Reservoir, which is the Jersey City water supply (Gross et al. 1976; Anderson 1988b).

Many abandoned munitions production buildings and active storage magazines surround the lake. These include Bldg. 920, located at the northern end of the lake, which was used to store lead azide and PETN in crock containers; Bldg. 527; Bldg. 561, located on the eastern side of the lake, which housed a blender operation; and Bldgs. 823 and 824, which housed operations for the reclamation of explosive scrap waste and the screening of explosives. A pyrotechnic test stand was located on an island in the lake. Building 561 and about 20 other buildings around the lake have been destroyed (Anderson 1988b; USATHAMA 1976; NJPDES Permit 1975).

Buildings that still house active operations include Bldg. 506, at the south end of the lake, which houses the steam and power generating plant for PTA; Bldgs. 809 and 810, which house shell loading and washout operations (see Sec. 10.6); and Bldg. 908, which houses a betatron and X-ray lab. Other currently active buildings include ammunition magazines and other storage facilities (ARDEC 1986). Some details of buildings around Picatinny Lake are shown in Fig. 10.13.

Water from Picatinny Lake was and is being used for many Arsenal operations. To supplement PTA's drinking water supply, a 6-in. pipe leads from the lake near Bldg. 506 to Bldg. 3013, which houses five pumps with a total capacity of 28,000 L/min (7,400 gal/min). Also, water is pumped up to tanks and reservoirs above the lake for storage and use in the lower Arsenal area (Anderson 1988b).

The lake water also is used for industrial and fire-fighting purposes. Several discharges into the lake are authorized by the NJPDES permit (No. NJ0002500) renewed in 1985. Noncontact cooling water for the power plant in Bldg. 506 (discharge No. 9) is withdrawn from and returned to the lake at rates up to 17,200,000 L/d (4,550,000 gal/d). Other discharges are cooling water and floor drain effluent for the power plant (discharge Nos. 14 and 15) and treated wastewater from Bldg. 809 (discharge No. 3). The permit requires that, by December 31, 1986, boiler blowdown, cleaning wastewater, and water softener recharge brine must have been diverted to the PTA sewer system. By June 30, 1988, all remaining discharges into Picatinny Lake, except for the noncontact cooling water for the power plant, must have been diverted to the Rockaway Valley Regional Sewer Authority wastewater treatment plant. Before diversion, brine from the softener recharge placed up to 220 kg/d (490 lb/d) dissolved solids into the lake. Also, Bldg. 506 sump wastewater, which drained into the lake, was found to contain 13-18 ppm PCBs. This is presumably a result of the past practice of routinely burning waste oil in the boiler (Gaven 1986; Anderson 1988b).

In addition to the discharge from Bldg. 809, discharges to Picatinny Lake have been permitted in the past from Bldg. 823 (outfall 10) and Bldg. 824 (outfall 11). Maximum NJPDES-allowed discharges were a 37,800-L/d (10,000-gal/d) average for Bldg. 809, 15,000 L/d (4,000 gal/d) for Bldg. 823, and 7,600 L/d (2,000 gal/d) for Bldg. 824. Water from the lake was also used in the past to cool the crocks containing lead azide and PETN in Bldg. 920 (USATHAMA 1976; Anderson 1988b; NJPDES permit NJ0002500 1977).

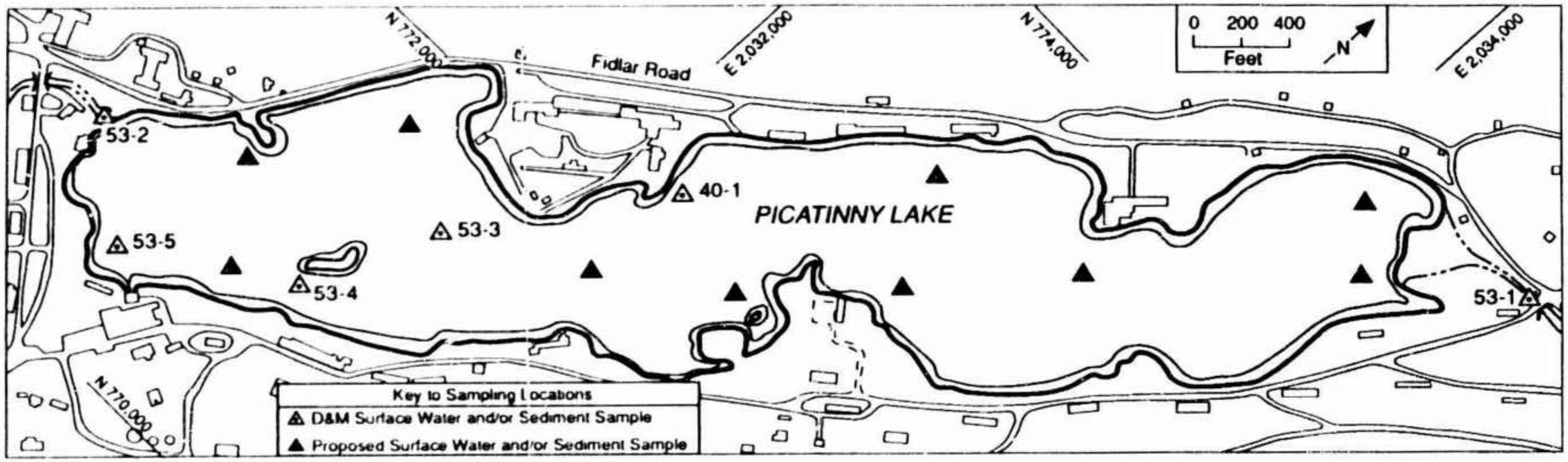

FIGURE 10.13 Details of Site 53, Picatinny Lake (Source: Map adapted from USACE 1984a; sampling locations from Dames & Moore 1989)

It is very likely that Picatinny Lake contains munitions, UXO, explosives, and other objects resulting from Arsenal operations. The 1926 explosion deposited UXO and other debris into the lake. PTA personnel reported during interviews in 1976 that the hill above the lake was used as an impact area and that "shortfalls" would have fallen into the lake. It was also reported during the interviews that since 1910 large containers of mercury fulminate were placed in the lake. Defective ordnance resulting from loading plant operations is also reported to have been put into the lake. Accidents in buildings located near the lake have also contributed debris into the lake. A press plant in Bldg. 527 is reported to have blown into the lake. In 1981, an oil spill of more than 21,000 L (5,500 gal) occurred near Bldg. 506. The spill was reported to have been cleaned up before any surface flow of oil reached the lake. Contaminants from the pyrotechnic test area on the island have also probably washed into the lake (Anderson 1988b; Gross et al. 1976; USATHAMA 1976).

A 1942 newspaper article reported that gunpowder, stored in Picatinny Lake for 16 years, still possessed full explosive strength. The article noted that tests were carried out on boxes of powder with holes in them, which were put in the lake for different time periods (Gabel 1990). Picatinny Lake is stocked with fish by the Picatinny Rod and Gun Club. During recent interviews with PTA personnel, it was reported that traces of explosives were found in fish from the lake. A newspaper article also reported the presence of traces of explosives in 1983 in fish from Green Pond Brook (Orlandini 1987). However, a 1983 study of explosives in fish taken from Picatinny Lake, the Northwestern Basin, and Pond 3110 showed no explosives detected at detection levels of 300 ppm for 24DNT, 26DNT, and TNT and 300 ppm or 30 ppm for RDX. The study also noted that levels of RDX detected in fish appeared to be a result of interference in the laboratory analysis procedure (USAEHA 1984a).

10.10.2 Geology and Hydrology

A large part of the area of Picatinny Lake is underlain by Precambrian gneiss and Lower Cambrian Hardyston quartzite. Leithsville dolomite overlies the quartzite. The rest of the lake area is underlain by the Green Pond Conglomerate from the Silurian Era. The glacial till overlying the bedrock underneath the lake is probably quite thick, up to 31 m (100 ft) in thickness. Soils in the area are acidic and quite permeable. As a result, there is a potential for groundwater contamination due to contaminants migrating downward through lake sediments (Gaven 1986; Dames & Moore 1989).

10.10.3 Existing Contamination

Arsenal activities have resulted in contaminants being deposited into the lake. These probably include UXO, containers of chemicals, debris, and contaminants either washed off the land surface around the lake or discharged into the lake through the outfalls. Analyses of water and sediment samples from the lake are useful as a check of the effect of Arsenal activities on the chemical environment in the lake. Results for samples taken in 1977 and 1980 at several locations are summarized in Table 10.4, which gives average and maximum observed concentrations. The outfall analyses are required by the NJPDES permit.

TABLE 10.4 Analytical Results for Water Samples Collected from Picatinny Lake in 1977 and 1980 (mg/L)[a]

Parameter	Lake Inlet[b]		Bldg. 506 Outfall[c]		Outfall 9[d]		Permit Maximum
	Average	Maximum	Average	Maximum	Average	Maximum	
Temperature (°C)	-	-	-	-	32.16[e]	38.00	30.00
Flow rate (gal/d)	-	-	-	-	4,270,000[e]	4,550,000	-
Chemical oxygen demand	11	12	15	17	12.09[f]	14.75	50.00
pH (pH units)	6.4	6.1 (minimum)	6.5	6.4 (minimum)	7.29[f]	8.40	6-9
Total suspended solids	1.7	2	-	-	-	-	-
Total organic carbon	7	7.1	-	-	-	-	-
Conductance (μmho/cm)	66	66	140	160	-	-	-
Total chromium	<0.025	<0.025	<0.025	<0.025	0[f]	0	1.00
Total cadmium	<0.005	<0.05	<0.062	0.010	-	-	-
Total copper	<0.025	<0.025	<0.027	0.032	-	-	-
Total zinc	<0.015	<0.015	<0.024	0.036	0.04[f]	0.07	1.00
Phosphate, USP	<0.05	0.03	-	-	-	-	-
MBAS	0.01	0.01	-	-	-	-	-
Kjeldahl nitrogen	0.29	0.34	-	-	-	-	-
Ammonia, as N	<0.02	<0.05	-	-	-	-	-
Nitrate + nitrite, as N	0.24	0.42	-	-	-	-	-
Cyanide	<0.01	<0.01	-	-	-	-	-
Chromium (VI)	<0.04	<0.10	-	-	-	-	-

[a]Units are mg/L except as noted for temperature, flow rate, pH, and conductance; a hyphen means that the parameter was not measured.

[b]Values are averages of three samples collected between August 5 and 10, 1977.

[c]Values are averages of four samples collected between August 3 and 10, 1977.

[d]Samples were collected between April 1 and June 30, 1980.

[e]Value is average of continuous measurements.

[f]Value is average of weekly measurements.

Source: Ludemann et al. 1981.

The data in the table show that, from 1977 to 1980, water at the lake inlet was of good quality as measured by concentrations of the limited number of parameters listed in the table. For those parameters included in the primary and secondary drinking water regulations, measured concentrations were well below the regulatory limits. Water quality at the Bldg. 506 outfall was degraded in that concentrations of some metals were above those observed at the lake inlet. In particular, the maximum observed concentration of cadmium was equal to the primary drinking water limit of 10 μg/L. Measurements of parameters required by the NJPDES permit at the Bldg. 506 outfall found most parameters within the limits required by the permit. An exception was the water temperature, which exceeded the maximum permitted value of 30°C on several occasions between April 1 and September 30 in 1979, 1980, 1983, and 1985 with maximum values ranging between 33°C and 42°C. Because of this, the present discharge permit requires temperature monitoring in order to determine a temperature limit that can be complied with for the months of April through September.

A more recent inspection of the Bldg. 506 outfall in June 1985 showed that effluent discharge concentrations of oil and grease and COD exceeded permit limitations. Also, an oily sheen was seen on the surface of the lake (Gaven 1986).

Sediment and water samples were recently collected in July 1988 at five locations in and around Picatinny Lake. Two locations were at the inlet and outlet; the remaining three were in the lake (Fig. 10.13). Each of the samples was analyzed for semivolatiles, explosives, pesticides, PCBs, and metals. All but one water sample was analyzed for volatiles. The results are summarized in Table 10.5, which contains results for only those parameters for which at least one sample showed a positive result. Lead was not measured in any of the sediment samples.

The sediment sample collected from Green Pond Brook near the lake inlet (SD53-1) showed concentrations of cadmium at 5.21 μg/g, copper at 130 μg/g, zinc at 381 μg/g, and sulfate at 250 μg/g. The positive detection of acetone may be an artifact resulting from possible rinsing of sample bottles with acetone. The sample collected from Green Pond Brook at the outlet (SD53-2) showed similar concentrations of sulfate at 260 μg/g. Two organics, di-n-octyl phthalate at 1 μg/g and fluoranthene at 0.469 μg/g, were also detected. The remaining three samples showed no metals contamination. However some organics contamination was present in the lake sediments in that sample SD53-4 contained 2.34 μg/g N-nitroso diphenylamine, 2.39 μg/g di-n-butyl phthalate, and 218 μg/g TPH and that sample DS53-5 contained 347 μg/g TPH.

The data in Table 10.5 show that surface water samples contained essentially no contamination by organics. The one detection of 120 μg/L of methylene chloride in sample SW53-4 may be due to the possible use of this chemical to rinse sample collection bottles. Metals were either not detected or were found at background concentrations in most samples. The main exception is the presence of lead at 79.3 μg/L in sample SW53-4. Since this value is above the drinking water limit of 50 μg/L (40 CFR 141), it raises the possibility that the lake water at this location may be contaminated with lead. As noted above, no lead data are available for the sediment samples.

TABLE 10.5 Analytical Results for Sediment and Surface Water Samples Collected from Picatinny Lake and Its Tributaries in July 1988

	Concentration in Sediment (μg/g)					Concentration in Water (μg/L)				
Parameter	SD53-1	SD53-2	SD53-3	SD53-4	SD53-5	SW53-1	SW53-2[b]	SW53-3	SW53-4	SW53-5
Arsenic	6.27	3.14	3.84	5.06	2.83	<4.7	-	<4.7	<4.7	<4.7
Barium	47.7	71.0	44.6	42.2	29.5	11.2	26.2	13.6	31.1	16.8
Beryllium	1.14	0.65	0.56	0.67	0.588	<2.92	<2.92	<2.92	<2.92	<2.92
Cadmium	5.21	<0.95	<0.95	<0.95	1.26	<4.09	<4.09	<4.09	<4.09	<4.09
Chromium	<9.31	<9.31	20.6	<9.31	<9.31	11.2	5.0	<4.44	<4.44	<4.44
Copper	130	24.6	10.1	34.6	70.0	<6.2	12.1	<6.2	24.2	<6.2
Nickel	11.9	10.6	11.2	8.95	11.9	<16.2	<16.2	<16.2	<16.2	<16.2
Lead	-	-	-	-	-	<45.1	<45.1	3.57	79.3	<45.1
Zinc	381	195	57.8	97.5	90.3	53.9	47.6	<5.35	75.2	26.4
Nitrate	4.56	5.28	3.71	2.84	7.46	175	-	<50	<50	<50
Sulfate	250	260	<14	14	14	7,500	-	6,700	7,100	7,000
CH2CL2	<0.01	<0.01	<0.01	<0.01	<0.01	<23	-	<23	120	<23
Acetone	0.206	<0.01		<0.01	<0.01	<10	-	<10	<10	<10
DNOP	<0.35	1.34	1.00	<0.35	<0.35	<18	<18	<18	<18	<18
DNBP	<0.35	<0.33	<0.33	2.39	<0.33	<10	<10	<10	<10	<10
FANT	<0.21	0.469	<0.21	<0.21	<0.21	<1.2	<1.2	<1.2	<1.2	<1.2
NNDPA	<0.33	<0.33	<0.33	2.34	<0.33	<6.7	<6.7	<6.7	<6.7	<6.7
TPH	<20	<20	<20	218	347	<2.0	<2.0	<2.0	<2.0	<2.0
Unknowns	51.4	1.14	24.5	38.7	57.7	55	10.6	34	73	86

[a]Only positive results are listed. Samples were analyzed for volatiles, semivolatiles, explosives, pesticides, PCBs, and metals. A hyphen means the sample was not analyzed for the parameter.

[b]Sample SW53-2 was not analyzed for volatiles.

[c]Values represent the maximum concentration observed for any unknown.

Sources: York 1989a, 1989b.

(See Sec. 10.6 for discussion of the other sediment and surface water sampling locations shown in Fig. 10.13 as 40-1. Explosives were the only parameters analyzed and none were detected.)

Other data show that contamination may be entering the lake from the inlet. This is especially possible during the spring when high water levels may move more contaminated sediment from Green Pond Brook into the lake. Contaminants in the sediment include up to 30 ppm cobalt, up to 280 ppm copper, up to 180 ppm lead, 420 ppb bis(2-ethylhexyl) phthalate, 360 ppb di-n-butyl phthalate, 16 ppb chlordane, up to 99 ppb DDD, 54 ppb DDE, 7.4 ppb DDT, 220 ppb PCBs, and 130 ppb Mirex. These values were measured in sediment samples collected by the USGS in 1983 and 1984 from Green Pond Brook at the inlet to Picatinny Lake (Gaven 1986, Attachment Z).

10.10.4 Proposed RI Plan

10.10.4.1 Phase I

Surface soil samples should be taken to a depth of 0.15 m (6 in.) at several locations on the island in the lake to determine the extent of contamination resulting from pyrotechnic testing. Exact locations, to be determined by field inspection, should be areas of likely contamination such as areas with little or no vegetative growth, areas of soil staining, around any building exits, and at points on a regular 30-m (100-ft) grid. The samples should be analyzed for TCL metals, explosives, TCL volatiles, and TCL semivolatiles.

The Army should make a strong effort to at least locate and possibly remove dangerous items, such as UXO and containers of explosives, on the bottom of Picatinny Lake. Possible survey techniques include geophysical surveys and the use of underwater video cameras. Methods to be considered for removal of UXO, containers of explosives (if any), and debris are those available to explosive ordnance demolition (EOD) teams and may include classified methods. Any dangerous items that are located but not removed should be marked with buoys.

Location and possible removal of these items is needed because their continued presence is incompatible with use of the lake for fishing. For example, fishermen in boats on the lake could snag bottom UXO while dragging an anchor or a fishing line could become entangled with UXO. Efforts to free the fishline or the anchor caught on UXO or a container of explosives could detonate the item. Also, corrosion of containers of explosives such as mercury fulminate and release of the contents could make the lake water unsuitable for human consumption.

Consideration should also be given to *slow* drainage of the lake to expose the bottom for cleanup and removal of dangerous items. This would also greatly facilitate the collection of sediment samples for analysis. For example, the use of pipes, valves, and pumps to increase the flow of Green Pond Brook at the lake outlet from the present flow rate by an additional 20 L/s (5 gal/s) should be sufficient to completely drain the lake in one year. Since the average flow rate of Green Pond Brook is much larger than

20 L/s (5 gal/s) (Vowinkel et al. 1985), the additional flow should not cause any flooding problems downstream. However, before such a project is started, a more detailed study should be carried out.

Surface water and sediment samples should be collected from at least 10 locations in Picatinny Lake. (This corresponds to about one sample for each 4.3 ha [11 acres] of lake area.) The sediment samples should be taken as core samples to a depth of 0.3 m (1 ft) in the lake bottom. Each water sample should be taken as an average over the water column at the sampling location. Each water and sediment sample should be analyzed for TCL metals (including lead), TCL volatiles, TCL semivolatiles, explosives, PCBs, pesticides (including Mirex), herbicides, fluoride, cyanide, nitrate, nitrite, gross alpha, gross beta, and macroparameters (water samples only). Suggested sampling locations are shown in Fig. 10.13. Exact locations will be determined by field inspections, to avoid taking samples at locations occupied by items that could detonate if disturbed. Underwater television cameras may be useful in selecting sample locations. This sampling could also be delayed until the program for location and removal at UXO is complete.

The samples are needed to complement those already collected and analyzed. The results already obtained are insufficient because lead was found in the surface water samples but not measured in any of the sediment samples (Table 10.5). Also, elevated metals and pesticides concentrations were found in sediments in the lake inlet along with slight contamination in the few locations already sampled. The additional sample locations are also needed because of the size of the lake and the potential for extensive contamination of the lake sediments.

Analyses for gross alpha and gross beta are included because surface drainage from several buildings and sites in which radioactive materials were used (App. B in Volume 1) enters the lake. If elevated values of gross alpha or beta activity are found, then additional analyses would be needed to identify the radionuclide sources.

10.10.4.2 Phase II

Soil borings and possibly monitoring wells should be installed on the island in Picatinny Lake if the results of the surface soil sampling program show the presence of significant contamination. The number and location of the wells and borings would depend on the results of the surface soil sampling program.

If significant contamination is found in the surface water or sediment samples taken from Picatinny Lake, then samples should be taken from additional locations to determine the extent and type of contamination. The parameters to be measured will depend on the characteristics of the contamination.

Surface water should be monitored quarterly at locations near any UXO or containers of explosives that are located and not removed (but presumably marked with buoys). Drinking water intakes in the lake should also be monitored. Parameters monitored should be explosives, TCL metals, volatiles, nitrate, nitrite, fluoride, and any other parameters detected in the surface water sampling or possibly present in any dangerous item near the sampling location. Monitoring is needed because corrosion of UXO and containers of explosives would result in the contents being released into the lake, which would degrade the quality of the water.

10.11 SITE 63/65 — BUILDING 506, STEAM AND POWER PLANT

10.11.1 Site History

Building 506, the steam and power plant for PTA, is located near the south end of Picatinny Lake (Fig. 10.14). Building 506 is one of PTA's 90-day storage areas. Presently, waste is stored on a 12 m (40 ft) square concrete pad located on the south side

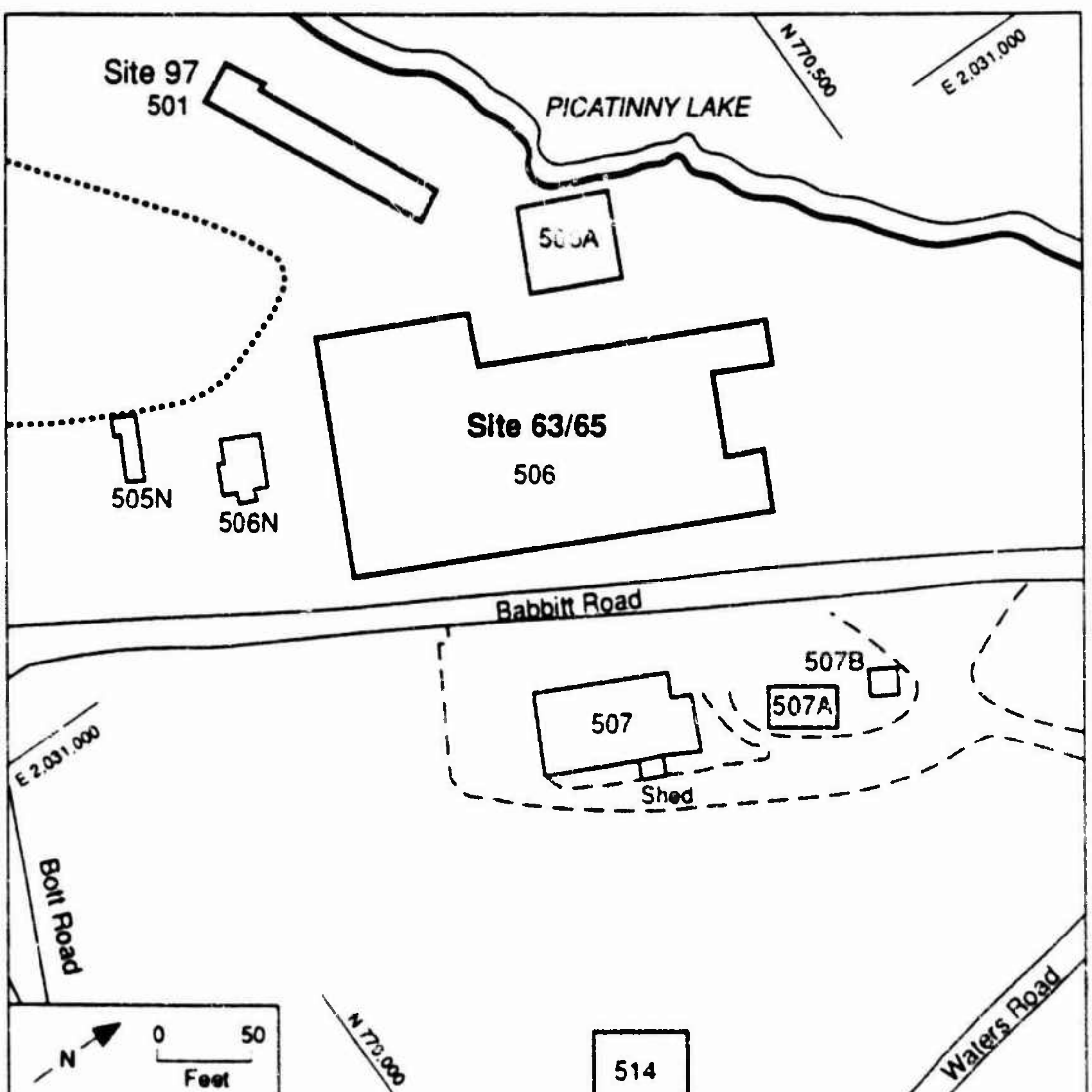

FIGURE 10.14 Layout of Site 63/65, the Steam and Power Plant at Building 506 (Source: Adapted from USACE 1984b)

of the building (Foster Wheeler 1989). Runoff from the pad drains into an oil/water separator. Fly ash residue generated during the cleaning of the air-heater hopper (in Bldg. 506) and waste oil from machine maintenance are stored on the pad. The fly ash is stored in two 225-gal tanks and is shipped offsite to a certified hazardous waste disposal facility because it is EP toxic.

From 1973 to 1979, waste oil from many sources at PTA was burned regularly in boiler no. 6. There is no information on the quantity or the source of the waste oil burned. Because of problems with the waste oil pump and PCB contamination, waste oil burning ended in 1982. In 1983 and 1984, waste oil was stored off the Site. Since 1984, waste oil has been stored in 55-gal drums in Bldg. 506. It is eventually transferred to Bldg. 3100 prior to off-post disposal (Foster Wheeler 1988a).

In 1984, most of the system was dismantled and removed. The waste oil pump and motor remain at Bldg. 506 (Foster Wheeler 1988a).

Building 506 discharges noncontact cooling water into Lake Picatinny under NJPDES Permit NJ0002500, issued to PTA on June 11, 1985.

Closure plans have been prepared for both the waste oil storage area and the waste oil burning system; both will be clean closures. A closure plan is required for the storage area (which will remain active) because information is not available in document previous storage times (Foster Wheeler 1988b). The burning system will be closed under RCRA because of the hazardous nature of the burned waste, which included oil contaminated with PCBs (Foster Wheeler 1988a).

The system and pad will be closed in accordance with New Jersey hazardous waste regulations because they never had interim status.

10.11.2 Geology and Hydrology

Building 506 is located along the south shore of Picatinny Lake. The ground surface near the site slopes towards the lake. The site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 63/65 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as the surface water in the vicinity of Site 63/65 flows north to northwest towards Picatinny Lake and Green Pond Brook.

10.11.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the site and past activities have not been well documented. It has been reported that the storage area in Bldg. 506 is a 90-day waste accumulation area (Solecki 1989c). Material (and the generation rates) stored at the Site includes waste diesel oil contaminated with No. 6 fuel oil (60 gal/yr), used lube oil (200 gal/yr), contaminated speedy-dry (25 lb/yr), and hazardous fly ash (8,000 lb/yr). The waste oil burning system is known to be contaminated with PCBs (Foster Wheeler 1988a).

10.11.4 Closure Plan

Revised RCRA closure plans for Bldg. 506 include sumping and steam cleaning the waste oil burning system pad and removing hazardous wastes from the storage area and steam cleaning the storage pad. Two condensate grab samples, two chip samples, and three soil samples will be collected for each pad. All samples will be analyzed for priority pollutant metals. Condensate and soil samples will be analyzed for VOCs, PCBs, and TPH (Foster Wheeler 1989; Solecki 1989a).

10.11.5 Proposed RI Plan

If clean closure is not possible, the proposed RI sampling plan may have to be modified as new data become available. It will be carried out independently of implementation of the closure plan.

10.11.5.1 Phase I

The interior of Bldg. 506, especially around the waste oil storage pad, should be visually inspected for signs of contamination. One soil boring should be drilled in the center of each visibly contaminated area near the pad to a depth interval of 0.9-1.5 m (3-5 ft). Another boring should be drilled between the pad and Picatinny Lake about 16 m (50 ft) from the pad. Samples collected from the borings should be analyzed for TCL volatiles, TCL semivolatiles, TCL metals, oil and grease, and PCBs.

10.11.5.2 Phase II

If contamination is found, additional soil boring sampling may be required to determine its extent. The samples should be analyzed for contaminants identified during Phase I.

10.12 SITE 70 — BUILDINGS 3028 AND 3029, R&D LABORATORY AND GENERAL PURPOSE WAREHOUSE

10.12.1 Site History

Buildings 3028 and 3029 are located in the central valley region of Picatinny Arsenal about 0.2 mi (1,000 ft) southeast of Picatinny Lake. A map of the Site is shown in Fig. 10.15.

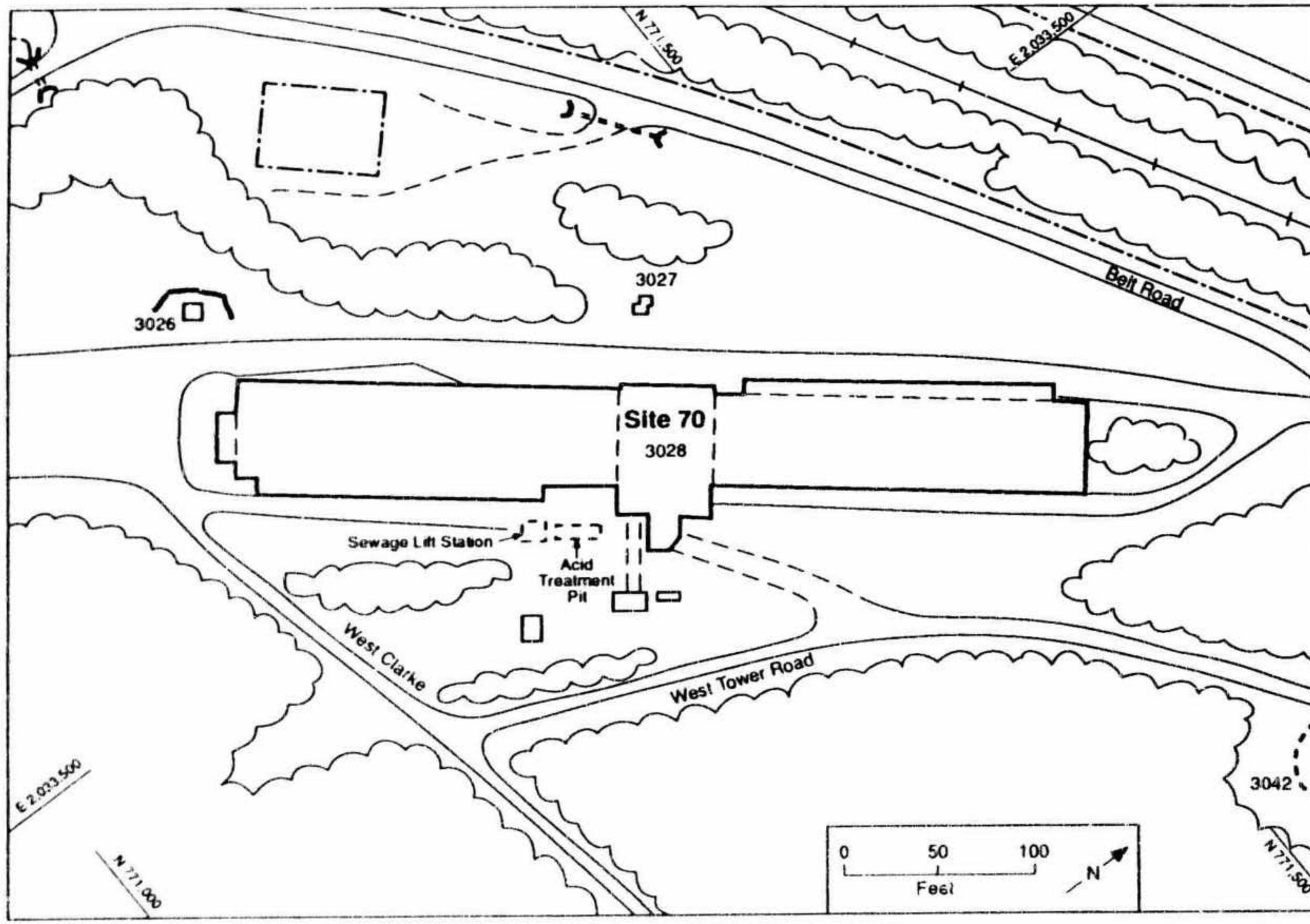

FIGURE 10.15 Layout of Site 70, the Laboratory and Warehouse at Buildings 3028 and 3029 (Note: The location of Building 3029 could not be determined) (Source: Adapted from USACE 1984b)

Building 3028 was built in 1900 as a storage building and was used for storage of large artillery cannons and spare equipment. The building was renovated in 1978-1980 into 30 R&D laboratories with a total area of 2,194 m^2 (23,606 ft^2) and an R&D administration building with an area of 554 m^2 (5,958 ft^2). Building 3028 is currently under the jurisdiction of the Energetics and Warhead Division. The building has a central storage area for inventory reagents. There is no central storage area for hazardous waste; each laboratory is responsible for segregating and storing its own chemical and energetic waste. Outside of the building there is an acid treatment pit and a sewage lift station.

Building 3029 was built in 1917 as a storage building and most recently has been used for storage of chemicals and other materials for Bldg. 3028. Building 3029 could not be located on the PTA Master Plan detail maps. Closure plans have been prepared for both buildings (Foster Wheeler 1988a). The buildings will be closed under New Jersey hazardous waste regulations because they never had interim status.

10.12.2 Geology and Hydrology

The area around Bldgs. 3028 and 3029 is about 850 ft above sea level and slopes to the northwest down to Picatinny Lake, which is about 700 ft above sea level. Soils at the Site belong to the Rockaway Series, and the bedrock is Precambrian gneiss. The three aquifers underlying the Site -- water table, confined, and bedrock aquifers -- are all interconnected in some places at PTA. Surface water flow near Bldgs. 3028 and 3029 would be toward Picatinny Lake.

10.12.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that, up to two or three years ago, while Bldg. 3028 was used as a chemical laboratory, some chemicals were disposed of down the sinks. Currently, the building is listed as a satellite waste accumulation area; activities in the building generate waste explosives (5 lb/mo) and waste solvents (15 gal/mo). The closure plan (Foster Wheeler 1988a) states that waste, including solvents, is collected from each lab and sent to the burning grounds for destruction. No documentation exists before February 1987 to indicate the quantity of waste accumulated or the duration of waste storage. Normal practice, however, is to remove waste every two weeks. The maximum waste inventory is listed in the closure plan as 85 gal of solvent and 5 lb of energetics stored under 25 gal of water.

For Bldg. 3029, the closure plan states that two spill areas believed to contain acetic acid and cadmium borate were identified on April 25, 1988. The building has been cleaned up and emptied. Reagent-grade chemicals have been transferred to Bldg. 3028. Remaining chemicals were declared excess and disposed of as hazardous waste. Unknown chemicals were sampled, analyzed, and characterized before removal.

Because Bldg. 3029 has a cement asbestos roof, any cleanup or decommissioning plans should consider the need to first remove any friable asbestos present and otherwise minimize worker exposure to asbestos.

10.12.4 Closure Plan

For Bldg. 3028, which contains R&D laboratories, the revised closure plans prescribe removing hazardous waste; sealing areas to be cleaned; and power washing tables, floors, and walls in each laboratory. Two chip samples will be collected from each laboratory, and two wash water or rinsate grab samples will be collected. All samples will be analyzed for priority pollutant metals. After Bldg. 3029 is cleaned, 12 chip samples and 2 wash water or rinsate grab samples will be collected and analyzed for priority pollutant metals (Foster Wheeler 1988a, 1989; Solecki 1989a).

10.12.5 Proposed RI Plan

The proposed phase sampling plan will be carried out independently of implementation of the closure plan. Should clean closure not be possible, the RI plan will be modified as new data become available.

10.12.5.1 Phase I

The exteriors of Bldgs. 3028 and 3029 should be inspected along their perimeters and especially near the acid treatment pit and the sewage lift station at Bldg. 3028. If the buildings appear clean, both inside and out, then no further investigation is necessary.

If the need for soil sampling is indicated by the inspections, then one surface soil sample should be collected over a depth of 0.3 m (1 ft) from the center of each visibly stained area. The samples should be analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

10.12.5.2 Phase II

If significant contamination is found in the surface soil samples, then soil borings should be drilled at or near the areas with contaminated surface soil identified during Phase I. Samples should be collected from the borings and be analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

10.12.5.3 Phase III

If significant contamination is found in the subsurface soils, it will be necessary to evaluate the movement of contaminants into groundwater by installing monitoring wells. The number and location of the wells would depend on the location of the contaminated soil boring samples.

10.13 SITE 71 — BUILDING 910, GENERAL PURPOSE LABORATORY

10.13.1 Site History

Building 910 is located on Fidlar Point Road on the northwestern tip of Picatinny Lake. A map of the Site is shown in Fig. 10.16.

Building 910 was built in 1950 as a magazine. From 1950 to the end of the Vietnam War, it was used for performing cyclic environmental testing on live ammunition to determine the effect of temperature and humidity on propellants and explosives in fixed rounds. The building, now abandoned, is being considered for demolition. Closure plans have been prepared for Bldg. 910 (Foster Wheeler 1988a). It will be closed under New Jersey hazardous waste regulations because it never had interim status.

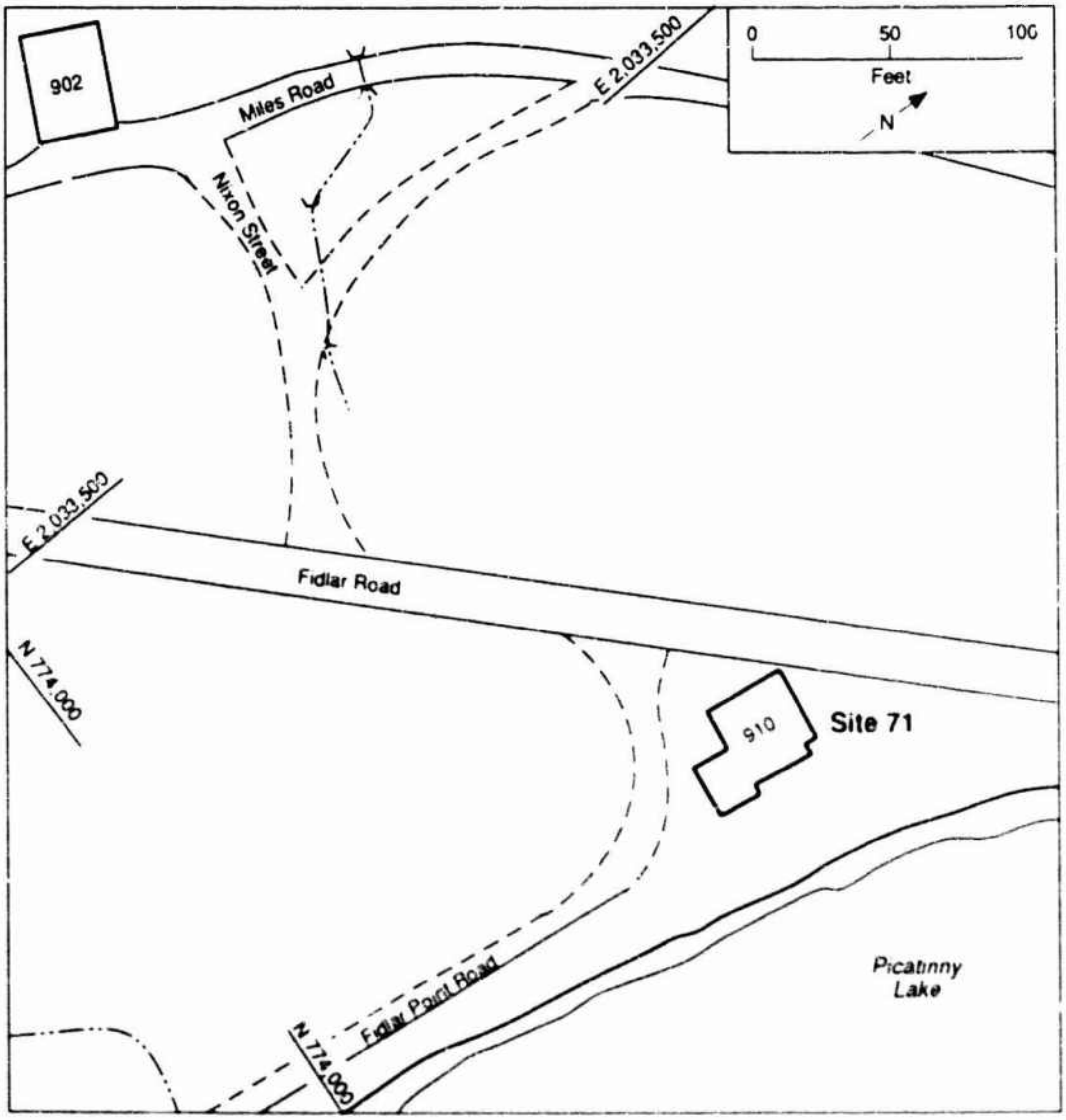

FIGURE 10.16 Layout of Site 71, the General Purpose Laboratory at Building 910 (Source: Adapted from USACE 1984b)

10.13.2 Geology and Hydrology

Site 71 and Picatinny Lake are at the same elevation, about 700 ft above MSL. Soils at the Site belong to the Rockaway Series, and the bedrock is Green Pond Conglomerate. The three aquifers underlying the Site -- water table, confined, and bedrock aquifers -- are all interconnected in some places at PTA. Surface water near Bldg. 910 would flow into Picatinny Lake.

10.13.3 Existing Contamination

During interviews with ANL staff, PTA personnel reported that Bldg. 910 was used to store propellants. All equipment, except five walk-in ovens, has been removed from the building. It is believed that all energetic waste was removed before 1980. The building is abandoned and is being considered for demolition, necessitating a closure plan to ensure removal of energetic material before demolition. The maximum hazardous waste storage is listed in the closure plan as 5 lb of energetic waste submerged in 25 gal of water (Foster Wheeler 1988a).

10.13.4 Closure Plan

Revised RCRA closure plans for Bldg. 910 include sealing the building, cleaning the ovens with hot water and steam, removing the ovens to the burning ground and flashing them off there, and cleaning the floor and walls of the building. Two wash water or rinsate grab samples and four chip samples will be collected and analyzed for priority pollutant metals (Foster Wheeler 1988a, 1989; Solecki 1989a). Closure does not appear to involve analyzing soil samples from outside of the building.

10.13.5 Proposed RI Plan

The proposed phase RI sampling plan will be carried out independently of implementation of the closure sampling plan. Should clean closure of Bldg. 910 not be possible, the RI plan will be modified as new data become available.

10.13.5.1 Phase I

To determine whether the building has released contaminants to the surrounding soil, the exterior perimeter of the building should be visually inspected for signs of soil staining, spills, or material disposal. Two surface soil samples should be collected to a depth of 0.3 m (1 ft) from each area identified during the inspection and analyzed for propellants, explosives, and TCL metals.

10.13.5.2 Phase II

If the surface soil samples show significant contamination, two soil borings should be drilled between Bldg. 910 and Picatinny Lake near the contaminated surface soils. Soil samples should be collected from the borings and analyzed for propellants, explosives, and TCL metals.

10.13.5.3 Phase III

If the subsurface soils are significantly contaminated, then it will be necessary to evaluate the possibility of movement of contaminants into Picatinny Lake by collecting two sediment samples to a depth of 0.3 m (12 in.) from the shore of Picatinny Lake near each contaminated soil boring. The sediment samples should be analyzed for the contaminants of concern identified in the soil samples. (Sampling of the water in Picatinny Lake is discussed in Sec. 10.10 [Site 53]).

10.14 SITE 79 — BUILDING 3013, HIGH-PRESSURE BOILER

10.14.1 Site History

Building 3013 is located in the central valley region of Picatinny Arsenal about 0.2 mi (1,000 ft) southeast of Picatinny Lake. A map of the site is shown in Fig. 10.17.

Building 3013 was built in 1900 as a coal-fired boiler. It now contains a 500-horsepower, high-pressure, oil-fired boiler unit in the left wing; the central portion of the building is empty (Foster Wheeler 1988a). According to the Master Plan (PTA 1971), the estimated life of the boiler is until the year 2000; currently, it is used only for emergencies (Foster Wheeler 1988a).

A closure plan has been prepared for Bldg. 3013's waste storage area (Foster Wheeler 1988a). The waste storage area will be closed under New Jersey hazardous waste regulations because it never had interim status.

10.14.2 Geology and Hydrology

The area around Site 79 is about 850 ft above MSL; the land surface slopes northwest toward Picatinny Lake. Soils near Bldg. 3013 belong to the Rockaway Series, and the bedrock is Precambrian gneiss. Three aquifers underly the area: water table, confined, and bedrock. Surface water and runoff from the Bldg. 3013 area would eventually flow into Picatinny Lake.

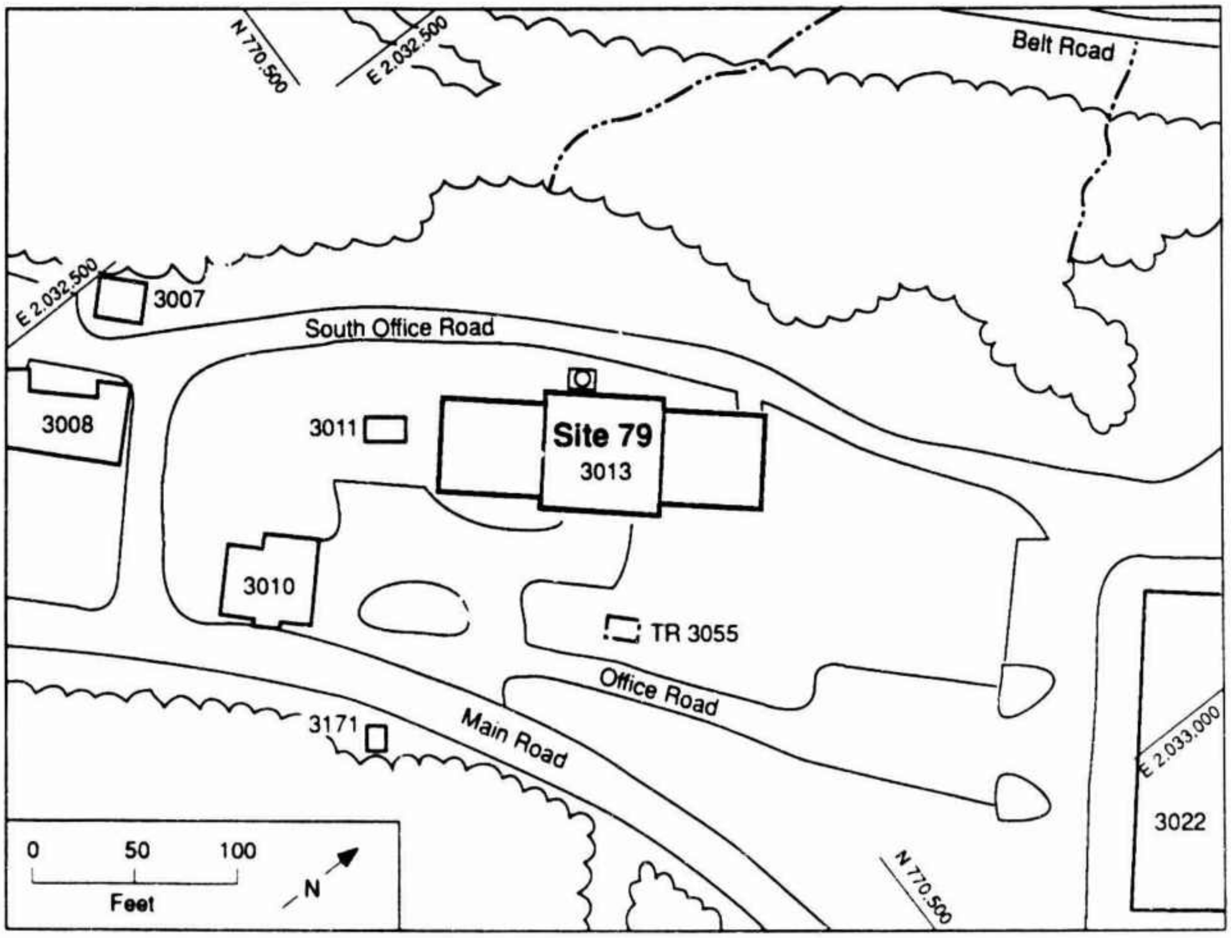

FIGURE 10.17 Layout of Site 79, the High-Pressure Boiler at Building 3013 (Source: Adapted from USACE 1984b)

10.14.3 Existing Contamination

The closure plan indicates that the maximum waste inventory for Bldg. 3013 is three 55-gal drums of waste oil. These drums are located at the southwest corner of the building.

10.14.4 Closure Plan

Revised RCRA closure plans include transferring the building's waste inventory to Bldg. 1094 or 3100, as appropriate, for storage prior to off-site disposal. The areas to be closed will be sealed off, and the building will be decontaminated by washing the walls and floor with high-pressure steam. Two rinsate grab samples and two chip samples will be collected and analyzed for priority pollutant metals. The revised closure plans do not include any sampling outside of the building. An exemption is claimed for the boiler house on the basis of a less than 90-day accumulation of hazardous waste (Foster Wheeler 1988a, 1989; Solecki 1989a).

10.14.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of Bldg. 3013 not be possible, the RI plan will be modified as new data become available.

10.14.5.1 Phase I

The perimeter of the building should be inspected for signs of visible soil contamination. Three surface soil samples should be collected to a depth of 0.3 m (1 ft) near the southwest corner of the building and in any visibly contaminated areas along its perimeter. The samples should be analyzed for TCL volatiles and TCL semivolatiles.

10.14.5.2 Phase II

If the surface soil samples indicate the presence of significant contamination, then one soil boring should be drilled near each area of contaminated soil found during Phase I. Subsurface soil samples should be collected from the borings and analyzed for TCL volatiles and TCL semivolatiles.

10.14.5.3 Phase III

If significant contamination is found in the subsurface soils, it will be necessary to evaluate the movement of contaminants into groundwater by installing monitoring wells. The number and location of the wells would depend on the location of the contaminated soil boring samples. Groundwater samples should be collected quarterly, with a review of the results after one year.

10.15 SITE 82 — BUILDING 908, X-RAY PHOTOPROCESSING LABORATORY

10.15.1 Site History

Building 908 is located on Fidlar Point Road directly on the northwestern shore of Picatinny Lake. A map of the Site is shown in Fig. 10.18. Building 908 was built in 1918 as a storage building. It was renovated in 1956 as a physics laboratory. Since 1945, the building has been used to process X-rays for PTA. From about 1963 to 1983, the facility operated a silver recovery unit.

Although Bldg. 908 is discussed in a closure plan document, PTA has claimed an exemption from RCRA permitting requirements because hazardous waste has not been stored there for more than 90 days and will not be stored for more than 90 days in the future. The building is expected to remain in use (Foster Wheeler 1988a).

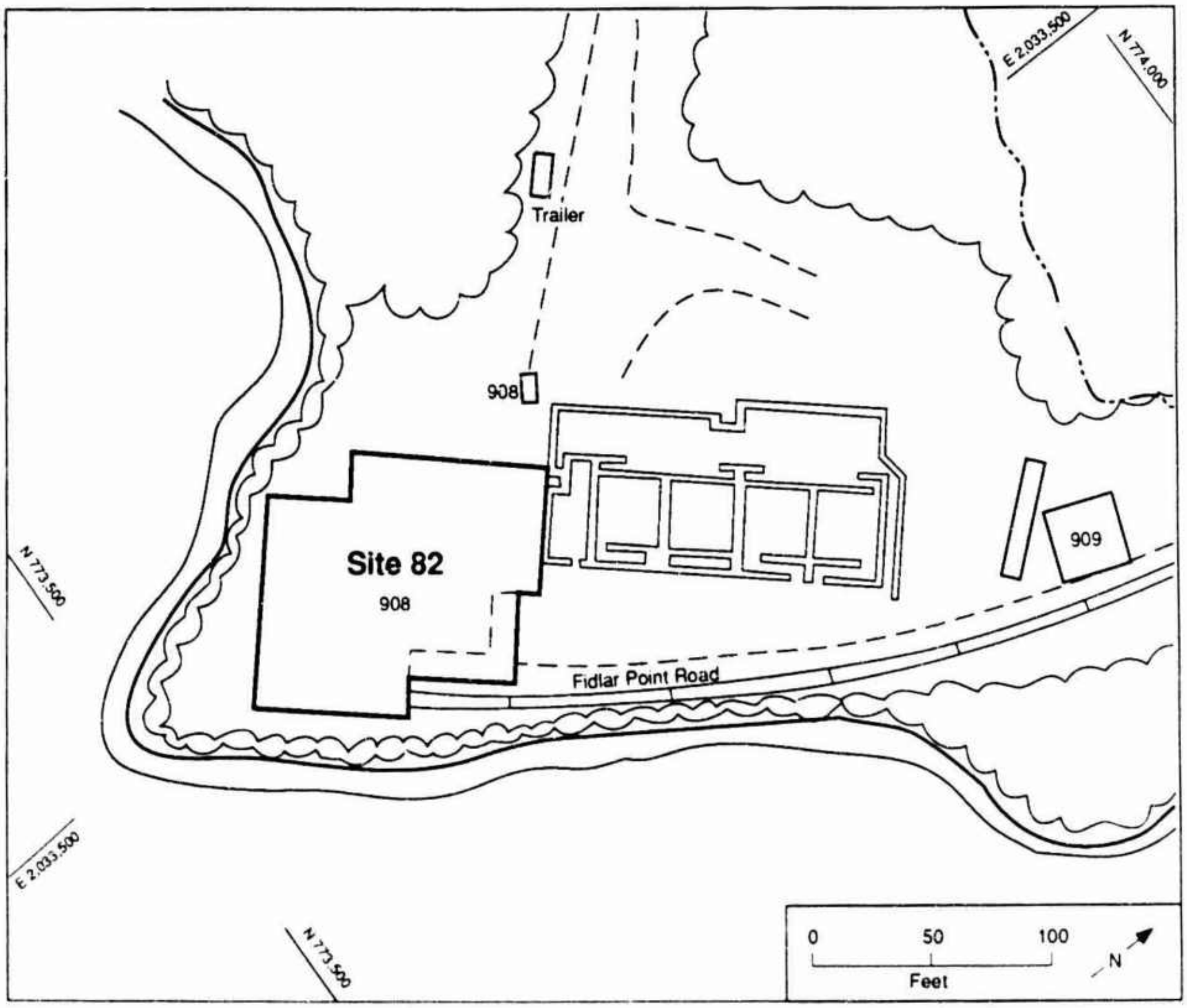

FIGURE 10.18 Layout of Site 82, the X-Ray Photoprocessing Laboratory at Building 908 (Source: Adapted from USACE 1984b)

10.15.2 Geology and Hydrology

Site 82 and Picatinny Lake are at the same elevation, about 700 ft above MSL. Soils in the area belong to the Rockaway Series, and the bedrock is Green Pond Conglomerate. Surface water and runoff from the Bldg. 908 area would flow into Picatinny Lake.

10.15.3 Existing Contamination

According to PTA staff (Solecki 1989c), waste generated from X-ray operation and maintenance (hypo solution at 30 gal/mo and hydraulic oil at 55 gal/yr) is stored on the concrete floor of Bldg. 908. The silver recovery unit in the building, which operated from 1963 to 1983, originally had an overflow line directly into Picatinny Lake. During the 1970s, the overflow line was rerouted to the sanitary sewer system for treatment at

PTA's industrial wastewater treatment plant. Currently, spent developer solution is flushed to the sanitary sewer system for treatment, and spent fixer is collected, temporarily stored, and sent to Bldg. 314 for silver reclamation. How the waste was handled before 1963 is not known. During normal operation, the temporary storage periods range from two to four weeks. However, beginning in December 1987, waste fixer solution was accumulated on the Site while Bldg. 314 was being modified (Foster Wheeler 1988a).

10.15.4 Proposed RI Plan

10.15.4.1 Phase I

The original outflow line and discharge point for the silver recovery unit should be located by visual inspection, use of detailed maps of the area, or a geophysical survey. If the line cannot be located, then no further action is necessary.

If the outflow line is located, then three surface soil samples should be collected to a depth of 0.3 m (1 ft) from along its path and one should be collected from the outfall area. The four samples should be analyzed for silver and TCL semivolatiles. The analysis will provide a measure of the magnitude and persistence of contaminants from the past discharges.

10.15.4.2 Phase II

If silver or semivolatiles are found in the samples, then two sediment samples (to a depth of 0.3 m [12 in.]) should be collected from the shore of Picatinny Lake near sampling sites of the contaminated soil. The sediments should be analyzed for silver and TCL semivolatiles. (Sampling of Picatinny Lake water is discussed in Sec. 10.10 [Site 53]).

10.16 SITE 83 — BUILDING 3022, ENERGETICS PHYSICAL ANALYSIS LABORATORY

10.16.1 Site History

Building 3022 is located in the central valley region of PTA about 0.2 mi (1,000 ft) southeast of Picatinny Lake. A map of the Site is shown in Fig. 10.19.

Building 3022 in its present form was constructed in 1978-1981 by combining Bldgs. 3021 and 3022 with a new two-story annex between the south ends of the old buildings, forming a U-shaped building. The original Bldgs. 3021 and 3022 were built in 1928 as storage buildings for large artillery cannons and spare equipment. In 1978-1981, the buildings were connected by the addition and renovated to serve as laboratories and offices. Currently, the building is a research, development, and testing facility for the Energetics and Warheads Division. Outside of the building there is an acid treatment pit with acid drain lines feeding into it.

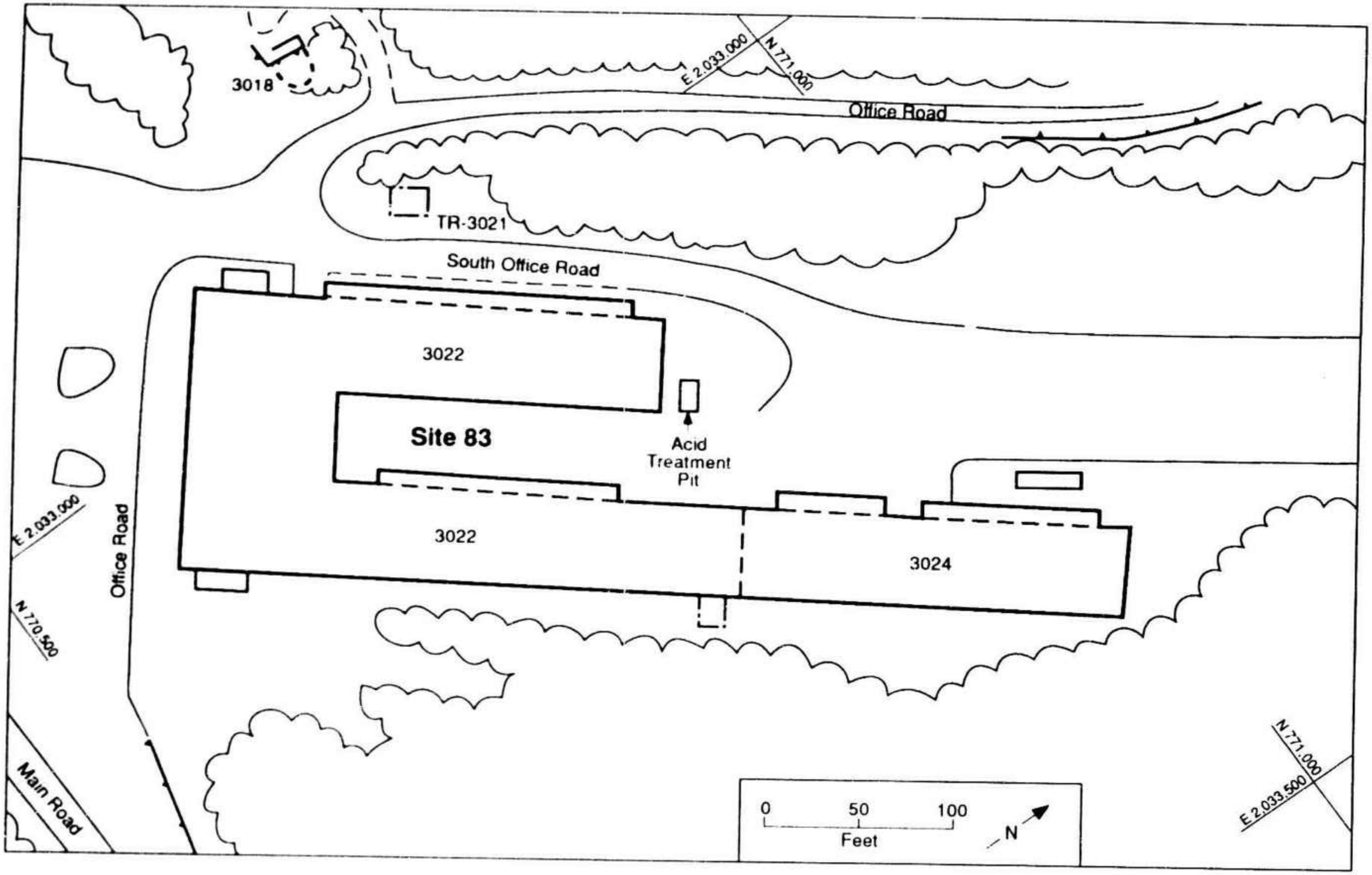

FIGURE 10.19 Layout of Site 83, the Energetics Physical Analysis Laboratory at Building 3022 (Source: Adapted from USACE 1984b)

Closure plans have been prepared for Bldg. 3022 because records of past hazardous waste storage are not available. PTA has claimed an exemption from RCRA permitting requirements because future hazardous waste storage at the building will be for less than 90 days (Foster Wheeler 1988a). The building will be closed under New Jersey hazardous waste regulations because it never had interim status.

10.16.2 Geology and Hydrology

The area around Bldg. 3022 is about 850 ft above MSL; the land surface slopes northwest toward Picatinny Lake. Soils at the Site belong to the Rockaway Series, and the bedrock is Precambrian gneiss. Surface water and runoff from the area would eventually flow into Picatinny Lake.

10.16.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that, up to 2 or 3 years ago, some chemicals were disposed of down the sinks in Bldg. 3022. The closure plan indicates that the laboratories generate waste chemicals, solvents, and energetics. Waste is segregated and stored in designated areas in the individual laboratories (13 in all). Generally, 0.5 lb of combined energetic waste is generated during a one-month period. All wastes, including solvents, are collected from each laboratory and sent to the burning grounds for destruction. The maximum waste inventory is 5 gal of waste solvent (alcohols, ketones, acetates, etc.) and 5 lb of energetic waste submerged in 25 gal of water.

Because Bldg. 3022 has a cement asbestos roof, any cleanup or decommissioning plans should consider the need to first remove any friable asbestos present and otherwise minimize worker exposure to asbestos.

10.16.4 Closure Plan

The revised RCRA closure plan for Bldg. 3022 includes sealing off the laboratories and cleaning them with steam or hot water. Two rinsate grab samples and 36 chip samples (two from each lab) will be collected and analyzed for priority pollutant metals. Closure does not appear to involve any sampling outside of the building (Foster Wheeler 1988a, 1989; Solecki 1989a).

10.16.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of Bldg. 3022 not be possible, the RI plan will be modified as new data become available.

10.16.5.1 Phase I

The exterior perimeter of the building should be visually inspected, especially near the acid treatment pit and along the acid drain lines.

If stained areas or signs of spills are found, then one surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each stained area and analyzed for explosives, TCL volatiles and TCL semivolatiles by gas chromatography (GC) scan, and TCL metals.

The Site should be inspected to locate the acid pit and the drain lines leading to the pit; geophysical methods may be needed. If the pit is exposed, surface soil samples should be collected to a depth of 0.3 m (1 ft) at the pit bottom and drain outfall. If the pit is covered, one soil boring should be drilled at the pit location and sampled at 0.6-m (2-ft) intervals from the top, through the pit bottom, and down to the boring. The boring samples should be analyzed for explosives, propellants, TCL metals, nitrate, nitrite, and sulfate.

10.16.5.2 Phase II

If significant contamination is found in the surface soil samples, then one soil boring should be drilled near each contaminated soil area identified during Phase I. Samples should be collected from the borings and analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

10.16.5.3 Phase III

If significant contamination is found in the subsurface soils, it will be necessary to evaluate the movement of contaminants into groundwater by installing monitoring wells. The number and location of the wells would depend on the location of the contaminated soil boring samples.

10.17 SITE 90 — BUILDING 329, ELECTROMAGNETIC-GUN TEST SHED

10.17.1 Site History

Building 329 was built in 1918 as a storage magazine. A small shed (about 65 ft^2) behind the building is used to store wastes from cleaning and maintenance. The Site is about 0.1 mi from the southern end of Picatinny Lake. Details are given in Fig. 10.20. Since 1982, it has housed the Fire Support Armament Center Technical Branch. Activities include fabrication for the Electromagnetic Armament Technical Branch and testing of electromagnetic guns. Fabrication uses only water-soluble machine coolants for cutting, bending, machining, and testing. The coolants are recycled (Foster Wheeler 1988b).

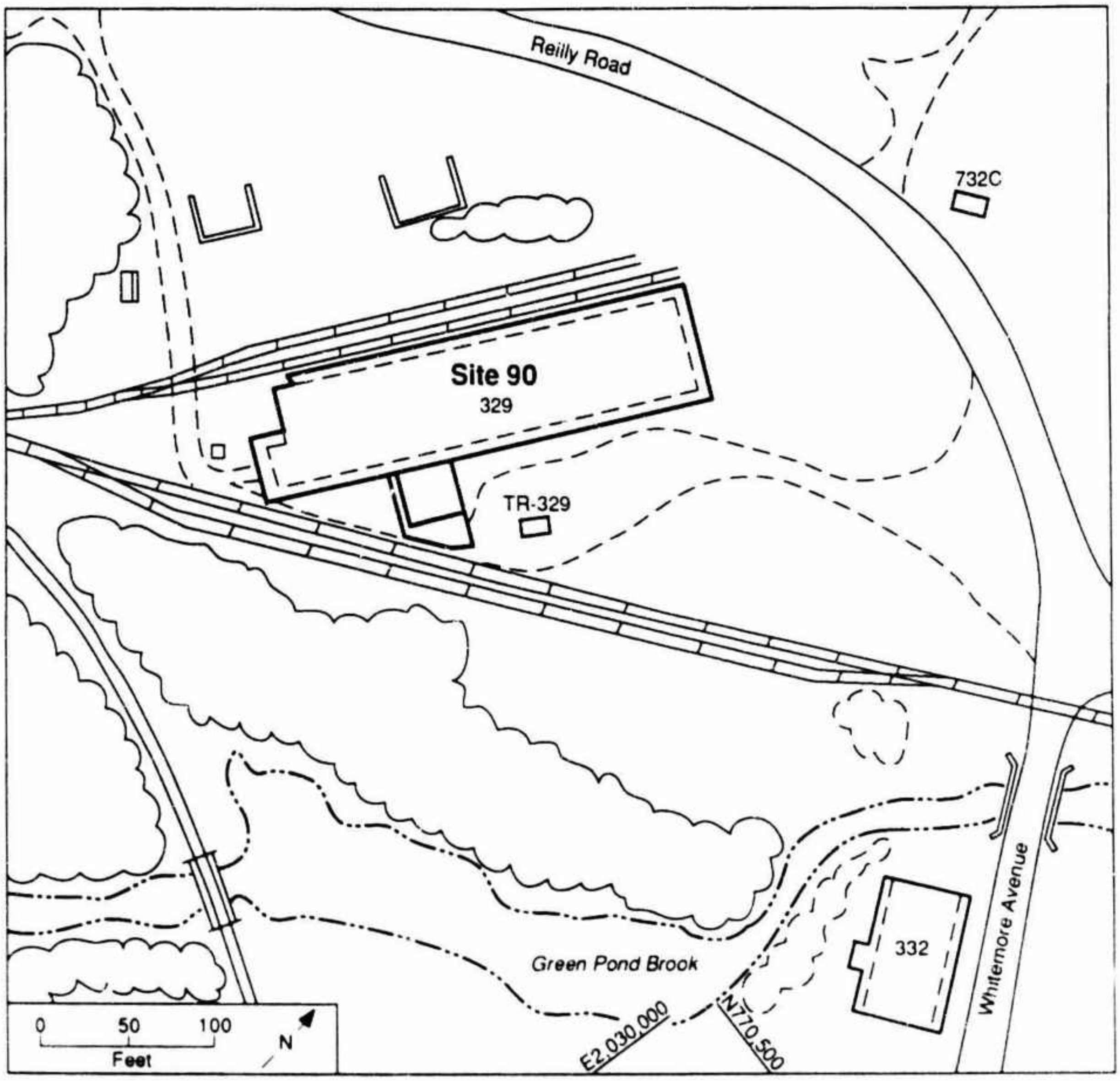

FIGURE 10.20 Layout of Site 90, the Building 329 Electromagnetic-Gun Test Shed (Source: Adapted from USACE 1984b)

According to available information, the only waste generated is about 10 gal/mo of lubricating oil for power generators. The waste oil is stored in containers in the shed along with unused solvents and cleaners. These include ethyl alcohol, carboline thinner, methyl ethyl ketone, acetone, gasoline, and adhesives (Foster Wheeler 1988b).

A closure plan has been prepared for the storage shed (Foster Wheeler 1988b; Solecki 1989a). It will be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

10.17.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is Precambrian gneiss, which has a varying medium- to coarse-grained composition. The predominant facies is biotite, quartz, and oligoclase. Minor facies are characterized by abundant garnet and microperthite, with local sillimanite and graphite. Groundwater occurs in fractures and joints, usually in low yields. Flow in this area is estimated to be east-northeast toward Green Pond Brook.

Soils in the area of Bldg. 329 are classified as Urban Land. These soil are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. They have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

10.17.3 Existing Contamination

No previous investigations, spills, or discharges are reported for this Site. Waste oil is the only potential contaminant. This Site is considered as having a low potential for releasing contaminants.

10.17.4 Closure Plan

Planned RCRA closure activities include removal and disposal of stored wastes, decontamination, and confirmation sampling. Two chip samples will be collected from the cleaned surfaces and two grab samples of wash water will be collected. The samples will be analyzed for priority pollutant metals (Foster Wheeler 1988b; Solecki 1989a).

10.17.5 Proposed RI Plan

A limited investigation is recommended to assess the current condition of the site and the potential impacts resulting from regular operations. The proposed RI sampling plan will be carried out independently of implementation of the closure sampling plan. If clean closure is not possible, the RI plan should be modified as new information becomes available.

10.17.5.1 Phase I

The current condition of the Site should be assessed by inspecting all areas to locate visible contamination, drains, and other migration pathways. If visible staining is found, one composite surface soil sample should be collected from 0.15 m (6 in.) deep in each area of stained soil.

All samples should be analyzed for TCL volatiles and TCL semivolatiles.

10.17.5.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area and samples should be collected from each boring. All samples should be analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

10.18 SITE 93 — BUILDINGS 800 AND 807 AMMUNITION DEMOLITION AND ORDNANCE FACILITIES

10.18.1 Site History

Buildings 800 and 807 are located within 50-100 ft of the northwestern shore of Picatinny Lake on Crain Road. A map of the Site is shown in Fig. 10.21. Building 800 was built in 1957 as an ammunition demolition facility. It was being considered for disposal according to the March 1977 Real Property Inventory. Building 807 was built in 1930 as an ordnance facility. Its estimated life, according to the 1971 Master Plan, is until the year 1995.

10.18.2 Geology and Hydrology

Site 93 and Picatinny Lake are at the same elevation, about 700 ft above MSL. Soils in the area belong to the Rockaway Series, and the bedrock is either the Green Pond Conglomerate or Leithsville Formation. The aquifers are as described for other Sites near Picatinny Lake. Surface water and runoff from the Site 93 area would flow into Picatinny Lake.

10.18.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that Bldg. 800 has been used for assembling, loading, and packing aerial grenades. In addition, steaming and washing of ammunition at this Site produced explosive-contaminated wash water. Reportedly, defective grenades and other ordnance were disposed of in outside pits behind Bldg. 800 and in Picatinny Lake. PTA personnel also reported that, in 1966, an accidental explosion scattered grenades throughout the Bldg. 800 area and that some were later found along the lakeshore during a drought.

Reportedly, Bldg. 807 had a use similar to that of Bldg. 800, that is, assembling, loading, and packing ordnance, including aerial grenades. Reportedly, powder was disposed of behind the building as well as down a drain (ARDEC undated). Steaming and washing of ammunition produced explosive-contaminated wash water. Defective shells and other ordnance were thrown into the lake.

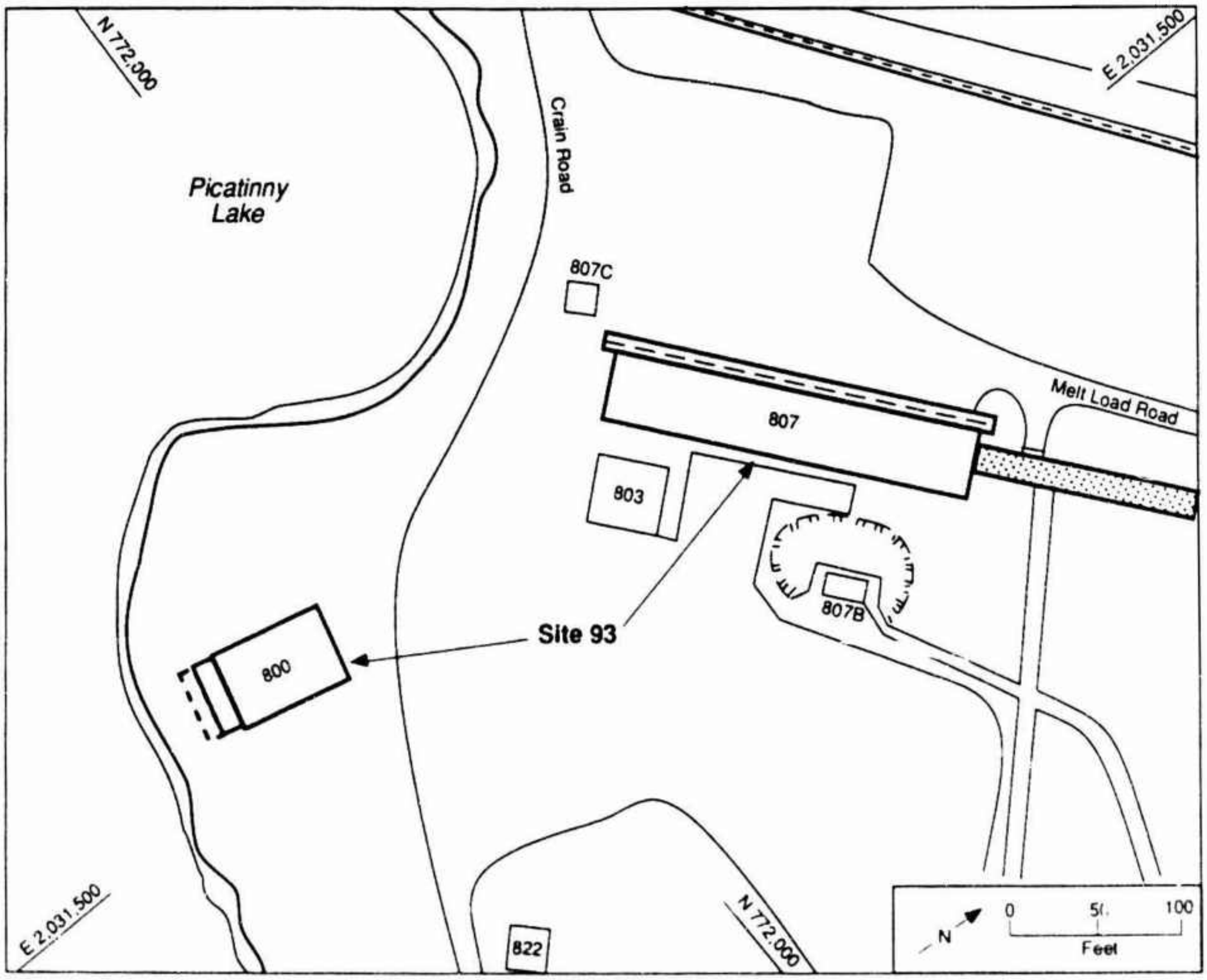

FIGURE 10.21 Layout of Site 93, the Ammunition Demolition and Ordnance Facilities at Buildings 800 and 807 (Source: Adapted from USACE 1984b)

Because Bldg. 800 has a corrugated asbestos roof, any cleanup or decommissioning plans should consider the need to first remove any friable asbestos present and otherwise minimize worker exposure to asbestos.

10.18.4 Proposed RI Plan

10.18.4.1 Phase I

The pits behind Bldg. 800, where defective devices were reportedly disposed of, should be located by visual inspection, use of detailed maps or aerial photos, or geophysical methods. If the pits cannot be located, then no further action is necessary for Bldg. 800.

If the pits are located, then one soil boring should be drilled in the center of each pit. Samples should be collected at over 0.6-m (2-ft) intervals from the top, through the pit bottom, and down to the bottom of the borings. The samples should be analyzed for propellants and explosives.

The reported powder disposal area behind Bldg. 807 should be located through visual inspection. If the disposal site can be located, then two surface soil samples should be collected from its center to a depth of 0.3 m (1 ft). The samples should be analyzed for propellants and explosives.

10.18.4.2 Phase II

If the Phase I sampling indicates the presence of significant contamination, then two soil borings should be drilled between Bldgs. 800 and 807 (one for each building) and Picatinny Lake. Subsurface soil samples should be collected from the borings and analyzed for propellants and explosives. The Phase II borings will help determine whether propellants and explosives have migrated from the buildings into Picatinny Lake.

10.18.4.3 Phase III

If the soil borings show contamination by propellants and/or explosives, two sediment samples should be collected from the lake near the soil boring locations to a depth of 0.3 m (12 in.). The sediment samples should be analyzed for propellants and explosives. (Sampling of the water from Picatinny Lake is discussed in Sec. 10.10.)

10.19 SITE 97 — BUILDING 501, POST ENGINEER MAINTENANCE SHOP

10.19.1 Site History

The Post Engineer maintenance shop (Building 501) is located about 150 ft south of the south end of Picatinny Lake (Fig. 10.22). PTA personnel reported that the shop was used for the repair of pumps. During repairs, mercury may have been spilled onto the floor of the building. Additional information on past activities at this Site is not available.

10.19.2 Geology and Hydrology

Building 501 is located along the south shore of Picatinny Lake. The ground surface near the Site slopes towards the lake. The site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

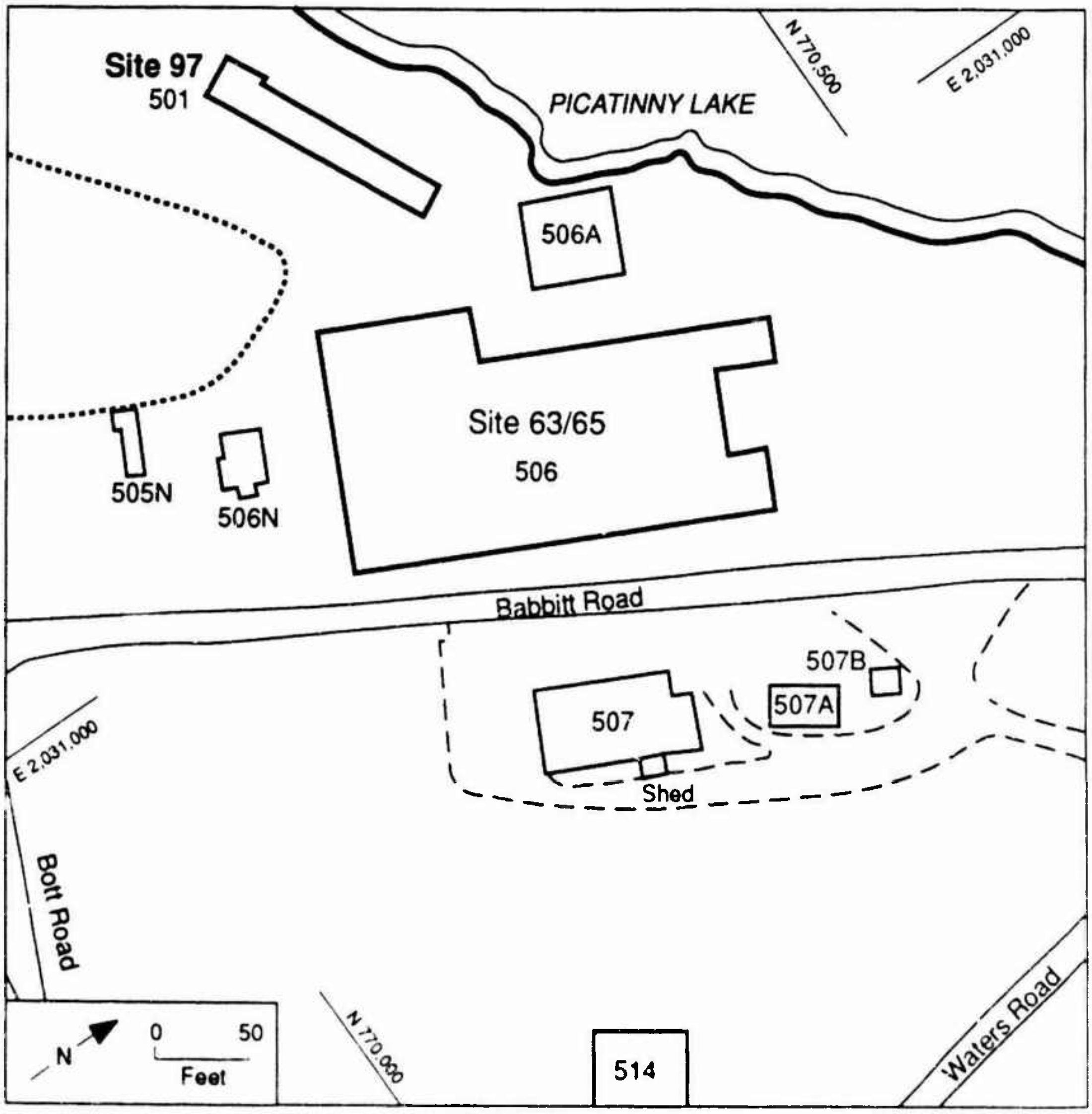

FIGURE 10.22 Details of Site 97, the Post Engineer Maintenance Shop at Building 501 (Source: Adapted from USACE 1984b)

The soils at Site 97 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as the surface water in the vicinity of Site 97 flows north to northwest towards Picatinny Lake and Green Pond Brook.

10.19.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Pump oil and mercury, which may have spilled onto the floor during pump repairs, are possible contaminants at this Site.

10.19.4 Proposed RI Plan

10.19.4.1 Phase I

The area around Bldg. 501 should be visually inspected for signs of soil contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each located stained area. In addition, one surface soil sample should be collected to a depth of 0.15 m (6 in) from each side of the building (4 samples total). All samples should be analyzed for TCL semivolatiles and mercury.

10.19.4.2 Phase II

If contamination is found, additional soil samples should be collected to determine its extent. The samples should be analyzed for contaminants identified during Phase I.

10.20 SITE 102 — BUILDING 3050, ENLISTED MEN BARRACKS

10.20.1 Site History

Building 3050 is located half-way between Picatinny Lake and the eastern PTA boundary, about 400 ft north of the basins. A map of the Site is shown in Fig. 10.23.

Building 3050 was built in 1943 as an enlisted men barracks. It has three floors (with two barracks rooms on each) and has a cement asbestos roof.

10.20.2 Geology and Hydrology

The elevation in the Bldg. 3050 area is 950 ft above sea level, and the land surface slopes eventually down toward Picatinny Lake to the northwest. Soils in the area belong to the Rockaway Series, and the bedrock is Precambrian gneiss. Surface water and runoff from the Bldg. 3050 area would eventually flow into Picatinny Lake or might move to the south or north basins.

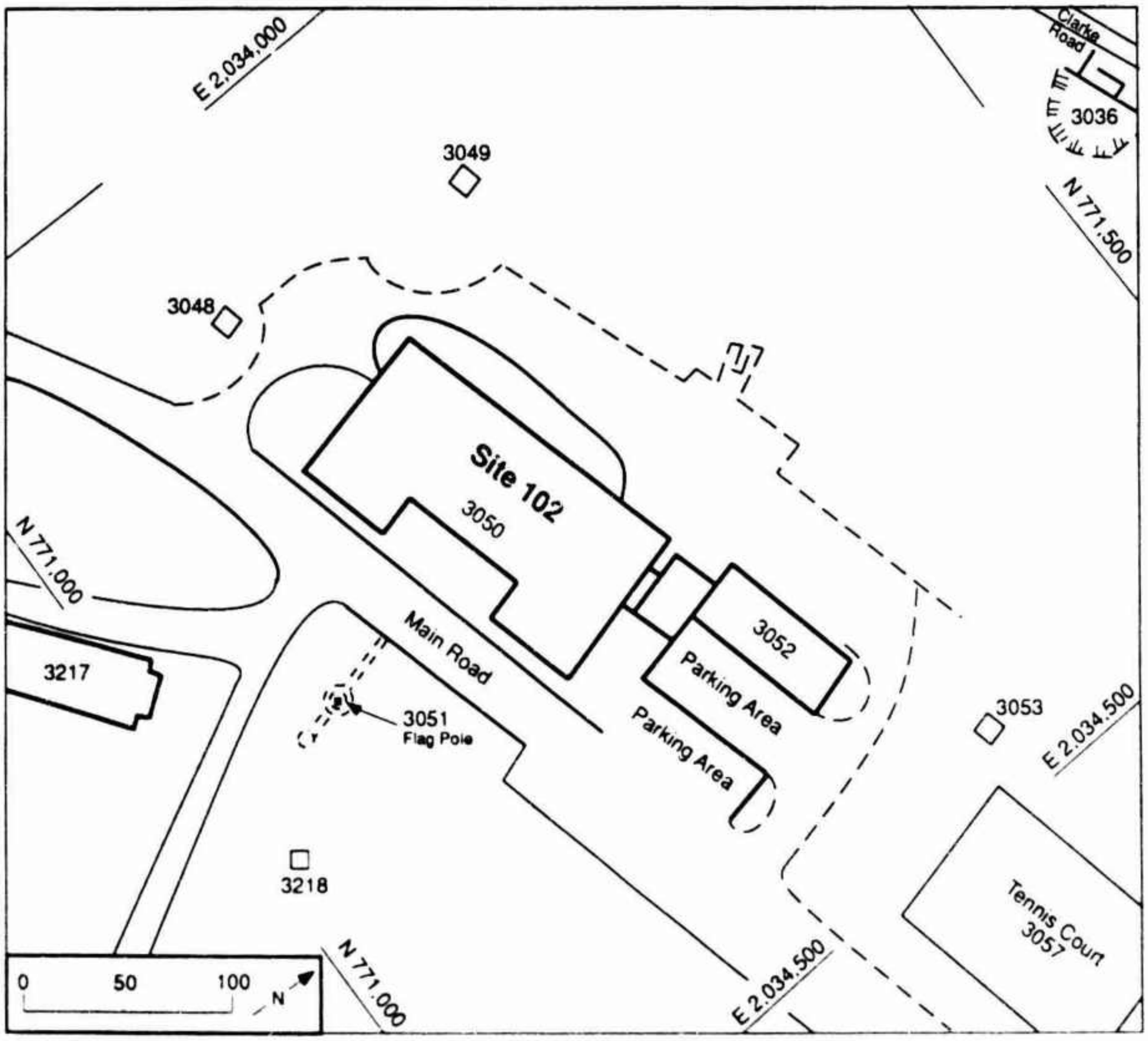

FIGURE 10.23 Layout of Site 102, the Enlisted Men Barracks at Building 3050 (Source: Adapted from USACE 1984b)

10.20.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that used oil from vehicle oil changes at a car rack behind the ceramic shop was routinely dumped on the ground and over the hill. Fill has since been added to the car rack area. A list of satellite waste accumulation areas (Solecki 1989c) indicates that photographic wastes are stored in a darkroom in the building. These wastes are generated at a rate of 2 gal/mo each of developer, stop bath, fixer, and hypoclearing agent and 1 gal/mo of other chemicals.

Consideration needs to be given to any potential health hazard to the barracks residents due to asbestos in the cement asbestos roof.

10.20.4 Proposed RI Plan

10.20.4.1 Phase I

The area should be inspected to locate the car rack and any areas of oil dumping (both near the rack and on the hillside). Areas of possible spills, soil staining, and stressed vegetation should be noted. If the car rack or any other evidence of oil spillage or dumping is found, then one surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each area identified. The samples should be analyzed for TCL volatiles, TCL semivolatiles, and lead.

Because fill has been added to the car rack area, a soil boring should be drilled in this area and sampled. Samples should be analyzed for TCL volatiles, TCL semivolatiles, and lead.

10.20.4.2 Phase II

If significant contamination is found in the surface soil samples, then one soil boring should be drilled in the center of each area of contaminated soil. Samples should be collected from the borings over 0.6-m (2-ft) intervals from the top to the bottom of the borings. The subsurface soil samples should be analyzed for TCL volatiles, TCL semivolatiles, and lead. These borings would be needed to determine the depth of soil contamination in the area.

10.20.4.3 Phase III

If significant contamination is found in the subsurface soils, it will be necessary to evaluate the movement of contaminants into groundwater by installing monitoring wells. The number and location of the wells would depend upon the location of the contaminated soil boring samples.

10.21 SITE 105 — BUILDING 511, PROPELLANT PLANT

10.. ' Site History

Building 511 was a propellant plant that was destroyed under TECUP. It was located near the south end of Picatinny Lake along Bott Road (Fig. 10.24). PTA personnel reported that all transformers were removed before the building was destroyed. Additional information on past activities at this Site is not available.

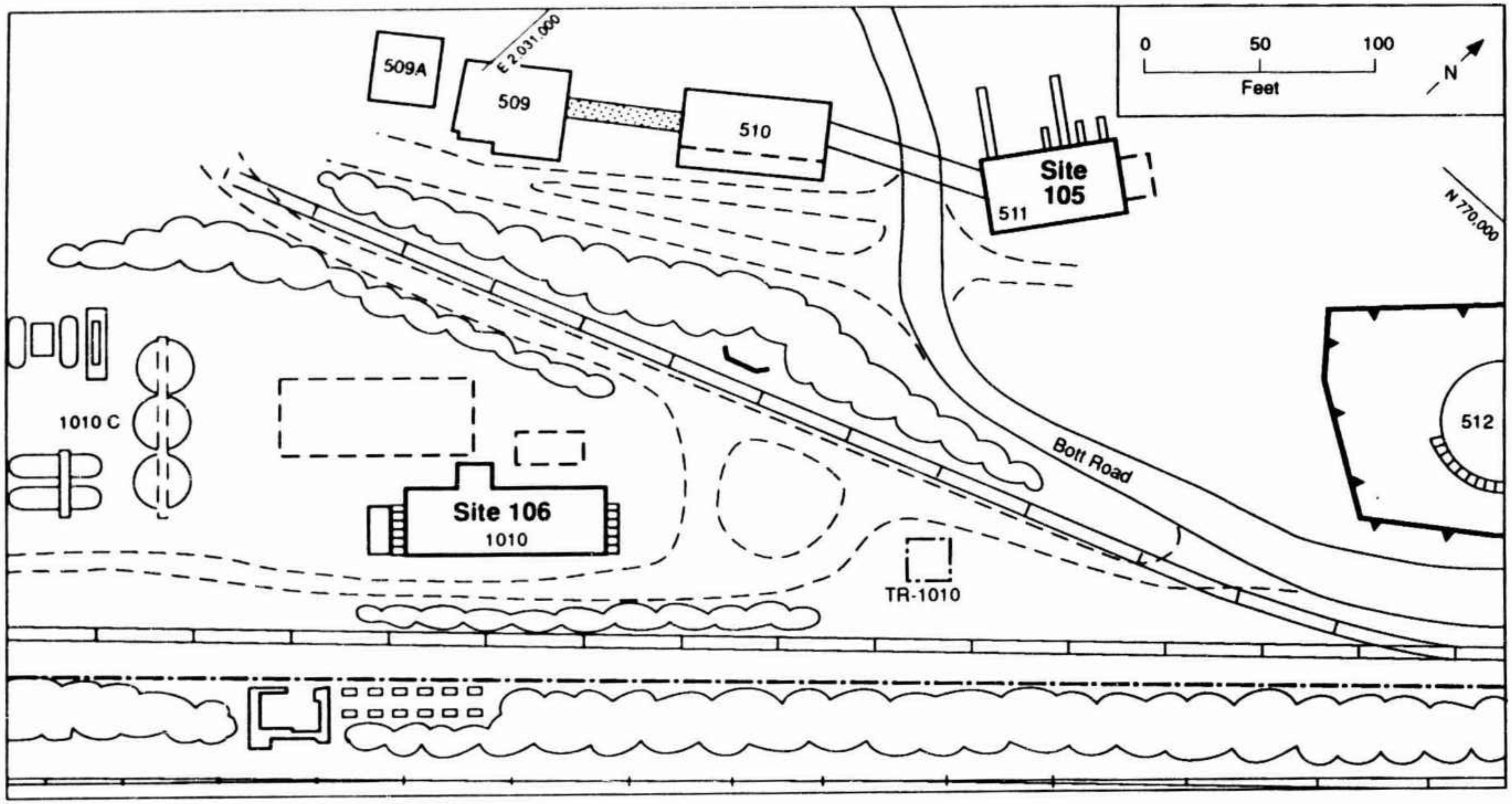

FIGURE 10.24 Layout of Site 105, Building 511, and Site 106, Building 1010 (Source: Adapted from USACE 1984b)

10.21.2 Geology and Hydrology

Building 511 is located approximately 530 ft south of Picatinny Lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 105 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 105 flows north to northwest towards Picatinny Lake and Green Pond Brook.

10.21.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. During interviews, PTA personnel reported that PCBs had leaked and were sprayed around.

10.21.4 Proposed RI Plan

10.21.4.1 Phase I

The Site should be visually inspected for signs of contamination. One surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from the center of each visibly contaminated area. In addition, one surface soil sample should be collected within 50 ft of each side of the building's former location. Because PCBs are immobile in soil, soil borings are not necessary for Phase I. All surface soil samples should be analyzed for PCBs.

10.21.4.2 Phase II

If contamination is found, additional surface soil sampling may be required to determine its extent. Soil borings should be drilled to determine its depth. Split-spoon samples should be collected from the borings; at least two samples should be collected from each boring. The samples should be analyzed for PCBs. If contamination is found at depth, it may also be necessary to install monitoring wells to collect groundwater samples.

10.22 SITE 108 — BUILDINGS 717, 722, AND 732, ORDNANCE FACILITIES

10.22.1 Site History

Site 108, the ordnance facilities at Bldgs. 717, 722, and 732, is located at the intersection of Whittemore Avenue and Fidlar Point Road on the southwestern tip of Picatinny Lake, near where Green Pond Brook flows out of the lake. A map of the Site is shown in Fig. 1 . The buildings on this Site were used for flare testing.

Building 717 was built in 1939 and was listed as a large-caliber projectile loading facility in 1971 and an ordnance facility in 1977. Building 722, built in 1922, was listed as a physics laboratory in both 1971 and 1977 and includes a flare testing room. Building 732 was built in 1938 and was listed as a physics laboratory in 1971 and an ordnance facility in 1977.

A closure plan has been prepared for Bldg. 722 (ARDEC undated). The building will be closed under New Jersey hazardous waste regulations because it never had interim status.

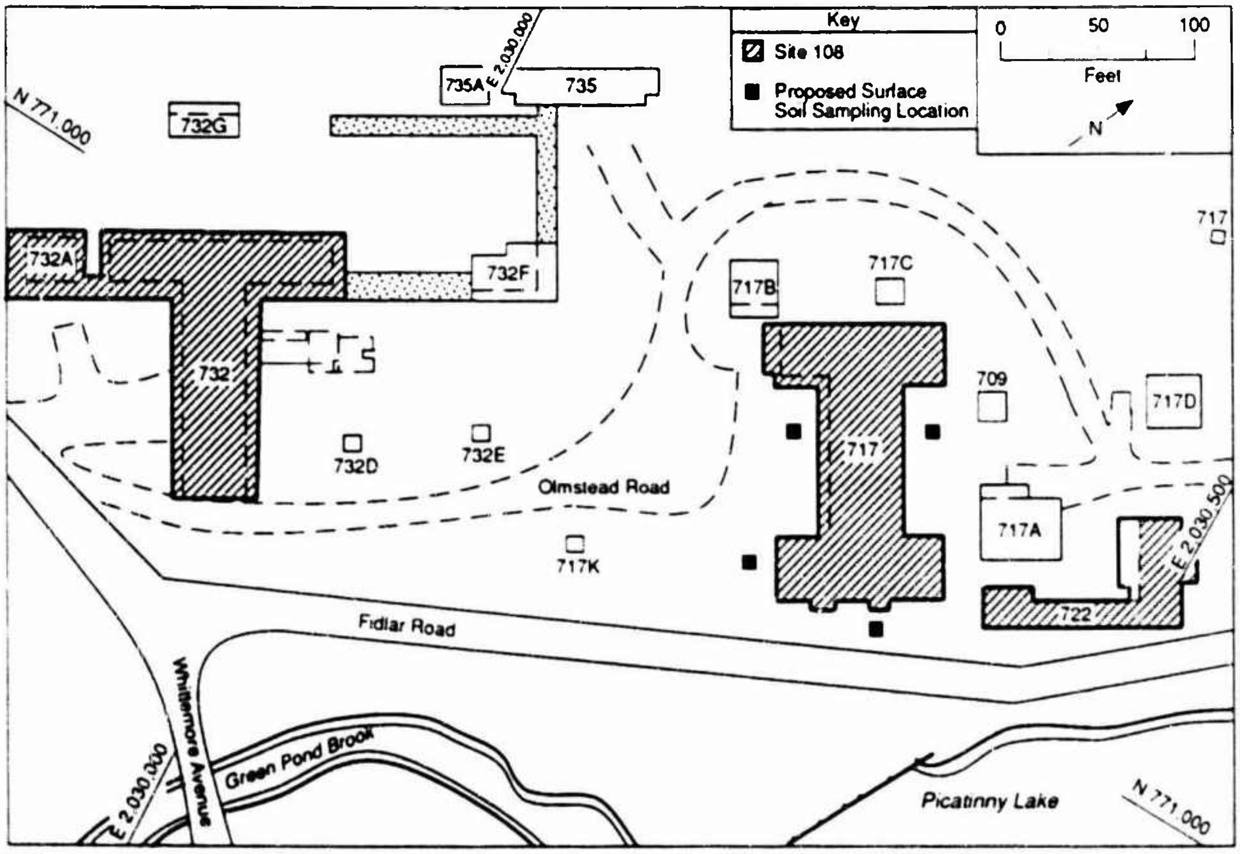

FIGURE 10.25 Layout of Site 108, the Ordnance Facilities at Buildings 717, 722, and 732 (Source: Adapted from USACE 1984b)

10.22.2 Geology and Hydrology

The surface elevation at Site 108 is 720 ft above MSL. The soil is Urban Land with a reworked soil profile, and the bedrock in the region is the Leithsville Formation. Surface water and runoff from the vicinity of the buildings would flow into either Picatinny Lake or Green Pond Brook.

10.22.3 Existing Contamination

For Bldg. 717, 1989 interviews with PTA personnel indicated that flares, pyrotechnics, and solvents were worked with in the building. Freon was stored behind the building; gallon cans were filled with freon, used for cleaning paint brushes, and dumped wherever used. Smoke flares were made with red phosphorus, and other flares were made with magnesium. In about 1965, there was a flare fire behind the building. The soil may be contaminated with heavy metals (anonymous undated).

A list of special areas indicates that Bldg. 722 has a (closed) concrete pit containing waste that is currently awaiting sampling and analysis (Solecki 1989c). The waste may contain aluminum and magnesium oxides, magnesium fluoride, heavy metals, and unburned pyrotechnic powder.

A closure plan (ARDEC undated) describes the flare testing room in Bldg. 722. It contains two hearths that are located in a trench in the floor and constructed of cinderblocks with metal grates over the hearths. Flares were burned over the hearth grating, with air drawn in through an inlet in the side of the building and exited from an exhaust stack at the upper portion of the room. Residue from flare testing accumulated in the hearths. When 15 lb of residue accumulated in a hearth, the residue was removed for disposal as hazardous waste. Analysis of the residues indicated that they contained no energetics, but contained mainly carbon and some magnesium oxides and potassium oxides. According to the closure plan, the flare testing room was last used in 1986, and there are no plans to reactivate this facility.

For Bldg. 732, 1989 interviews with PTA personnel indicated that pyrotechnics and solvents were worked with in the building. Materials were kept in crocks. Most pyrotechnics were loaded. Freon was dumped out in 0.5-gal cans. Flares were also assembled in Bldg. 732.

10.22.4 Closure Plan

The closure plan for Bldg. 722 (ARDEC undated) includes removing residues from the hearths and associated trench and cleaning the walls, floor, ceiling, and exhaust stack. Rinsate grab samples will be analyzed for EP toxic metals. After washing, wipe tests will be taken from the floor and walls, and core and soil boring samples will be taken from the hearth floor. If significant contamination levels are not exceeded, closure will be considered complete. Otherwise, remedial action will be taken to effect a clean closure. Closure does not involve any sampling outside of the building.

10.22.5 Proposed RI Plan

The proposed phased sampling plan will be carried out independently of implementation of the closure plan for Bldg. 722. Should clean closure of the building not be possible, the RI plan will be modified as new data become available.

10.22.5.1 Phase I

A field inspection should be carried out at the Bldg. 717 Area to locate areas of potential contamination due to flare activities and reported freon dumping. If stained areas or signs of spills are found, then one surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each stained area and analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals. In addition, four surface soil samples should be collected along the perimeter of Bldg. 717 and analyzed for TCL metals. Suggested locations are shown in Fig. 10.25; final locations should be determined in the field. These samples will help determine whether metal contamination has moved from the building into the surrounding soil.

For Bldgs. 722 and 732, two surface soil samples should be collected to a depth of 0.3 m (1 ft) along the perimeter of each building (four samples altogether), and one surface soil sample should be collected at the air inlet for the trench in the floor of the flare testing room in Bldg. 722. The samples should be analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals. In addition, two samples should be collected from the concrete pit in Bldg. 722 and analyzed for explosives, TCL metals, and fluoride.

10.22.5.2 Phase II

If significant contamination is found in the surface soil samples, then three soil borings should be drilled; one boring should be located between Picatinny Lake and each of Bldgs. 722 and 717, and one boring should be located between Bldg. 732 and Green Pond Brook. If possible, the soil borings should be located near the sampling sites of contaminated soil, as identified during Phase I. The subsurface samples should be collected from the borings and analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

10.22.5.3 Phase III

If significant contamination is found in the subsurface soils, then sediment samples should be collected to a depth of 0.3 m (12 in.) from Green Pond Brook and Picatinny Lake near the soil borings showing contamination. Two sediment samples should be collected for each contaminated boring. If the boring for Bldg. 732 shows contaminants, surface and bottom water samples should be collected from Green Pond Brook at the site of contaminated sediment. The sediment and soil samples should be analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals. (Sampling of water from Picatinny Lake is discussed in Sec. 10.10.)

10.23 SITE 109 — BUILDING 445, PYROTECHNIC PLANT

10.23.1 Site History

The Site is located near the intersection of 13th Avenue and Whittemore Avenue (Fig. 10.26). The 445-m^2 (4,795-ft^2) building, which was built in 1930, has an asphalt-protected metal roof and hollow-tile walls. The building was used as a pyrotechnic plant to produce flares.

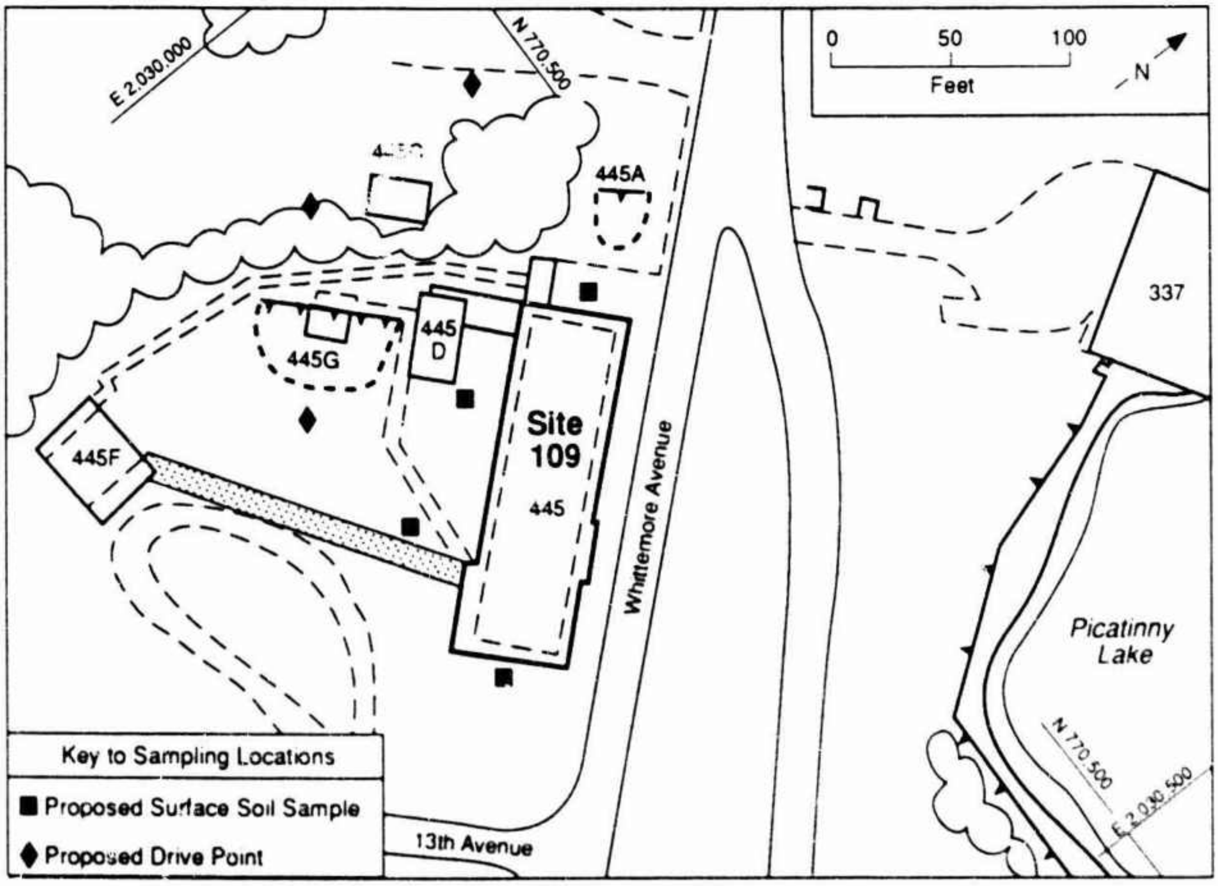

FIGURE 10.26 Layout of Site 109, Pyrotechnic Plant at Building 445 (Source: Adapted from USACE 1984b)

10.23.2 Geology and Hydrology

The Site is situated near the outlet of Picatinny Lake in the central valley. It is covered with surficial deposits about 23 m (75 ft) thick (Lacombe et al. 1986); these deposits overlie either Cambrian Hardyston Quartzite or Leithsville dolomite bedrock. The surface soil on the Site has been disturbed by development. Coarse sands and gravels are expected near surface. The sands and gravels form a water-table aquifer on the Site. Hydraulic conductivity of the aquifer is estimated to be high. Because of the low altitude of the Site, the water table is shallow. The direction of groundwater flow in the area is not known.

10.23.3 Existing Contamination

There is not much information regarding the contamination of the Site. During interviews, PTA personnel reported that ingredients to make flares were washed into soils. A sump in the back of the building was reported by PTA personnel to contain nitro-compounds. No more information is available to ANL.

10.23.4 Proposed RI Plan

10.23.4.1 Phase I

A field inspection should be conducted around Bldg. 445 to inspect for signs of contamination and to locate any drains and the reported sump behind the building. If contaminated areas are visible, one surface soil sample should be collected to a depth of 0.3 m (1 ft) from each area. If the drains are found, one sediment sample should be collected to a depth of 0.6 m (2 ft) from each drain outfall area. One sediment sample should be collected from the sump if it can be located.

One surface soil sample should be collected to a depth of 0.6 m (2 ft) from each side of the building. One drive-point water sample should be collected over a 5-ft interval from the groundwater surface at each of three different areas (a total of three samples) downgradient of the building. Suggested locations are shown in Fig. 10.26. All samples should be analyzed for TCL metals, nitrates, propellants, and explosives. If contamination is not found, no further action is needed.

10.23.4.2 Phase II

If contamination is found in the Phase I samples, one soil boring should be drilled in each contaminated area. Soil samples should be collected from each boring and analyzed for the contaminants found in the surface soil samples. Two monitoring wells should be installed in areas downgradient of the Site to monitor for TCL metals, nitrates, propellants, and explosives in groundwater.

10.23.4.3 Phase III

Additional soil and water samples may be required, depending on the Phase II results.

10.24 SITE 110 — 500 AREA

10.24.1 Site History

Site 110, the 500 area, is located southeast of Picatinny Lake. During interviews, PTA personnel reported that during the past 40 years or more, especially in the 1950s, it was not unusual for maintenance personnel to discard such items as plumbing fixtures into Picatinny Lake. Other unknown materials may have been dropped or spilled throughout the area. It was also reported that propellant sticks, which had fallen off trains, may still be lying along the bed of a narrow-gauge railroad track that ran through the area.

10.24.2 Geology and Hydrology

The 500 area is located along the southeast shoreline of Picatinny Lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 110 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 110 flows north to northwest towards Picatinny Lake and Green Pond Brook.

10.24.3 Existing Contamination

No previous investigations have been made to determine the presence of contamination at the Site and past activities have not been well documented. Propellants, which reportedly fell off trains, are the contaminants of concern. Some may still be lying along the narrow-gauge railroad track.

10.24.4 Proposed RI Plan

The descriptions of the spills at Site 110 are too vague to identify useful sampling locations. However, many of the buildings in the 500 area will be characterized for their contamination potential as part of investigations at other Sites. Therefore, the only recommended action for Site 110 is to inspect the old railroad bed to determine the presence of propellants and explosives. If sticks of propellants are found, they should be removed and disposed of properly.

10.25 SITE 113 — BUILDING 561, PROPELLANT PLANT

10.25.1 Site History

Building 561 was located on the promontory that extends out into Picatinny Lake along the south shore (Fig. 10.27). The building, which was used for the manufacture of explosives and ammunitions, burned down under TECUP a few years ago. Additional information on past activities at this Site is not available.

10.25.2 Geology and Hydrology

Building 561 is located along the south shore Picatinny Lake. The ground surface near the site slopes towards the lake. The site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 113 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 113 flows north to northwest towards Picatinny Lake and Green Pond Brook.

10.25.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. During interviews, PTA personnel reported that the soil around the building may be contaminated with unknown substances. Since Bldg. 561 was destroyed under TECUP, residual contamination, if present, would be restricted to the ground around the former building's location.

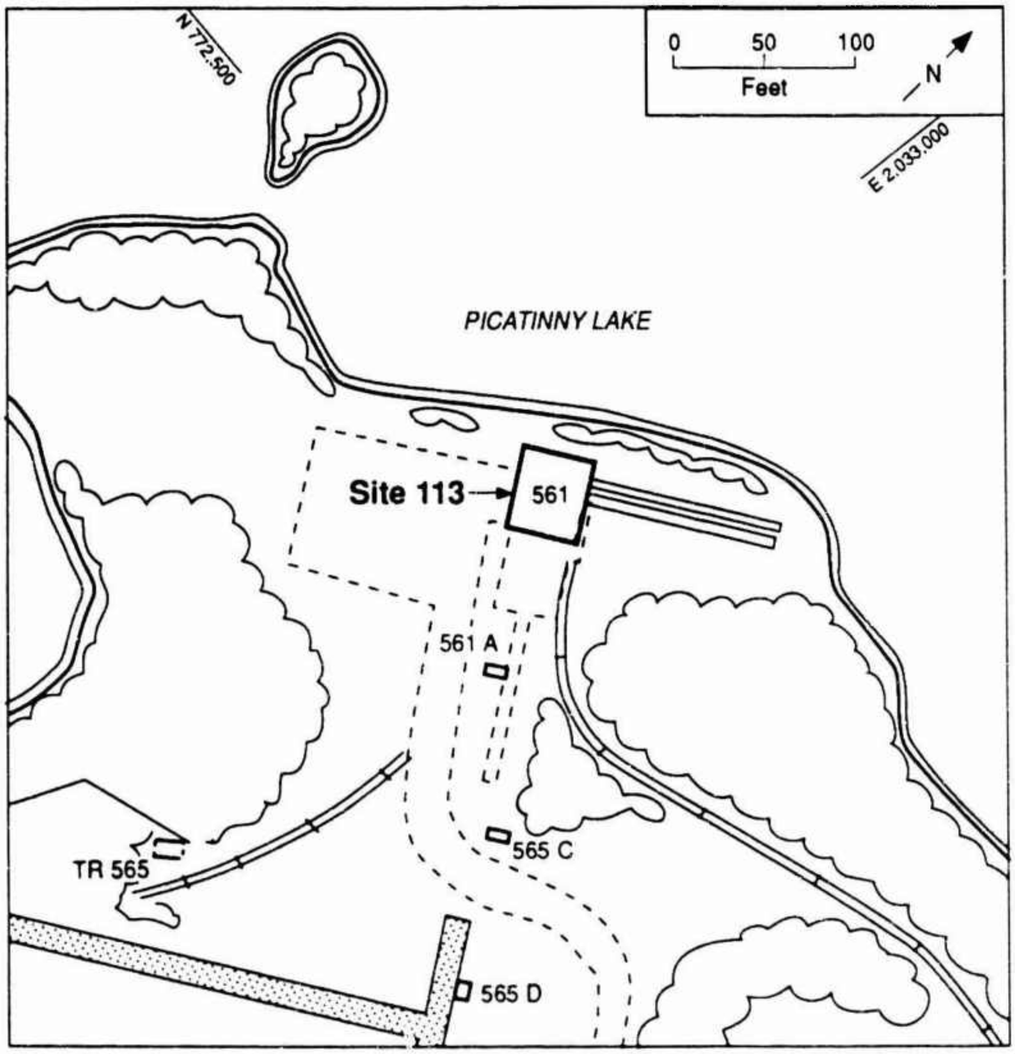

FIGURE 10.27 Layout of Site 113, the Propellant Plant at Building 561 (Source: Adapted from USACE 1984b)

10.25.4 Proposed RI Plan

10.25.4.1 Phase I

The area around the building location should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area. One surface soil sample should also be collected over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the former building location. In addition, two soil borings should be drilled: one located on the east side of the building location, and the other located on the west side. At least two samples should be collected from each boring. Because the type of possible contamination is unknown, the soil samples should be analyzed for explosives, TCL semivolatiles, TCL metals, and TCL volatiles.

10.25.4.2 Phase II

If contamination is found, additional soil boring sampling may be required to determine its extent. The samples should be analyzed for contaminants identified during Phase I.

10.26 SITE 137 — BUILDING 382, ADMINISTRATIVE BUILDING

10.26.1 Site History

Building 382 is located near the intersection of Reilly Road and 10th Street in the southern part of PTA (Fig. 10.28). It was built in 1942 as a general-purpose administration building. PTA personnel reported that, between 1940 and 1950, disposal pits were located in the area between Bldgs. 382 and 321.

10.26.2 Geology and Hydrology

The overall PTA characterization shows that the bedrock formation directly underlying the Site is Precambrian gneiss. It is a varying composition, medium- to coarse-grained. The predominant facies is biotite, quartz, and oligoclase. Minor facies are characterized by abundant garnet and microperthite, with local sillimanite and graphite. Groundwater occurs in fractures and joints, usually in low yields. Flow in this area is estimated to be east-southeast toward Green Pond Brook.

Soils in the area of Bldg. 382 are classified as Urban Land. These soils are usually well-drained, deep sandy, gravelly, or stoney material of glacial deposits. The soils have been reworked to the extent that the original soil profile may not be recognized (Sargent 1988).

10.26.3 Existing Contamination

No previous investigations are reported for this Site. During interviews, PTA personnel reported that a variety of wastes -- including materials dredged from Picatinny Lake in the late 1960s and ammunition boxes and tubes -- were buried in the disposal pits between the buildings. Potential contaminants for this Site are waste solvents, waste oil, and explosives.

10.26.4 Proposed RI Plan

10.26.4.1 Phase I

A geophysical survey should be conducted to locate the disposal pits. If the pits are found, a hand auger should be used to collect three soil samples from the pit area at

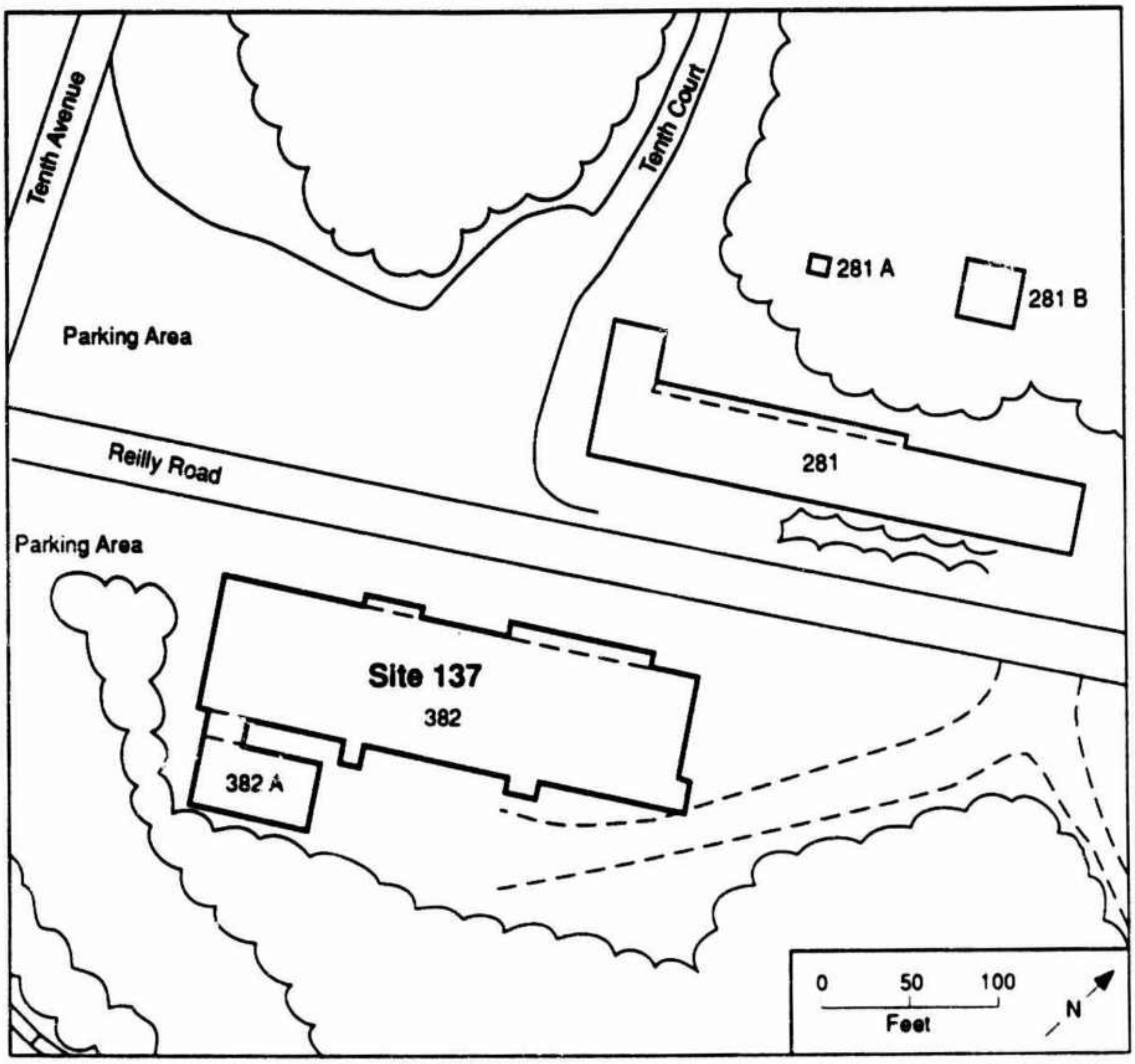

FIGURE 10.28 Layout of Site 137, the Building 382 Administrative Building (Source: Adapted from USACE 1984b)

a depth of 0.6 m (2 ft). If the pits have been paved over, collect the samples by coring through the asphalt.

The Site area should be inspected for visible contamination, drains, and other migration pathways. If visible staining is found, one soil sample should be collected from each area.

All samples should be analyzed for all TCL parameters except dioxin and for explosives.

10.26.4.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to 10 ft or groundwater, whichever comes first, in each contaminated area. Samples should be collected from each boring and analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

10.27 SITE 147 — BUILDING 520, POACHING HOUSE

10.27.1 Site History

Building 520 was located in the 500 area along the south shore of Picatinny Lake (Fig. 10.29). The guncotton line (Site 16) traverses the Site (Fig. 10.1). Because the building was burned down under TECUP, it no longer appears on the PTA Master Plan (USACE 1984b). However, the plan shows a transformer numbered TR 520 located along the east side of Picatinny Lake and west of 21st Street (Fig. 10.29). It is assumed that Building 520 was located near this transformer. Various energetic materials were used in this building in the past. During interviews, PTA personnel reported that nitrocellulose-water slurry was processed in the building and that waste was disposed of in pits in the basement.

10.27.2 Geology and Hydrology

Building 520 is located approximately 400 ft from the southeast shoreline of Picatinny Lake. The ground surface near the Site slopes toward the lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 147 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 147 flows north toward Picatinny Lake.

10.27.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Because

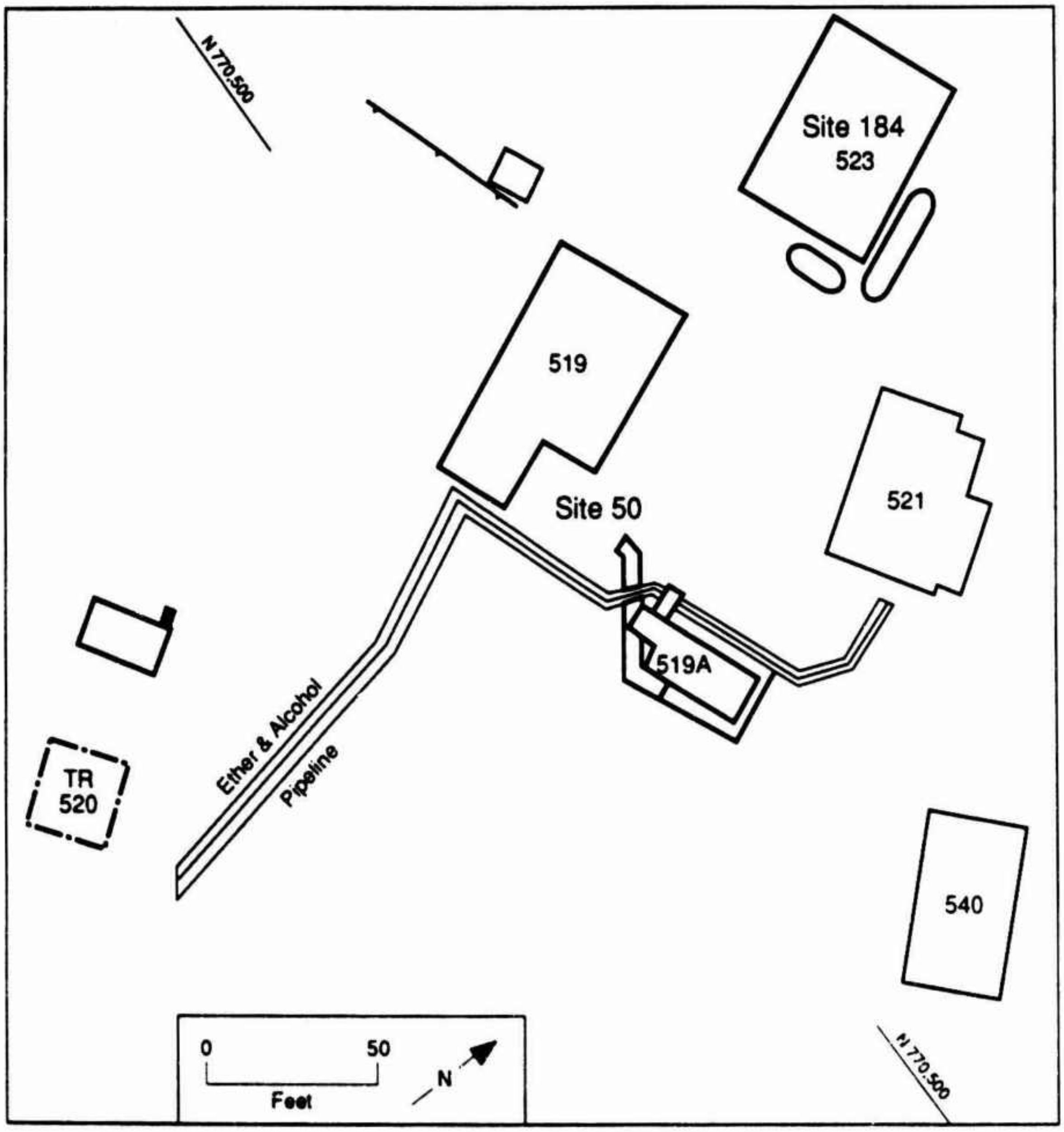

FIGURE 10.29 Layout of the Area near Site 147, the Former Location of Building 520 (Source: Adapted from USACE 1984b)

Bldg. 520 was destroyed under TECUP, residual contamination, if present, would be restricted to the ground around the former building's location.

10.27.4 Proposed RI Plan

Before Site 122 can be characterized, the exact location of Bldg. 520 and the guncotton line (Site 16) must be determined. The Site should be visually inspected for signs of contamination. Old detailed maps and/or geophysical surveys may be required to determine the location of the disposal pits.

10.27.4.1 Phase I

One surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the former building's location, within 6 m (20 ft). If the disposal pits are found, one soil boring should be drilled in the center of each pit. An additional boring should be drilled no more than 9 m (30 ft) north of the building location. Samples should be collected from the top, pit bottom depth, and bottom of each boring. The soil samples should be analyzed for propellants, TCL semivolatiles, and TCL metals. Soil boring samples should also be analyzed for TCL volatiles.

10.27.4.2 Phase II

If contamination is found, additional soil boring sampling may be required to determine its extent. The samples should be analyzed for contaminants identified during Phase I.

10.28 SITE 148 — BUILDING 527 CHANGE HOUSE

10.28.1 Site History

Building 527 is located on the north side of Babbitt Road along the south shore of Picatinny Lake (Fig. 10.30). It is a rectangular, one-story building about 290 by 37 ft. The building was used for nitrocellulose powder production (Foster Wheeler 1988c). During interviews, PTA personnel reported that in the past, nitrocellulose was delivered to the building by truck for processing. No problems associated with the storage tank outside the building have been reported. Additional information on past activities at this Site is not available.

Closure plans have been prepared for Bldg. 527 (which is scheduled for TECUP) because hazardous waste has been stored in the building for more than 90 days in the past (Foster Wheeler 1988c). The building will be closed in accordance with New Jersey hazardous waste regulations because they never had interim status.

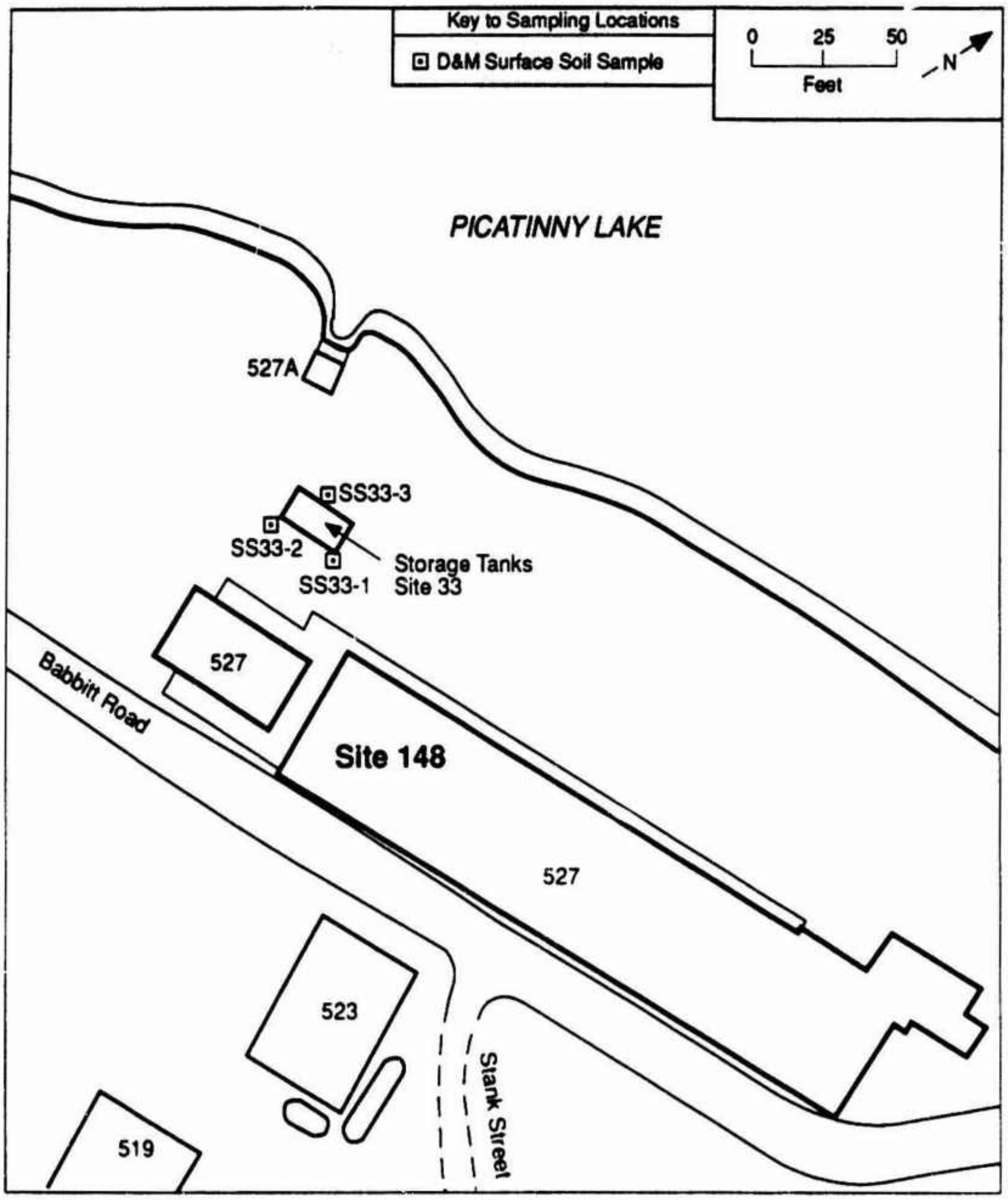

FIGURE 10.30 Layout of Site 148, the Change House at Building 527 (Source: Adapted from USACE 1984b)

10.28.2 Geology and Hydrology

Building 527 is located about 100 ft from the southeast shore of Picatinny Lake. The ground surface near the building probably slopes towards the lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 148 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water flows north or northwest towards Picatinny Lake and Green Pond Brook.

10.28.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site. Materials or chemicals used at the Site include nitrocellulose, dibutylthiolate, alcohols, ether, dinitrotoluene, and diphenylamine (Foster Wheeler 1988c). No spills or leaks have been reported.

10.28.4 Closure Plan

Revised closure plans for Bldg. 527 include cleaning equipment with hot water and steam cleaning the building. Two grab samples of wash water or condensate and 24 chip samples will be collected and analyzed for priority pollutant metals (Foster Wheeler 1988c; Solecki 1989a).

10.28.5 Proposed RI Plan

If clean closure is not possible, the proposed RI sampling plan may have to be modified as new data become available. It will be carried out independently of implementation of the closure plan.

10.28.5.1 Phase I

The area around Bldg. 527 should be inspected for signs of contamination. One surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from the center of each visibly contaminated area around the building. All soil samples should be analyzed for explosives, propellants, TCL volatiles, TCL semivolatiles, and TCL metals.

10.28.5.2 Phase II

If contamination is found, additional sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from the borings and analyzed for contaminants identified during Phase I.

10.29 SITE 149 — BUILDING 541, PROPELLANT PLANT

10.29.1 Site History

Building 541 was a propellant plant located along the southern shore of Picatinny Lake. The location of the former building is shown in Fig. 10.31. Because the building was burned down in 1983 under TECUP, it no longer appears on the PTA Master Plan (USACE 1984b).

PTA personnel reported during interviews that a vat in Bldg. 541 ruptured and liquid leaked onto the building floor and outside (date unknown). The liquid was reported to be single-base powder grains dissolved in solvents. The explosives were nitrocellulose or nitroglycerin. The solvents were ether, alcohol, or acetone.

10.29.2 Geology and Hydrology

Building 541 was located a few hundred feet southeast of Picatinny Lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly the Cambrian Hardyston Quartzite which is exposed along the eastern shore of Picatinny Lake.

The soils at Site 149 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that the groundwater as well as surface water in the vicinity of Site 149 flows north to northwest towards Picatinny Lake and Green Pond Brook.

10.29.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Liquid containing explosives was reported during interviews to have leaked onto the building floor and outside. The liquid probably contained nitrocellulose, nitroglycerin, ether, alcohol, and acetone. Since Bldg. 541 was destroyed under TECUP, contamination if

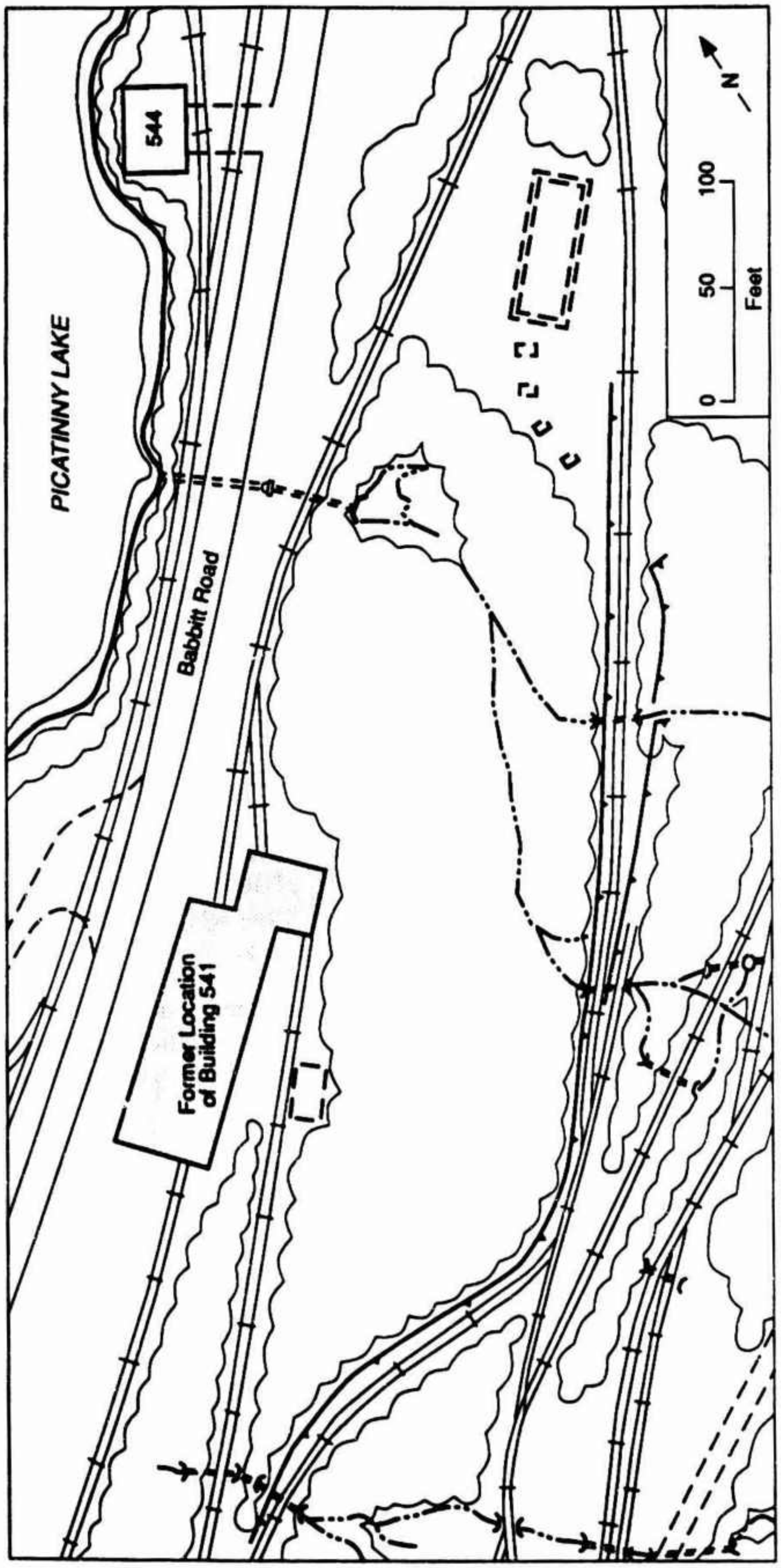

FIGURE 10.31 Layout of Site 149, Building 541 (Source: Adapted from USACE 1984b)

present (except ether, alcohol, and acetone, which are highly volatile), would be restricted to the ground around the building's former location.

10.29.4 Proposed RI Plan

10.29.4.1 Phase I

The area around the location of the former Bldg. 541 should be visually inspected for signs of contamination. One surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the former building's location. One soil boring should be drilled at a location downslope from the Site, and at least two samples should be collected from the boring. The surface soil samples and soil boring samples should be analyzed for explosives and TCL semivolatiles. The soil boring samples should also be analyzed for TCL volatiles.

10.29.4.2 Phase II

If contamination is found, additional soil boring sampling may be required to determine its extent. The samples should be analyzed for contaminants identified during Phase I.

10.30 SITE 150 — BUILDING 555, PROPELLANT PLANT

10.30.1 Site History

Building 555 is a propellant plant located south of Picatinny Lake and north of the abandoned railroad line at the east end of Stank Street. The building shown in Figure 10.32, is scheduled to be destroyed under TECUP. The building was used for the manufacturing of explosives and ammunition.

10.30.2 Geology and Hydrology

Building 555 is located approximately 600 ft south of the southeast shoreline of Picatinny Lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 150 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

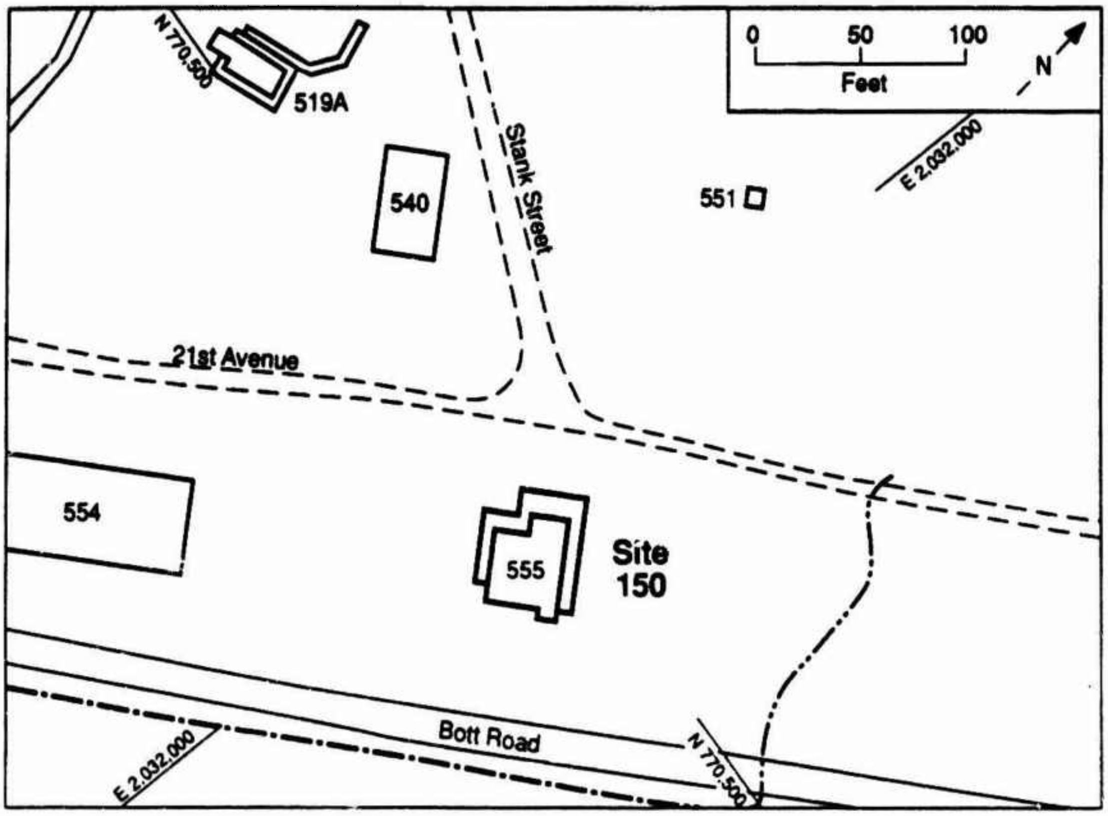

FIGURE 10.32 Layout of Site 150, the Propellant Plant at Building 555 (Source: Adapted from USACE 1984b)

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 150 flows north to northwest towards Picatinny Lake and Green Pond Brook.

10.30.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Various energetic materials were probably used in the building over the years. During interviews, PTA personnel reported that nitrocellulose chunks and water from powder operations were found in the drainpipe. The drainpipe reportedly contained enough powder that it exploded when cut years ago (date unknown). Except for the drainpipes in the building, contamination would be restricted to the outside of the building.

10.30.4 Proposed RI Plan

10.30.4.1 Phase I

Even though Bldg. 555 is scheduled to be destroyed under TECUP, an investigation should be conducted due to the possibility that explosive compounds may have been spilled or leaked onto the ground. The area around the Bldg. 555 should be visually inspected for signs of contamination. One surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from each side of Bldg. 555, within 16 m (50 ft). One soil boring should be drilled at the center of the west side of the building, no farther than 9 m (30 ft) west of the building. Samples should be collected from the boring. All samples should be analyzed for propellants and explosives.

In addition, samples should be collected from the drainpipes in Bldg. 555 and analyzed for propellants and explosives. Sampling locations should be based on visual inspection of the building interior. Because the material in the drainpipes may be unstable, caution must be taken to ensure the safety of workers collecting samples.

10.30.4.2 Phase II

If contamination is found, additional surface soil and soil boring sampling may be required to determine its extent. All explosive materials should be removed from drainpipe before the building is destroyed.

10.31 SITE 156 — BUILDINGS 813, 816, AND 816B, ORDNANCE FACILITIES

10.31.1 Site History

Buildings 813, 816, and 816B are located on the northwestern shore of Picatinny Lake. A map of the Site is shown in Fig. 10.33. The three buildings at this Site are listed as large-calibre projectile loading plants.

Building 813, built in 1948, was used as a large-calibre projectile loading plant. Interviews with PTA personnel indicated that the building has wooden floors. In 1977, it was listed as vacant and being considered for demolition. Buildings 816 and 816B were built in 1930 and have been used for large-calibre projectile loading. Building 816B was designed as a compressor house.

10.31.2 Geology and Hydrology

The surface elevation at Site 156 is 675 ft above MSL. Soils in the area belong to the Rockaway Series, and the bedrock is Green Pond Conglomerate and Leithsville Formation. Surface water and runoff from this Site would flow into Picatinny Lake.

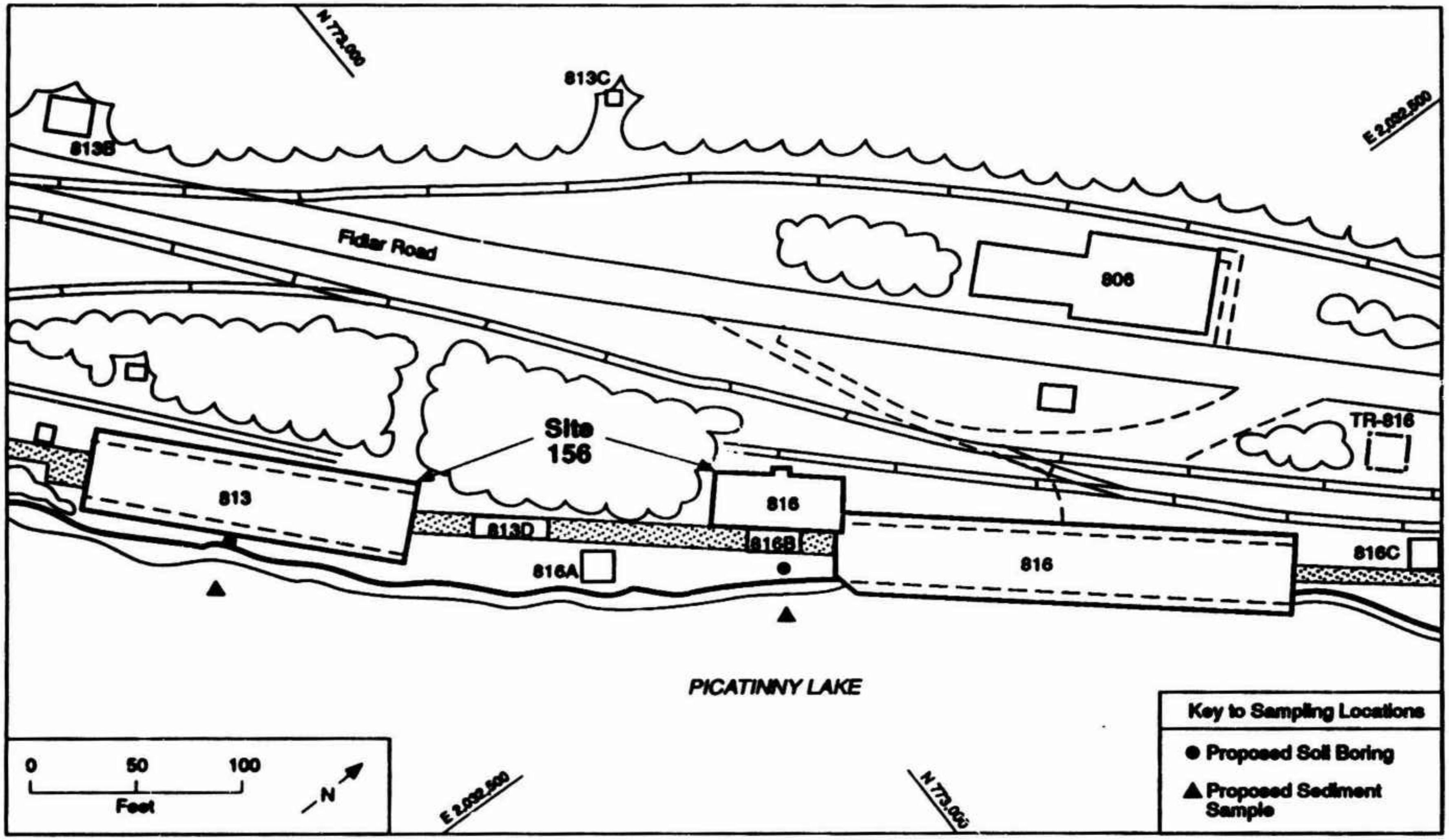

FIGURE 10.33 Layout of Site 156, the Ordnance Facilities at Buildings 813, 816, and 816B (Source: Adapted from USACE 1984b)

10.31.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that the buildings were used to load 105-mm, 155-mm, and 8-in. projectiles; to pack loaded rounds; and to load propellant into bags from hoppers. Production levels were high before 1957. Much explosive dust was reportedly generated, and explosive-contaminated wash water ran outdoors, possibly into the lake. Building 813 reportedly contained an X-ray laboratory.

10.31.4 Proposed RI Plan

10.31.4.1 Phase I

The areas around the buildings should be inspected for signs of contamination. One soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each visibly contaminated area and analyzed for explosives and TCL metals.

To determine whether propellant material was released from any of the buildings in Site 156, two soil borings, one for each building, should be drilled between Bldgs. 816B and 813 and Picatinny Lake; suggested locations are shown in Fig. 10.33. Samples should be collected from the borings.

Because the buildings are directly on the shore of Picatinny Lake, four sediment samples, two for each building, should be collected to a depth of 0.3 m (12 in.) from the lakeshore near Bldgs. 813 and 816; suggested locations are shown in Fig. 10.33. All samples should be analyzed for propellants and explosives and TCL metals. (Sampling of Picatinny Lake water is discussed in Sec. 10.10 [Site 53]).

10.31.4.1 Phase II

If significant contamination is found in the surface soil samples, then one soil boring should be drilled in the center of each area of contaminated soil identified during Phase I. Samples should be collected from each boring and analyzed for propellants, explosives, and TCL metals. These borings would be needed to determine the depth of soil contamination in the area.

10.32 SITE 157 — BUILDINGS 820 AND 823, ORDNANCE FACILITIES

10.32.1 Site History

Buildings 820 and 823 are located on the northwestern shore of Picatinny Lake. Maps of the two buildings are shown in Fig. 10.34. Buildings 820 and 823 were built in 1930 and have been used as large-calibre projectile loading plants. Interviews with PTA personnel indicated that the buildings may also have been used for shell steamout and washout operations. No more information is available.

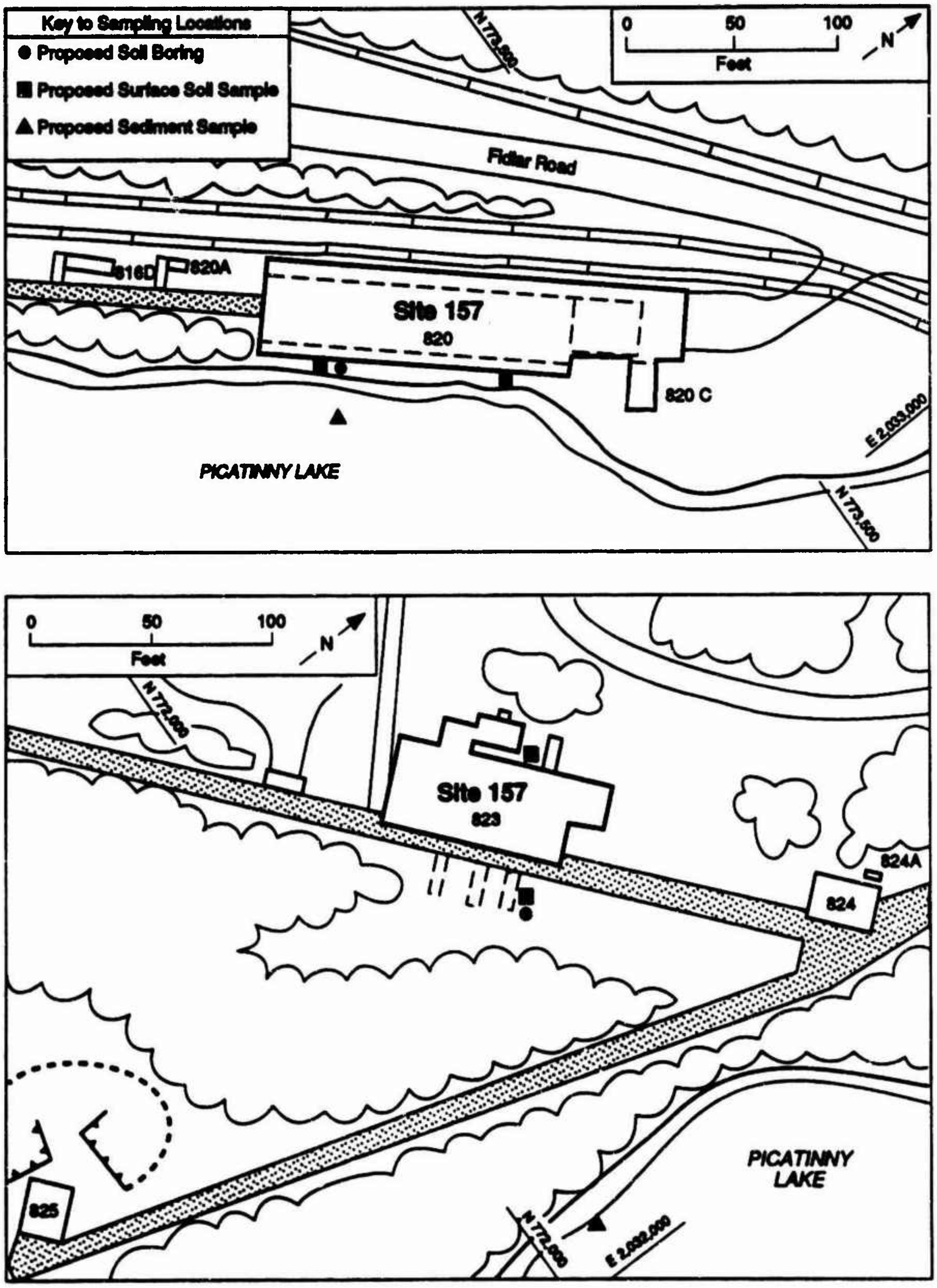

FIGURE 10.34 Layout of Site 157: Building 820 (top) and Building 823 (bottom) (Source: Adapted from USACE 1984b)

10.32.2 Geology and Hydrology

The surface elevation at Site 157 is 675 ft above MSL. Soils in the area belong to the Rockaway Series, and the bedrock is the Green Pond Conglomerate and Leithsville Formation. Surface water and runoff from the area would flow into Picatinny Lake.

10.32.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that shells were packed and sealed in crates for shipping. The shells were steamed and washed out in the buildings, and the washout water was reportedly discharged into Picatinny Lake.

10.32.4 Proposed RI Plan

10.32.4.1 Phase I

To determine whether contamination was released from the buildings, four surface soil samples, two for each building, should be collected to a depth of 0.3 m (1 ft) between Bldgs. 820 and 823 and Picatinny Lake; suggested locations are shown in Fig. 10.34. The samples should be analyzed for propellants, explosives, and TCL metals.

To determine whether any contaminants have migrated into subsurface soils, two soil borings, one for each building, should be drilled between Bldgs. 820 and 823 and Picatinny Lake. Suggested locations are shown in Fig. 10.34. Samples should be collected from each boring and analyzed for propellants, explosives, and TCL metals.

10.32.4.2 Phase II

If the Phase I samples show significant contamination, then sediment samples should be collected to a depth of 0.3 m (12 in.) from the shore of Picatinny Lake. Two sediment samples should be collected from the shore near each contaminated soil boring; suggested locations are shown on Figs. 10.34. The sediment samples should be analyzed for propellants, explosives, and TCL metals. (Sampling of the water in Picatinny Lake is discussed in Sec. 10.10 [Site 53].)

10.33 SITE 158 — BUILDING 926, HIGH-EXPLOSIVE MAGAZINE

10.33.1 Site History

Building 926 is located on the southeastern edge of a marshy area at the northern tip of Picatinny Lake where Green Pond Brook flows into the lake. A map of the Site is shown in Fig. 10.35.

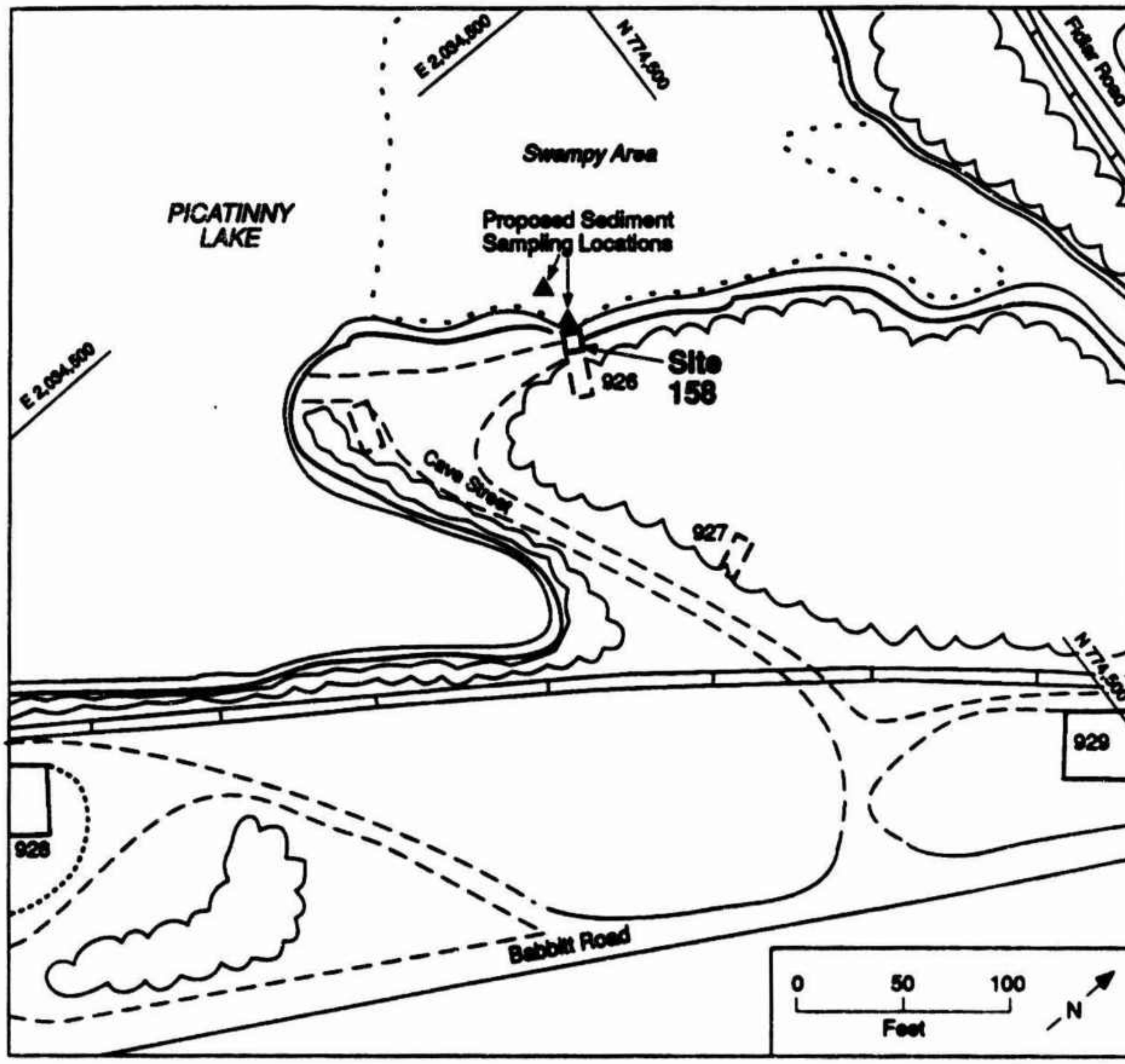

FIGURE 10.35 Layout of Site 158, the High-Explosive Magazine at Building 926 (Source: Adapted from USACE 1984b)

Building 926 was built in 1922 and used as a high-explosive magazine. It is an all-concrete structure. As of 1971, its estimated life was until the year 1995 (PTA 1971). In 1977, it was listed as vacant and being considered for demolition.

10.33.2 Geology and Hydrology

The surface elevation at Site 158 is about 700 ft above MSL. The soil is Urban Land with a reworked soil profile. The bedrock underneath is Precambrian gneiss.

10.33.3 Existing Contamination

During interviews with ANL staff, PTA personnel reported that the building housed lead azide and lead styphnates in large quantities (700-800 lb). The building is located directly on the lakeshore, and portions of the building may be in contact with lake water. The lead styphnates were stored under the water. All azides and styphnates were removed in 1985.

10.33.4 Proposed RI Plan

10.33.4.1 Phase I

To determine whether Bldg. 926 has released contaminants into Picatinny Lake, two sediment samples should be collected from the lakeshore near the building to a depth of 0.3 m (12 in.). Suggested locations are shown in Fig. 10.35. The samples should be analyzed for propellants and explosives.

10.33.4.2 Phase II

If the sediment samples are significantly contaminated, more sediment samples should be collected from other locations to help determine the areal extent of contamination. The additional samples should be analyzed for propellants and explosives.

10.34 SITE 159 — BUILDING 975, SUPPLIES AND SERVICES BUILDING

10.34.1 Site History

Building 975 is located at the intersection of Babbitt and Fidlar Roads at the northern end of Picatinny Lake. A map of the Site is shown in Fig. 10.36. Building 975 was built as a bomb shelter in 1942. It was being used as a supplies and services administration building in both 1971 and 1977. Its estimated life, as of 1971, was until the year 2000 (PTA 1971).

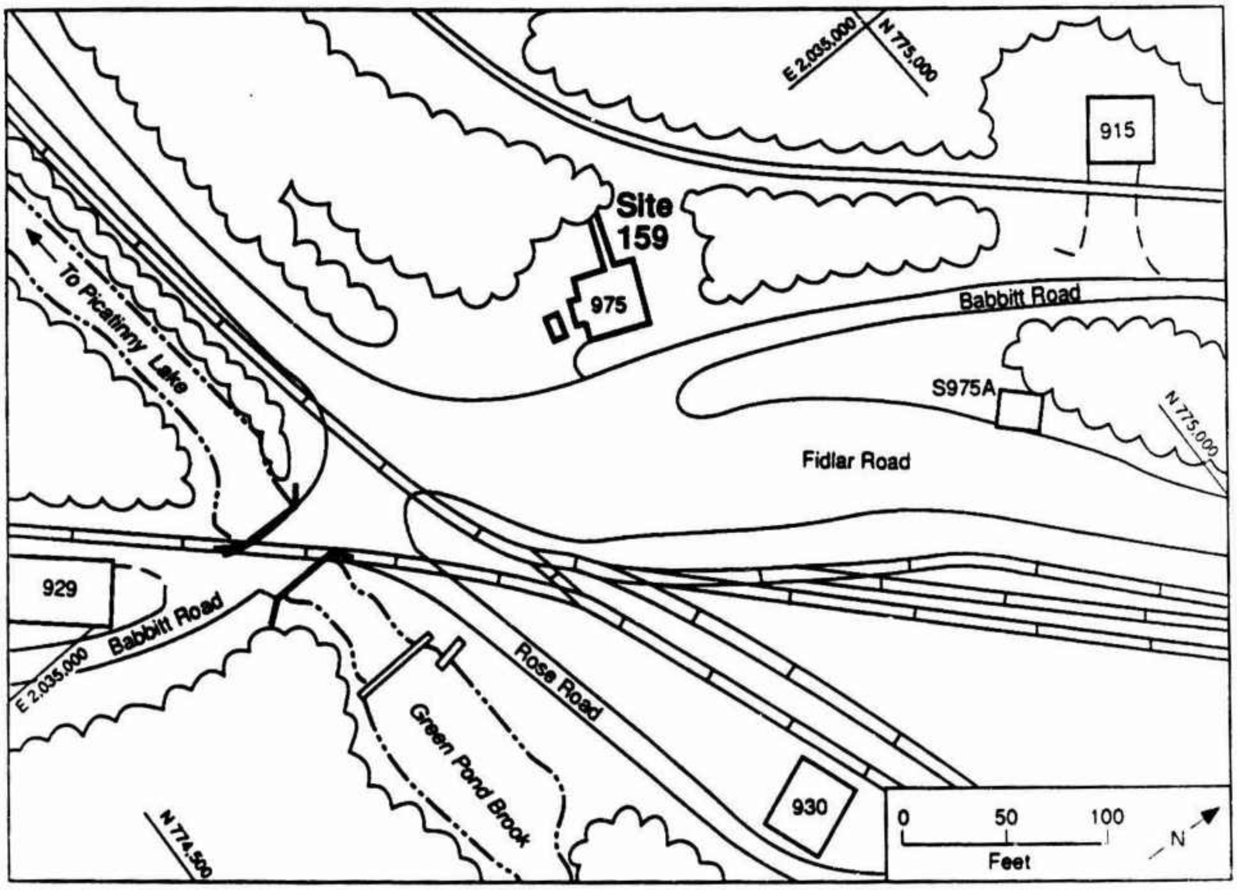

FIGURE 10.36 Layout of Site 159, Building 975 (Source: Adapted from USACE 1984b)

10.34.2 Geology and Hydrology

The surface elevation at Site 159 is about 725 ft above MSL. The soil is Urban Land with a reworked profile. The bedrock under the area is Precambrian gneiss. Surface water and runoff from the Bldg. 975 area would flow southeast into Green Pond Brook.

10.34.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that, in 1983, lead azide was taken from Bldg. 926, and was buried behind Bldg. 975. Building 975 was used to store packed shells and explosives, such as composition B, prior to shipping. No more information is available.

10.34.4 Proposed RI Plan

10.34.4.1 Phase I

A geophysical survey should be conducted behind Bldg. 975 to locate disturbed soil or buried metal.

If areas of disturbed soil or buried metal are located by the geophysical survey, two soil borings should be drilled in each of these areas. Samples should be collected from the top, depths of bottoms at areas of disturbance or buried metal, and bottoms of the borings and analyzed for lead.

10.34.4.2 Phase II

If the soil borings show contamination by lead, then two sediment samples should be collected to a depth of 0.3 m (1 ft) from Green Pond Brook near the contaminated borings. Surface and bottom water samples should also be collected from the brook. The samples should be analyzed for lead.

10.35 SITE 178 — TECUP BUILDINGS

10.35.1 Site History

This Site consists of 145 buildings that were decontaminated between January 1981 and October 1988; 97 of the buildings were decontaminated by burning with diesel fuel, and 48 were decontaminated by washing (Table 10.6). An additional 135 buildings are also included in this Site (Table 10.7). The latter buildings are on a demolition list; currently, 33 of the buildings have been approved for demolition. About half of the TECUP buildings (124 of the 280 buildings) were constructed with asbestos sides, roofs, or both, indicating that consideration needs to be given to a potential for asbestos release and exposure during or after building demolition; these buildings are noted in the second column of each table.

10.35.2 Geology and Hydrology

The TECUP buildings are located throughout PTA, making a description of geology and hydrology not meaningful. A general description of the geology and hydrology of PTA can be found in Sec. 2 of Volume 1.

10.35.3 Existing Contamination

This Site was selected because of the possibility of contaminated drain lines and soil. Contamination by explosives is a common feature to these buildings, necessitating

TABLE 10.6 TECUP Buildings Decontaminated

Bldg. No.	Asbestos Present[a]	Building Description	Decontamination Date	Method Flash	Method Wash
Primary Explosives					
268B		Ready Magazine	01-27-81	X	
268C		Ready Magazine	01-28-81	X	
269	CAR	Maj Cal Pro Ldg Plant	07-13-85	X	
269A	CAR	General Storehouse	05-14-85		X
269B	CAR	Ready Magazine	07-13-85	X	
269C	CAR	Blending Unit	07-13-85	X	
269D	CAR	General Purpose Magazine	07-13-85	X	
271R	CAR	General Purpose Magazine	01-28-81	X	
281B		General Purpose Magazine	06-04-85		X
601	CAR	Ammo Test Lab	01-22-81	X	
1050		Operating	02-19-81	X	
1052	CAR	Lead Azide Plant	04-10-82	X	
1055	CAS, CAR	High Explosives Building	12-11-82	X	
1062	CAS, CAR	High Explosives Building	03-07-81	X	
1071B		Mine Loading Plant	04-16-81	X	
1071E	CAR	General Purpose Magazine	03-27-81	X	
1071F	CAR	Dry House	03-27-81	X	
1079	CAR	Blender Building	03-07-81	X	
1080	CAR	High Explosives Magazine	12-11-82	X	
Secondary Explosives					
256G		40mm Loading Plant	02-07-81	X	
276		Maj Cal Pro Ldg Plant	12-21-85	X	
276F		Maj Cal Pro Ldg Plant	12-21-85	X	
276G		General Purpose Magazine	06-27-85		X
276H	CAR	General Purpose Magazine	06-27-85		X
323A	CAR	High Explosives Magazine	05-28-85		X
323B	CAR	High Explosives Magazine	05-29-85		X
323C	CAR	High Explosives Magazine	05-30-85		X
329A	CAR	General Purpose Magazine	02-27-82	X	
329B	CAR	Ceneral Purpose Magazine	02-27-82	X	
329C	CAR	General Purpose Magazine	02-27-82	X	
329D	CAR	General Purpose Magazine	02-27-82	X	
329E		General Purpose Magazine	02-27-82	X	
823A		Maj Cal Pro Ldg Plant	08-31-83	X	
1620	CAR	General Purpose Magazine	03-16-85	X	
1621	CAR	Pyro Unit	03-16-85	X	
1622	CAR	Fuse Assembly Plant	03-16-85	X	
1623	CAR	Storage	03-16-85	X	

TABLE 10.6 (Cont'd)

Bldg. No.	Asbestos Present[a]	Building Description	Decontamination Date	Method Flash	Method Wash
Propellants					
408D		Propellant Plant	05-21-83	X	
424E	CAR	Propellant Plant	10-15-88	X	
511		Propellant Plant	07-27-85	X	
520	CAR	Propellant Plant	09-17-83	X	
520B		Propellant Plant	02-01-86	X	
541	CAR	Propellant Plant	02-06-83	X	
542		Propellant Plant	10-05-85	X	
543		Propellant Plant	03-05-83	X	
544		Propellant Plant	05-16-85		X
545		Propellant Plant	08-03-85	X	
554		Propellant Plant	02-01-86	X	
556		Propellant Plant	04-21-85	X	
556B		Propellant Plant	04-21-85	X	
557		Propellant Plant	04-16-83	X	
558	AS	Propellant Plant	04-16-83	X	
560	CAR	Propellant Plant	04-16-83		X
561	AS, CAR	Propellant Plant	03-14-87	X	
564		Propellant Plant	03-05-83	X	
565	CAR	Propellant Plant	09-20-86	X	
565A		Propellant Plant	09-20-86	X	
568	CAR	Propellant Plant	05-20-85		X
577		Propellant Plant	04-16-83	X	
1010	CAS, CAR	Propellant Plant	10-12-85	X	
1010A	CAR	General Storehouse	10-09-85		X
1010B		Propellant Plant	10-07-85		X
1010C		Propellant Plant	10-03-85		X
1010D		Maj Cal Pro Ldg Plant	10-01-85		X
1039		Propellant Plant	04-27-85	X	
1068	CAR	Pulverizer + Neutralizer	01-15-83	X	
1074	CAR	Packing	03-06-81	X	
1077	CAR	Screening	03-27-81	X	
1179B		General Purpose Magazine	07-23-86	X	
1359B		Propellant Plant	04-09-81		X
1374A		Propellant Plant	07-08-82	X	
1401		General Purpose Magazine	12-02-85		X
1406A		Propellant Plant	04-04-85	X	
1419		Propellant Plant	12-02-85		X
1432	CAS, CAR	Propellant Plant	05-20-88	X	
1433	CAS, CAR	Propellant Plant	06-20-88	X	
1434	CAS, CAR	Propellant Plant	07-11-88	X	
1460	CAR	Cast High Explo Filling Plant	05-14-85		X

TABLE 10.6 (Cont'd)

Bldg. No.	Asbestos Present[a]	Building Description	Decontamination Date	Method	
				Flash	Wash
Pyrotechnics					
601C	CAR	Pyro Unit	01-22-81	X	
601D	CAR	General Purpose Magazine	01-24-81	X	
Black Powder					
603E		Flammable Materials Storehouse	02-07-81	X	
603H		General Purpose Magazine	01-24-81	X	
603I		General Purpose Magazine	01-24-81	X	
Paints and Solvents					
266B		Flammable Materials Storehouse	01-27-81	X	
276B		Flammable Material Storehouse	12-21-85	X	
276C		Flammable Material Storehouse	12-21-85	X	
457A	CAR	Flammable Material Storehouse	08-30-83	X	
457B		General Purpose Magazine	08-30-83	X	
565B		Flammable Materials Storehouse	09-20-86	X	
813B		Flammable Materials Storehouse	09-17-88	X	
823B	CAR	Flammable Materials Storehouse	08-31-83	X	
1073		Flammable Materials Storehouse	03-06-81	X	
Inert Materials					
276A	CAR	Inert Storehouse	12-21-85	X	
276D		General Storehouse	12-21-85	X	
321F	CAR	General Storehouse	01-29-81	X	
321H	CAR	General Storehouse	02-21-81	X	
445B	CAR	General Storehouse	05-16-85		X
538		General Storehouse	02-01-86	X	
551		General Storehouse	03-01-86	X	
601A	CAR	Heat and Fan House	01-22-81	X	
601B	CAR	Flammable Materials Storehouse	04-21-85	X	
603D		General Storehouse	02-07-81	X	
802	CAR	General Storehouse	05-31-86	X	
807A		Storage	02-24-87		X
1051	CAS, CAR	General Storehouse	03-06-81	X	
1077A	CAR	Fan House	03-27-81	X	
1622A		Air Conditioning Plant	03-16-85	X	

TABLE 10.6 (Cont'd)

Bldg. No.	Asbestos Present[a]	Building Description	Decontamination Date	Method	
				Flash	Wash
Acids					
1032		Acid Storage Tanks	02-11-81	X	
1085	CAR	Acid Pump House	03-06-81	X	
1086		Acid Storage Tanks	03-26-81	X	
1087	CAR	Acid Pump House	02-19-81		X
1355		Spent Acid Storage Tanks	04-09-81	X	
Other					
404B		High Explosives Magazine	06-12-85		X
404C		General Purpose Magazine	02-19-85		X
405C		General Purpose Magazine	08-25-83	X	
407C	CAR	Flammable Material Storehouse	06-19-85		X
407E	CAR	Flammable Material Storehouse	06-19-85		X
626		Test Facility	08-01-86		X
626A		Workshop	05-22-86		X
627A		Ordnance Facility	05-20-86		X
628		High Explosives Magazine	12-05-84		X
648		High Explosives Magazine	02-19-85		X
717M		Flammable Materials Storehouse	05-20-85		X
901		General Purpose Laboratory	05-10-85		X
1071A		General Purpose Magazine	04-16-81	X	
1215		Fixed Ammo Magazine	11-14-84	X	
1216		High Explosives Magazine	11-15-84	X	
1606		Neutralizing	05-07-85		X
1607		Flammable Materials Storehouse	05-10-85		X
1613	ABR	High Explosives Magazine	02-26-85		X
3501		Propellant Systems Facility	04-30-85		X
3503		Propellant Systems Facility	01-18-84		X
3505		Propellant Systems Facility	02-15-84		X
3506		Propellant Systems Facility	03-14-84		X
3507		Propellant Systems Facility	04-11-84		X
3508		Propellant Systems Facility	04-25-84		X
3516		Flammable Materials Storehouse	11-16-84	X	
3520	CmAR	General Purpose Magazine	11-15-84		X
3523		General Purpose Magazine	11-15-84		X
3524	CmAR	General Purpose Magazine	11-14-84		X
3530		Propellant Systems Facility	05-03-85		X
3535		Fuze and Det Magazine	05-07-85		X

TABLE 10.6 (Cont'd)

Bldg. No.	Asbestos Present[a]	Building Description	Decontamination Date	Method Flash	Method Wash
Other (cont'd)					
3538		Propellant Fuel Facility	11-30-84		X
3549		Flammable Materials Storehouse	09-19-84		X
3556		Electrical Equipment Facility	11-27-84	X	

[a]This column lists the type of asbestos, if any, that was used in construction. This information is provided because the potential for release of asbestos needs to be considered, especially during demolition. Key to abbreviations: CAR = corrugated asbestos roof, AS = asbestos sides, CAS = corrugated asbestos sides, ABR = asbestos board roof, and CmAR = cement asbestos roof.

Source: Synder 1989.

TABLE 10.7 Buildings on the TECUP Demolition List

Bldg. No.	Asbestos Present[a]	Building Description	Approval No	Approval Yes
Primary Explosives				
268A	CAR	Magazine	X	
271		Operating Building	X	
271A	CAR	Operating Building	X	
271C		Magazine		X
271D		Heater Room	X	
271E		Fan House	X	
271F		Office	X	
271G		Magazine	X	
271H		Operating		X
271I		Operating Building	X	
271J	CAR	Dry House	X	
271K		Fan House	X	
271L	CAR	Dry House	X	
271M	CAR	Dry House	X	
271N	CAR	Dry House	X	
271O		Magazine	X	
271P		Magazine		X
271S		Fuze Det Magazine	X	
281A		Magazine		X
807B		Vacuum House	X	
926		Primary Explosives Magazine	X	
Secondary Explosives				
210	CAR	Fuze Assembly	X	
210E	CAR	Magazine	X	
210F		Magazine	X	
238		Pressing	X	
256D		Magazine	X	
717I	CAR	Magazine	X	
717K	CAR	Magazine		X
810A	CAR	Vacuum Pump House	X	
813A	CAR	Fuze + Prro Mag	X	
813D		Vacuum Pump House		X
816A	CAR	Vacuum House	X	
816B		Compressor House	X	
822		Magazine	X	
823		Cast Explo Fill	X	
824A		Dust Collection Building	X	
1033	CAR	Cast Explosives Fill	X	
1462		Cast Explosives Fill	X	
1463		Cast Explosives Fill	X	
1615		Magazine		X

TABLE 10.7 (Cont'd)

Bldg. No.	Asbestos Present[a]	Building Description	Approval No	Approval Yes
Propellants				
435		Propellant Plant	X	
448D		Storage	X	
452		Ordnance Facility	X	
452A		Storage	X	
454A	CAR	Ammunition Storage	X	
454B	CAR	Ammunition Storage	X	
457	CAR	Propellant Plant	X	
472B		Hand Car Storage		X
477E	CAR	Magazine		X
497	AS	Propellant Plant	X	
509		Supply Storage (on hold)		X
509A	CAR	Tool Room (on hold)		X
510		Storage		X
521	CAR	Screening Building		X
527		Propellant Plant	X	
534		Propellant Plant	X	
539		Prp Blender	X	
555		Dry House	X	
562		Transfer Building	X	
563		Glasing Building	X	
1036B	AS, CAR	Pump House	X	
1037	AS, CAR	Waste Water Incinerator	X	
1052A	CAR	Rest House	X	
1350		Blender	X	
1352	CAR	Blender	X	
1361A		Catch Tank House		X
1365		NG Spent Acid Tank	X	
1369	CAR	Glycerine Heater House	X	
1374		Propellant Plant	X	
1377		Propellant Plant	X	
1402A		Conditioning Building	X	
1405		Heater House	X	
1414		Dry House	X	
1414A		Fan House	X	
1415		Dry House	X	
1425	AS, CAR	Cast Explosives Fill	X	
1426	AS, CAR	General Purpose Magazine	X	
1428	AS, CAR	General Purpose Magazine	X	
1429	AS, CAR	Control Building	X	
1431	CAR	Propellant Plant	X	
1435	AS, CAR	Propellant Plant	X	
1436	AS, CAR	Propellant Plant	X	

TABLE 10.7 (Cont'd)

Bldg. No.	Asbestos Present[a]	Building Description	Approval No	Approval Yes
Propellants (cont'd)				
1437	AS, CAR	Packing and Shipping	X	
1461		Propellant Plant	X	
Pyrotechnics				
295	CAR	Operating		X
296	CAR	Operating		X
732C		Storage	X	
732E		Magazine	X	
732F	CAR	Magazine	X	
732G		Magazine		X
735		Pyro Mix + Press	X	
735A		Fan House		X
Black Powder				
602		Blender Building	X	
602A		Magazine	X	
603	CAR	Dry House	X	
603F	CAR	Storage	X	
Paints and Solvents				
445E		Paint Storage		X
519	CAR	Still House	X	
519A	CAR	Alcohol Storage Tank	X	
527A		Solvent Pump House	X	
533	CAR	Lab Storage	X	
535		Recov Solvent Storage		X
553		Ether/Alcohol Storage	X	
732D	CAR	Plant Storage	X	
813B		Paint Storage		X
1071C	CAR	Acetone Storage	X	
Inert Materials				
209	CAR	Storage	X	
241E	CAR	Storage	X	
427C	CAS, CAR	Storage		X
445D		Storage		X
523		Refrig Inert Gas Mfg	X	
537		Storage	X	
813E	AS	Inert Storage		X

TABLE 10.7 (Cont'd)

Bldg. No.	Asbestos Present[a]	Building Description	Approval No	Approval Yes
Inert Materials (cont'd)				
1304	CAR	Fan House/AC Building	X	
1308	CAR	Packing Building	X	
1309	CAR	Shipping Building	X	
1352A	CAR	Motor House	X	
1354A	CAR	Heater and Fan House	X	
1366		Refrigeration Building	X	
1368	CAR	Tool House	X	
1370A		Emergency Air Receiver	X	
1430	AS, CAR	Inert Storehouse	X	
Acids				
1030		Acid Tank Farm	X	
1355		Spent Acid Tank		X
1380		Acid Storage Tanks		X
Other				
642C		Inert Storage Shed		X
716G		Magazine (on hold)		X
717J	CAR	Magazine	X	
732B		Magazine	X	
1375	CAR	Chemical Storage	X	
1511		Conditioning		X
3206	CmAR	Utilities Spare Parts		X
3405		Boiler House (on hold)		X
3525	CmAR	Boiler House (on hold)		X
3537	CmAR	Passination Hs (on hold)		X

[a]This column lists the type of asbestos, if any, that was used in construction. This information is provided because the potential for release of asbestos needs to be considered, especially during demolition. Key to abbreviations: CAR = corrugated asbestos roof, AS = asbestos sides, CAS = corrugated asbestos sides, ABR = asbestos board roof, and CmAR = cement asbestos roof.

Source: Solecki 1989b.

their inclusion in TECUP for decontamination, demolition, or both. About 30 of the 145 buildings that were decontaminated from 1981 to 1988 were propellant plants. Another 30 were high-explosive or flammables magazines. One building was a lead azide plant (Bldg. 1052). Focus has been placed on these building types to assess the level of contamination associated with the TECUP buildings. As mentioned above, almost half of the TECUP buildings were built with asbestos-containing sides or roofs, requiring that an evaluation be made of the potential for asbestos release during any scheduled demolition.

10.35.4 Proposed RI Plan

The locations of two propellant plants were chosen for evaluation, one that was burned in April 1983 (Bldg. 557), and one that was burned more recently, in Sept. 1986 (Bldg. 565). In addition, the former locations of a high-explosive magazine (Bldg. 323A) and a lead azide plant (Bldg. 1052) will be evaluated. These buildings are characteristic of those included in TECUP.

10.35.4.1 Phase I

For each of the four building locations (Nos. 557, 565, 323A, and 1052), four surface soil samples should be collected to a depth of 0.3 m (1 ft), one sample from each side of the building location. In addition, each former building area should be inspected for any stained or spill areas; one surface soil sample should be collected from the center of each. For the former propellant plants (557 and 565), the soil samples should be analyzed for propellants and explosives, TCL volatiles, TCL semivolatiles, and TCL metals. The volatile/semivolatile analysis will indicate whether any diesel fuel residue was left when the buildings were burned. For the former high-explosives magazine (323A), the samples should be analyzed for explosives and for TCL volatiles and TCL semivolatiles. For the former lead azide plant (1052), the samples should be analyzed for lead, TCL volatiles, and TCL semivolatiles.

For each of the above building areas, remaining drain lines should be located, and, if feasible, two samples should be collected from the lines of each and analyzed for explosives.

10.35.4.2 Phase II

If the soil samples from Phase I show contaminants, one soil boring should be drilled in the vicinity of each contaminated surface soil area. Samples should be collected from each boring and analyzed for the same elements as for the Phase I surface soil samples.

If explosives are found in the drain lines in Phase I, geophysical methods should be used to locate the entire drain line and additional samples should be collected. If explosives are found, consideration should be given to removing the contaminated drain lines.

10.35.4.3 Phase III

To evaluate movement of contaminants into groundwater, monitoring wells should be installed if the Phase II soil borings show contaminants. The well locations should depend upon the location of the contaminated soil boring samples.

If any one of the four representative former buildings is significantly contaminated, then other TECUP buildings should be similarly sampled, with the choice of other sampling areas to be determined by PTA and USATHAMA personnel.

10.36 SITE 184 — BUILDING 523, REFRIGERATION AND INERT GAS PLANT

10.36.1 Site History

Site 184, the Bldg. 523 refrigeration and inert gas plant, is located east of Bldg. 527 (Site 148), across Babbitt Road (Fig. 10.37). Little information is available on historical activities at the building, which has a 55- by 38-ft area. Refrigeration and inert gases (nitrogen and carbon dioxide) were manufactured at the Site. Also, brine cooled by freon was circulated to other users and returned to Bldg. 523. Operations at Bldg. 523 have ceased (no hazardous waste has been generated at the building since 1976), and it is essentially empty (Foster Wheeler 1988a).

A closure plan has been prepared for Bldg. 523 because drums of hazardous waste were discovered during a recent inspection of the building; the waste included two drums of PCB waste, three drums of contaminated water, and 12 drums of resins. It is not known how long the drums have been stored in the building. In addition, a closure plan has been prepared for underground tanks outside the building that were used to store gasoline (which was used to make inert gas). PTA has claimed an exemption from RCRA permitting requirements for the building because hazardous wastes are not expected to be stored in the building in the future (Foster Wheeler 1988a).

10.36.2 Geology and Hydrology

The Site is located along the east side of Picatinny Lake on glacial till. Bedrock, which is not exposed, is probably Precambrian gneiss. Detailed geohydrological information about the area is not available.

Eby (1976) mapped the soils in the area as Urban Land (undivided). This soil unit generally consists of areas that are either paved or built upon. The soils in the remaining open spaces have been reworked to the extent that the original profile cannot be recognized. The characteristics of the materials are variable. For the most part, these units are well-drained, deep sandy, gravelly, or stony materials of assorted glacial deposits (Eby 1976).

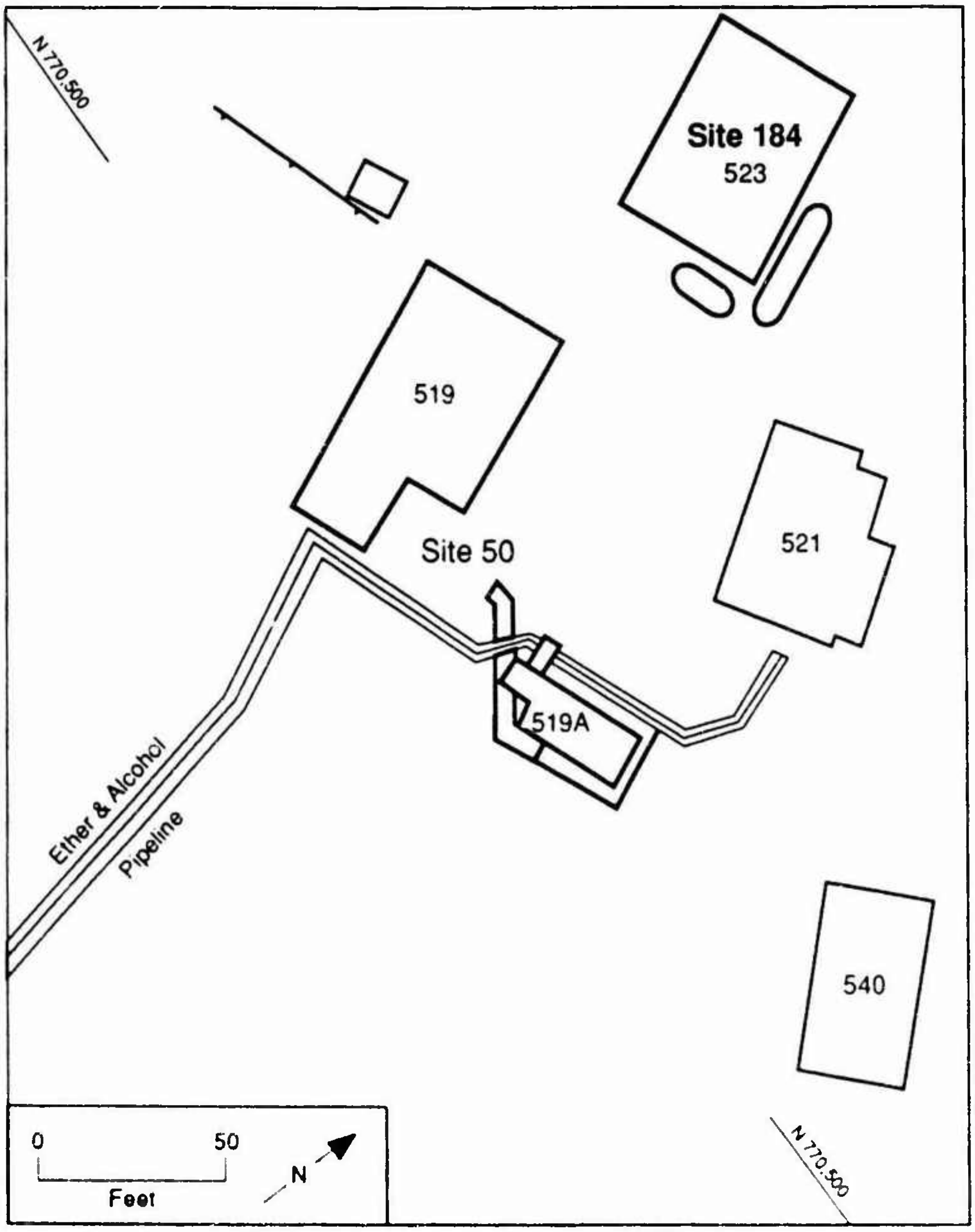

FIGURE 10.37 Layout of Site 184, the Propellant Plant at Building 523 (Source: Adapted from USACE 1984b)

10.36.3 Existing Contamination

The potential for contamination at the Site exists because of the underground storage tanks for gasoline. Freon is another potential contaminant. Also, the building interior was exposed to explosives because of the proximity to Bldg. 519, which was used to manufacture nitrocellulose (Foster Wheeler 1988a).

10.36.4 Closure Plan

The revised RCRA closure plan for Bldg. 523 calls for sealing off the building and cleaning it with hot water and detergent. Two wash-water or condensate grab samples and four chip samples will be collected and analyzed for priority pollutant metals. Revised closure plans for the underground tanks include sampling their contents, flushing the tanks, and removing them. Two rinsate grab samples will be collected from each tank and analyzed for priority pollutant metals. Four soil samples will be collected from around each tank (two tanks are believed to be present) and analyzed for priority pollutant metals, VOCs, TPH, and, if necessary, EP toxicity for metals (Foster Wheeler 1988a, 1989; Solecki 1989a).

10.36.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan.

10.36.5.1 Phase I

The area around Bldg. 523 should be visually inspected to locate staining and other signs of contamination. In addition to the soil samples collected in the closure plan sampling, one surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each located stained or contaminated area. The samples should be analyzed for explosives, PCBs, TCL semivolatiles, TCL volatiles, and TCL metals.

10.36.5.2 Phase II

If significant contamination is found in the surface soil samples, then soil borings should be drilled to bedrock or groundwater, whichever comes first. One boring should be drilled at each contaminated Site identified during Phase I. Samples should be collected from each boring and analyzed for the contaminants of concern identified by the Phase I analyses.

11 AREA J: AROUND SNAKEHILL ROAD

11.1 INTRODUCTION

Area J includes four large Sites on the northeastern part of the Arsenal. Three of the Sites are Reaction Motors Rocket Test areas and one is a helicopter maintenance building. Potential contaminants include rocket fuel components and petroleum products. The headwaters of Ames Creek are located in the Area.

11.2 SITE 1 — G-2 AREA, REACTION MOTORS/ROCKET FUEL TEST AREA (G-2 ROAD)

11.2.1 Site History

Site 1 is a 4.4-ha (11-acre) area located on a hillside near G-2 Road about 0.8 km (0.5 mi) southeast of the outlet of Lake Denmark near the eastern PTA boundary. The Site was part of the 317 ha (784 acres) occupied by the U.S. Navy until 1962.

Aerial photos of the Arsenal taken from 1940 to 1987 show what appears to be residential activity near Site 1 at least up to 1951. The area is masked out in a 1957 photo. By 1963, photos showed several buildings with three berms, suggesting explosive-related activity. By 1987, a container and tanks, which can be seen in photos taken in the 1970s, had been removed along with the buildings and berms. However, the area appeared to be scarred, and many objects appeared to be dumped outside its entrance, along the north side of the access road (Sitton 1989).

In 1980, the Site was reported to contain 13 structures (Gaven 1986, Attachment B). Details of buildings and roads that existed in 1975 at and near the Site are shown in Fig. 11.1. The functions of some of these buildings, as reported in a 1975 facilities directory (PTA 1975), are given in Table 11.1.

At present, the Site contains an abandoned tower (less than 15 m [50 ft] tall) and a tower-like structure enclosed by a fence. These structures were present in the 1986/1987 aerial photo. Nearby are pads and other areas presumably used for testing. The tower, which is held up by guy wires, is on a base about 3 m (10 ft) square, and the fenced area occupies about 9.3 m^2 (100 ft^2) (Dames & Moore 1989).

The Site was used by the Reaction Motors Division of Thiokol Chemical Corporation, a government contractor, for various tests, including tests of rocket fuel containers containing explosives and rocket fuels. The containers were tested until they failed. The Site is reported to be contaminated with debris including metal fragments and possibly live ammunition from the 1926 Lake Denmark explosion. Chemicals reported to have been used at the Site include hydrazine, nitric and other acids, chlorine trifluoride (CTF), cyanide, phenols, metals, and pickling liquors (Gaven 1986).

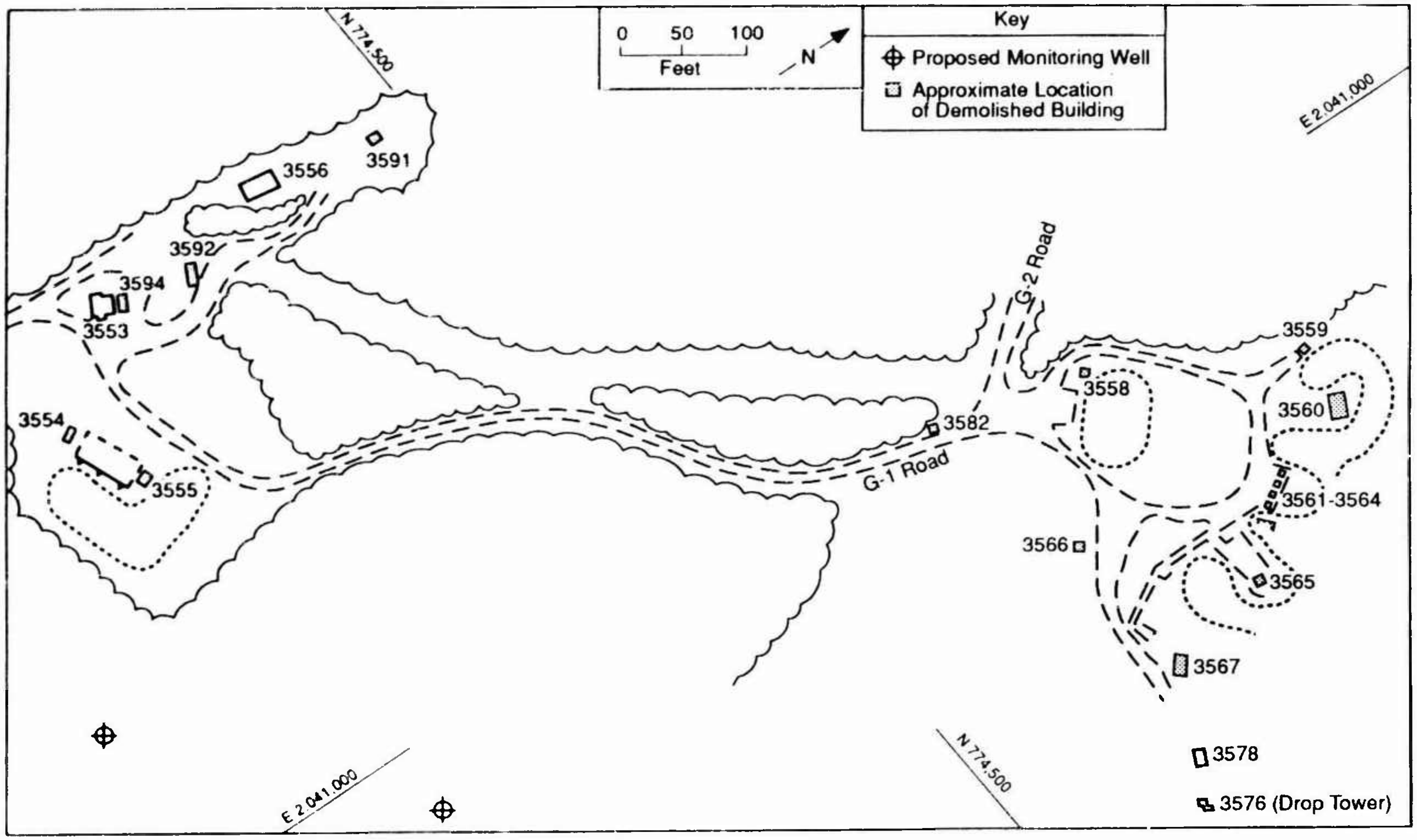

FIGURE 11.1 Layout of Site 1, the G-2 Area, Reaction Motors/Rocket Fuel Test Area (Sources: Adapted from PTA 1975; USACE 1984b)

TABLE 11.1 Designation of Buildings Existing in 1975 in or near Site 1

Bldg. No.	Designation
3553	Inactive control house
3554	Inactive turret
3555	Inactive target pad
3556	Inactive propellant preparation and staging bldg.
3558	Control
3559	Oxidizer storage
3560	Instrument turret
3561	Workshop
3562	Storage
3563	Workshop
3564	Storage
3565	Instrument turret
3566	Fuel storage
3567	Oxidizer storage
3576	Drop tower
3582	Latrine
3594	Inactive turret

Source: PTA 1975.

During 1989 interviews with ANL staff, PTA personnel reported that a dump area, which is now covered, existed behind the drop tower on the east or southeast side of the Site. Reported materials dumped included broken barrels of orange napalm powder. Open pan testing of hydrazine detonation (probably with chlorine trifluoride) was reportedly carried out in the area. It was also reported that, as part of a Navy testing program, drums of fuel were blown up on the Site. The location of these activities at the Site is unknown. PTA personnel interviewed earlier in 1976 reported that chemical tests were carried out at Bldgs. 3555, 3591, and 3592 (Gross et al. 1976).

The years during which the Site was active are not known. Aerial photo analysis suggests that it became active between 1951 and 1957. Gaven (1986, Attachment B) reports that the Site had been deactivated for some time. However, the building designations reported in the 1975 facilities directory (PTA 1975) and given in Table 11.1 suggest that the Site was active in 1975. It was also reported by PTA personnel that the Site was last used six years ago to test flares.

11.2.2 Geology and Hydrology

The bedrock underlying the Site is Precambrian gneiss. No information is available on the thickness of glacial till or even if any is present at the Site. It is not known if groundwater is present at the Site. No surface water is present near the Site (Dames & Moore 1989). The surface contours of the Site (USGS 1981) show that the surface at the Site slopes both to the south toward Ames Brook and to the northwest toward the head of Gravel Dam Cove on Lake Denmark. Surface runoff from storm events would be expected to follow the surface slope to these two bodies of water. In the absence of information indicating otherwise it is assumed that any groundwater, if present, would also follow the surface slopes and move toward Ames Brook and Gravel Dam Cove.

11.2.3 Existing Contamination

No data are available on soil or groundwater contamination at the Site. Some water quality data for Ames Brook and the Cove well, which are located about 340 m (1,100 ft) and 400 m (1,300 ft) in a general downgradient direction from the Site, are summarized in Table 11.2. The 1979 and 1981 data for Cove well show that, at the times of sampling, concentrations of most chemical species were below the regulatory limits. The sample taken in 1979 contained iron at 0.66 mg/L and showed a pH value of 5.1. The iron value is above the federal secondary drinking water limit of 0.3 mg/L, and the pH value is outside the range of 6.5-8.5 given in the federal secondary drinking water regulations (40 CFR 143). The nitrate-plus-nitrite concentration of 9.1 mg/L (as N) measured in May 1981 is close to the federal primary drinking water limit of 10 mg/L (40 CFR 141). Water samples taken from the well in May, July, and August 1981 were analyzed for purgeable organics. None were detected at detection limits of 1 μg/L for most chemicals (ICM 1981; USAEHA 1981a, 1981b). A sample taken in May 1981 was analyzed for explosives. None were found at detection limits that ranged from 0.001 mg/L for TNT to 0.05 mg/L for RDX (USAEHA 1981b).

The concentrations of iron (up to 0.66 mg/L) and nitrate-plus-nitrite (up to 9.1 mg/L as N) and the low pH value may not be indicative of contamination resulting from Site activities. Cove well is distant from the Site, and the direction of groundwater flow from the Site is not established. Also, the observed concentrations of iron may be naturally occurring. Data from more samples would be needed to confirm or refute whether or not the highest observed values are representative of iron and nitrate concentrations in the Cove well.

Water samples were collected at unknown locations from Ames Brook in 1975, 1976, and 1981 but analyzed for only a few parameters. The results of the 1975 and 1981 analyses are summarized in Table 11.2. The samples taken in three successive weeks in January 1975 show the presence of up to 30 μg/L cyanide, up to 30 μg/L chromium, up to 130 μg/L copper, and up to 6.5 mg/L phosphates. Chromium and copper are the only two of these parameters for which federal and state maximum concentration limits exist, and the observed concentrations are below the regulatory limits.

TABLE 11.2 Analytical Results for Water Collected from Cove Well (No. 3820) and Ames Brook on Various Dates (mg/L)[a]

Parameter	Concentration in Cove Well 5/23/79	5/15/81	7/30/81	Concentration in Ames Brook 1/8/75	1/15/75	1/22/75	6/5/81
Aluminum	-	<1.0	-	-	-	-	-
Antimony	-	<0.20	-	-	-	-	-
Arsenic	<0.010	<0.010	<0.010	-	-	-	-
Barium	<0.30	<0.30	-	-	-	-	-
Beryllium	-	<0.050	-	-	-	-	-
Cadmium	<0.005	<0.001	<0.010	-	-	-	-
Calcium	7	8.5	-	-	-	-	-
Chloride	11	8.9	5.3	15	10	15	21.3
Chromium	<0.025	<0.025	<0.025	0.01	0.01	0.03	-
Copper	<0.025	0.033	<0.025	0.10	0.10	0.13	-
Cyanide	<0.01	<0.01	<0.01	0.01	0.02	0.03	-
Fluoride	0.13	0.13	-	-	-	-	-
Iron	0.66	<0.10	0.12	-	-	-	-
Lead	<0.005	<0.001	<0.005	-	-	-	-
Magnesium	3.7	3.4	-	-	-	-	-
Manganese	0.033	0.034	<0.030	-	-	-	-
Mercury	0.0004	<0.0002	<0.0002	-	-	-	-
Nickel	-	<0.10	<0.10	-	-	-	-
Nitrite-nitrate nitrogen	<0.04	9.1	-	-	-	-	0.05
Phenols, total	-	<0.01	-	-	-	-	-
Phosphate phosphorus	-	<0.02	-	2.5	2.3	6.5	-
Potassium	-	1.04	-	-	-	-	-
Selenium	<0.005	<0.005	-	-		-	-
Silver	<0.025	<0.025	-	-	-	-	-
Sodium	75	4.5	-	-	-	-	-
Sulfate	15	16	-	-	-	-	15.2
Thallium	-	<0.50	-	-	-	-	-
Tin	-	<1.0	-	-	-	-	-
Zinc	0.148	0.12	0.068	-	-	-	-
Hardness, as $CaCO_3$	33	40	-	-	-	-	-
pH (pH units)	5.1	6.6	6.5	7.1	7.1	7.0	-
Specific conductance (µmho/cm)	217	114	98	-	-	-	-
Total alkalinity	21	21	-	-	-	-	-
Total dissolved solids	183	96	-	-	-	-	-
Total organic carbon	-	<1	-	-	-	-	-

[a]Units are mg/L except as noted for pH and conductance; a hyphen means the parameter was not measured.

Sources: USAEHA 1981a, 1981b; ICM 1981; PTA 1976.

Water samples were also collected weekly from Ames Brook from January 6, 1975, to January 7, 1976, and analyzed for pH, chloride, color, total phosphates, and chemical and biological oxygen demands (PTA 1976). The data showed that, as far as these parameters are concerned, the water was not contaminated. The more recent 1981 data for chloride, sulfate, nitrate, and total organic carbon (Table 11.2) show that the water is of good quality as far as these parameters are concerned. However, samples were not analyzed for metals, cyanide, and explosives. A sample taken in June 1981 was analyzed for purgeable organics. The only positive results were an unknown chemical found at less than 50 μg/L and toluene at less than 1.0 μg/L (ICM 1981).

It is not possible to determine if the concentrations of cyanide, copper, chromium, and phosphates found in the Ames Brook water samples collected in 1975 were due to contamination migrating from the G-2 area. Because the sampling location was not reported for the brook, it is not known if the sample was taken upstream or downstream from the potential points of entry of surface water runoff from the Site.

One sediment and one water sample were collected from Ames Brook in June 1988 at the PTA boundary. This location is in the general downgradient direction from Site 1. The samples were analyzed for metals, volatiles, explosives, semivolatiles, PCBs, cyanide, nitrate, nitrite, and some macroparameters. The results are summarized in Table 11.3. The data show that the sediment is probably not contaminated. No volatiles were detected and only two semivolatiles were found at low concentrations, up to 2.15 μg/g of phthalates, which are ubiquitous in the environment. Unknown organics were found at concentrations up to 26.6 μg/g. Beryllium at 0.702 μg/g was found. Since background data are not available, it is not known if this value represents contamination or naturally occurring material. Cyanide was not detected.

The results for the water sample show that no contamination was present. The positive result for lead, 3.25 μg/L, may represent a background concentration. No cyanide or identifiable volatiles or semivolatiles were detected. Unknown volatiles were found up to 37 μg/L. These data and the data in Table 11.2 suggest that the concentration levels of cyanide, copper, and chromium found in 1975 may no longer be present.

Six water samples were collected approximately monthly from Ames Brook from the end of November 1988 to the middle of April 1989 and analyzed for chlorinated volatile organics, benzene, toluene, and xylenes (BTX), and ethyl benzene. The samples were collected from a point about 600 ft downstream from the Arsenal boundary. None of the analytes were detected in most samples at a detection limit of 1 μg/L. The single exception was a sample collected on March 15, 1989, which contained 2.3 μg/L toluene and 2.9 μg/L xylenes (Chemtech 1989). The data show that chlorinated volatile organics are not present in Ames Brook water and that amounts of BTX may be present on occasion at concentrations of a few micrograms per liter.

TABLE 11.3 Selected Analytic Results for Sediment and Surface Water Samples Collected from Ames Brook in June 1988

Parameter[a]	Concentration in Sediment (μg/g)	Concentration in Water (μg/L)
Metals[b]		
Aluminum	5,250	70.1
Barium	44.4	4.85
Beryllium	0.702	<2.92
Calcium	208	13,000
Copper	11.6	<6.2
Iron	5,600	156
Lead	c	3.25
Potassium	424	<794
Magnesium	1,300	4,640
Manganese	1,500	47.1
Sodium	95.6	7,130
Nickel	7.71	<16.2
Zinc	101	12.2
Semivolatiles		
Bis(2-ethylhexyl) phthalate	1.61	<34
Di-n-octyl phthalate	2.15	<18
Unknowns	≤26.6	≤37
Other		
Nitrate	5.5	<50
Chloride	<32.6	8,900
Sulfate	<14	12,000

[a]Only those parameters are listed for which either the sediment or water sample showed a positive result.

[b]Samples were also analyzed for the metals antimony, arsenic, cadmium, cobalt, chromium, selenium, thallium, and vanadium.

[c]The parameter was not measured.

Sources: York 1989a, 1989b.

11.2.4 Proposed RI Plan

11.2.4.1 Phase I

Phase I of the plan for the characterization of Site 1 should begin with a complete walkover field inspection of the Site. This should include a thorough walkover and search for buried metal objects using geophysical methods. The sizes and locations of all former buildings, pads, and areas of soil staining (if any) within the Site should be recorded. The aerial photos should be used as an aid in carrying out the inspection. All UXO, drums, and containers found during the inspection should be removed and disposed of appropriately. The drums and containers should be sampled before removal.

A geophysical survey of the southeast and southern edges of the Site should be carried out to locate the area or areas of reported dumping. The area to be surveyed, about 190 by 61 m (620 by 200 ft), should be based on the results of the walkover field inspection and the aerial photos taken in 1963 and 1970 (Sitton 1989).

At least six surface soil samples should be collected at locations around existing structures, pads, areas of stained soils, former bermed areas, and locations of former structures. The sampling locations should be based on the results of the walkover inspection and the 1963 and 1970 aerial photos (Sitton 1989). The samples should be collected to a depth of 0.3 m (12 in.) and analyzed for TCL volatiles and TCL semivolatiles and, as possible rocket fuel components, explosives, lead, chromium, and phthalates.

Two surface soil or sediment samples should be collected 100 m (330 ft) apart along the bed of each channel or depression through which surface water runs off the G-2 area during periods of rainfall or snowmelt. In each channel or depression in which water is present, surface water samples should be collected at the same two locations as the soil or sediment samples. The soil or sediment and water samples should be analyzed for the parameters described above for the other soil samples.

Sampling for airborne contamination is not needed at this Site because it is not in use and there is minimal potential for contamination to become airborne.

11.2.4.2 Phase II

If one or more dump areas or large buried metal objects are located by the walkover field inspection or the geophysical survey, then at least five soil borings should be drilled to bedrock or the water table, whichever comes first, at locations indicated by the survey. For each boring, the sample depth intervals should be such that at least three but no more than five samples are taken and that at least two samples are taken at different depths in the dumped material and at least one sample is taken from below the material.

Each soil boring sample should be analyzed for explosives, lead, chromium, phthalates, TCL volatiles, and TCL semivolatiles. Also, some of the samples should be analyzed in more detail to determine the possible hazardous material components of the dumped material. To this end, analyses for TCL metals should be carried out on the three samples with the highest level of contamination.

Additional surface soil samples should be taken and additional soil borings should be drilled if they are warranted by the results of the surface and subsurface soil sampling program described above.

Two groundwater monitoring wells should be installed between the Site and Ames Brook and downgradient from the dump area. The purpose of the wells is to monitor for any contaminants leaving Site 1 and PTA in groundwater. Tentative locations of the wells along the 250-m (825-ft) contour are shown in Fig. 11.1. Exact locations should be determined by the field inspection and the results of the geophysical survey and surface soil sampling programs. The wells should be screened so that the screened interval extends partly above and mostly below the water table. This ensures that water samples will include water from the top region of the groundwater aquifer.

Beginning at least two weeks after well installation, samples should be taken for two successive quarters from the two new wells and the existing Cove well and analyzed for macroparameters, explosives, nitrate, nitrite, cyanide, TCL volatiles, TCL semivolatiles, and TCL metals. The monitoring program should be continued for any well found to have significant contamination.

11.3 SITE 2 — G-1 AREA, REACTION MOTORS/ROCKET FUEL TEST AREA (3500 SERIES BUILDINGS)

11.3.1 Site History

Site 2 is located on the northern part of the PTA midway between the PTA boundary and the outlet to Lake Denmark. In the past, the 13.2-ha (33-acre) G-1 area has contained numerous buildings (the 3500 series buildings). The locations and functions of buildings and structures that were on the Site in 1962 are shown in Fig. 11.2. The functions of some of the buildings, as reported in a 1975 facilities directory (PTA 1975), are listed in Table 11.4. The 1962 and 1963 aerial photos in Figs. 11.3 and 11.4 provide more details of the Site. Buildings that were approved for demolition in 1978 include Nos. 3501-3508, 3512, and 3552. At present, a concrete pad behind Bldg. 3517 is scheduled for RCRA closure. The pad is to be closed in accordance with New Jersey hazardous waste regulations because it never had interim status. A 500,000-gal reservoir or pond is on the Site, and a 5,000,000-gal reservoir that discharges into Ames Brook is adjacent to the northeastern side of the Site (Dames & Moore 1989; Gaven 1986, Attachment B; USATHAMA 1976; Edson 1962; ARDEC undated; Solecki 1989d).

Since Site 2 was used for rocket testing, most of the buildings on the Site were test stands and supporting structures. The test stands consisted of single-story structures on concrete pads with 12-in. thick concrete walls separating the fuel and oxidizer bays, the control room, and the motor area. About half of the 18 test stands had

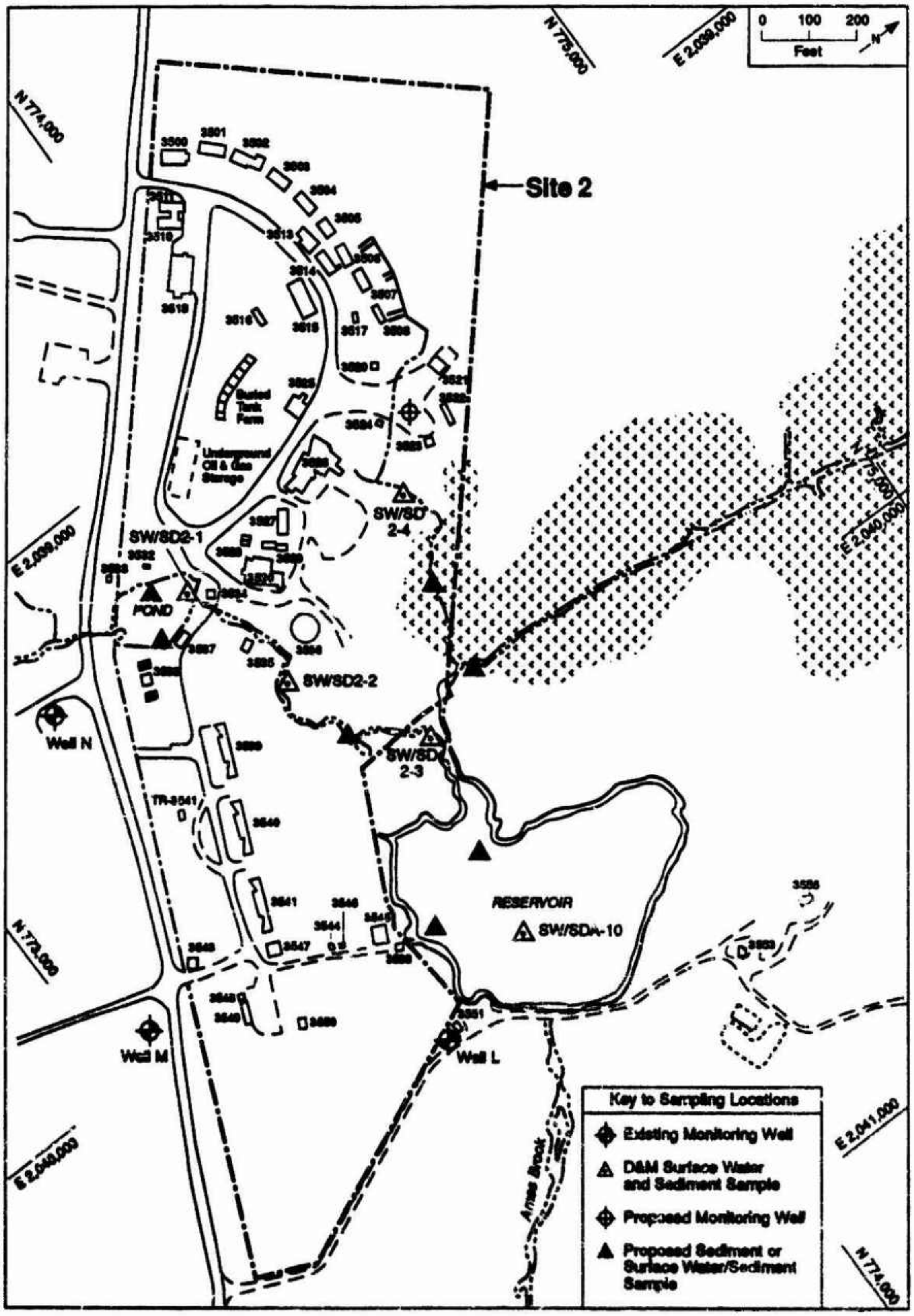

FIGURE 11.2 Layout of Site 2, G-1 Area Reaction Motors/Rocket Fuel Test Area (3500 buildings) (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

TABLE 11.4 Designations of Buildings in 1975 in the G-1 Area

Bldg. No.	Designation	Bldg. No.	Designation
3500	Detached day rooms	3528	Inactive barricade
3501	Inactive test stand	3529	Inactive control house
3502	Inactive test stand	3530	Inactive test stand
3503	Inactive test stand	3532	Inactive pump house
3504	Inactive test stand	3533	Inactive sewage pump station
3505	Inactive test stand	3534	Inactive office
3506	Inactive battalion storage	3535	Inactive storage
3507	Inactive test stand	3536	Inactive low-speed rig
3508	Inactive test stand	3537	Inactive passination house
3509	Inactive sentry station	3538	Inactive nitrogen cascade
3510	Battalion storage	3539	Inactive test stand
3511	Battalion storage	3540	Inactive test stand
3512	Inactive barricade	3541	Inactive test stand
3513	Battalion storage	3542	General purpose magazine
3514	Battalion storage	3543	Sentry station
3515	Motor repair shop	3544	Settling tank
3516	Storage	3545	Trickling filter
3517	Inactive battalion storage	3546	Inactive dosing tank
3518	Battalion administration and classroom	3547	Inactive latrine and heating bldg.
3520	Inactive magazine	3548	Inactive ammonia pump
3521	Inactive magazine	3549	Inactive ammonia storage
3522	Inactive hydrant house	3550	Inactive high-speed rig
3522A	Liquid propellant storage facility	3551	Inactive pump house
3523	Inactive magazine	3552	Inactive propellant sys. facility
3524	Inactive magazine	3598	Sewage treatment plant
3525	Inactive boiler house		
3526	Inactive test stand		
3527	Inactive maintenance bldg.		

Source: PTA 1975.

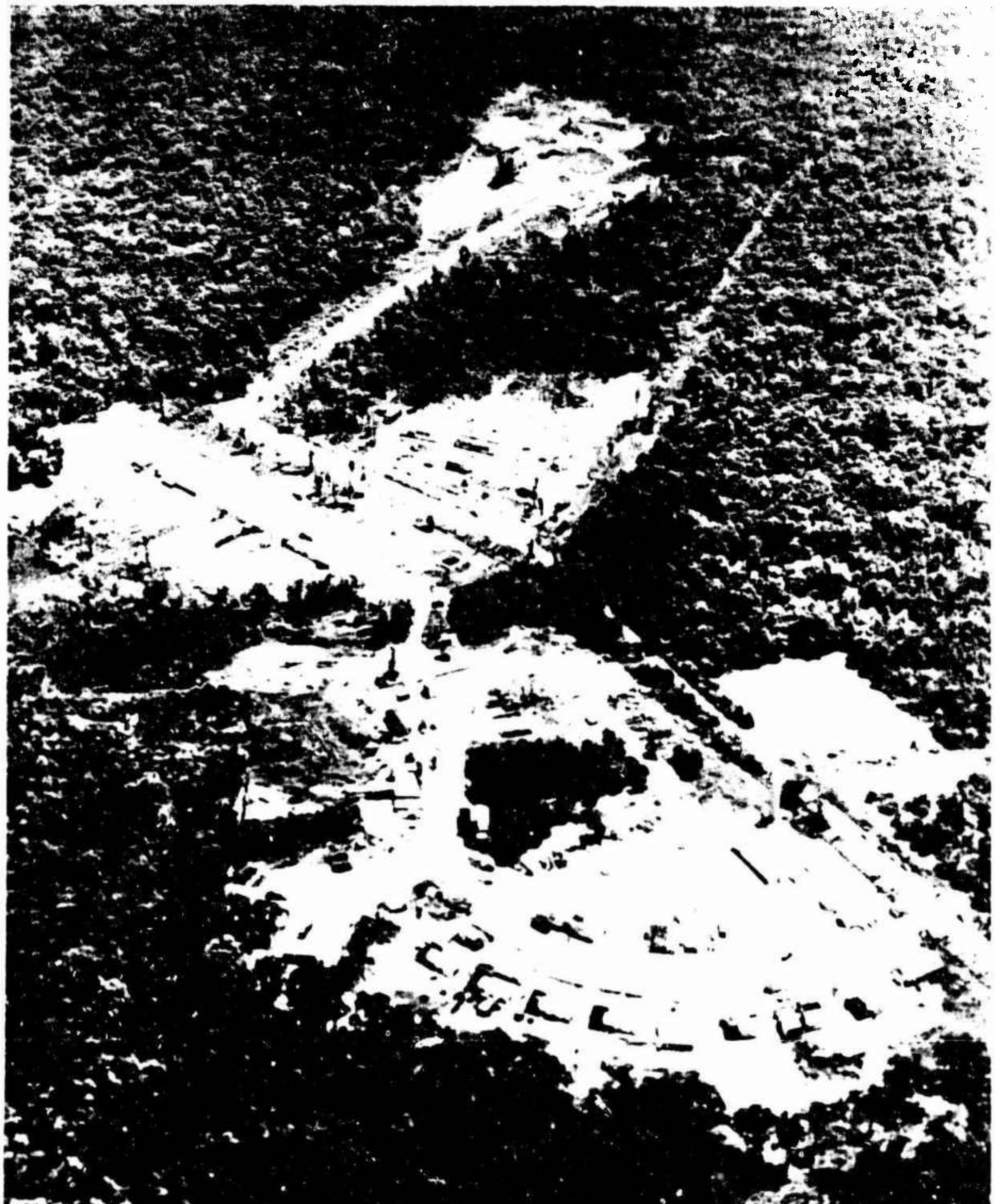

FIGURE 11.3 Aerial View of the Site 2 Area in 1962 (Source: Edson 1962)

FIGURE 11.4 Aerial View of the Site 2 Area in 1963 (arrows indicate possible stained areas) (Source: Sitton 1989)

a test rating of 5,000 lb and half a test rating of 20,000 lb. A 2-ft deep concrete flume for liquid and waste disposal was in back of each test stand. The location or locations of the discharge points of the flumes is not known. Areas in back of some of the test stands were excavated to allow for test firings at different angles (Edson 1962).

The Site contains several above- and below-ground tanks and some magazines for storage of petroleum products, gasoline, and other materials. The location of a buried tank farm is shown on Fig. 11.2. A 1962 tank inventory listed almost 100 tanks on the Site containing such materials as nitrogen tetroxide, hydrogen peroxide, liquid oxygen, jet fuel, white and red fuming nitric acids, ammonia, hydrazine and its derivatives, oxygen and chlorine fluorides, air, water, and similar materials (Edson 1962). Locations and other data on storage tanks for petroleum products are listed in Table 11.5. Information on a few of the storage locations for nonpetroleum products is summarized in Table 11.6. Four tanks on the Site have roof vents for which atmospheric discharges are covered by air permits expiring in 1990. The permitted tanks are two gasoline storage tanks, a 94,500-L (25,000-gal) fuel oil tank at Bldg. 3521, and a 56,700-L (15,000-gal) fuel oil tank at Bldg. 3549. A sump near Bldg. 3521 collected runoff from a rocket test area (Gaven 1986, Attachment A; Ludemann et al. 1981; Edson 1962).

The Site also included transformers containing PCBs. These are listed in Table 11.7.

Rockets were probably tested from 1947 (when the G-1 area was completed [Edson 1962]) to the mid 1960s. Interviews with PTA personnel suggest that the Site was active during the 1950s and at least up to 1964-1965 when Thiokol stopped using the Site (Gross et al. 1976). In 1980, the Site was reported to have been deactivated for some time with no plans for resumption of the former activities (Gaven 1986, Attachment B). Currently, the western part of the Site contains an active motor pool (Dames & Moore 1989).

Several buildings at the G-1 area have been washed under TECUP: 3501, 3503, 3505-3508, 3520, 3523, 3524, 3530, 3535, 3538, and 3549. Building 3516 was demolished by burning. Buildings scheduled to be decommissioned under TECUP are 3525 and 3537 (Snyder 1989; Solecki 1989b).

Spills have occurred at Site 2. On or about January 19, 1988, a tanker truck spilled about 1,130 L (300 gal) of diesel fuel near Bldg. 3513. The spill covered an area of about 230 m^2 (2,500 ft^2) and soaked into soil along an asphalt road. Cleanup of the spill, which included soil and asphalt removal and soil analysis to ensure removal to acceptable residual levels, began on February 29 and was completed on March 14, 1988. On February 2, 1988, another spill of about 190 L (50 gal) of diesel fuel was noticed near Bldg. 3541. The fuel was spilled at two locations on the soil and brush and was attributed to deliberate dumping during a weekend (Clune 1988a; Wagner 1988).

During interviews with ANL staff in 1989, PTA personnel and retirees reported spills and disposal of wastes onto the ground and into the water. It was reported that when pipes were cut and ends crimped, chemicals spilled out onto the ground. Spills of fuels and oxidizers such as red nitric acid (RNA), hydrazine (N_2H_4), mixed amines, CTF, and hydrogen peroxide (H_2O_2) were reported to have run into the reservoir. Reportedly, troughs and sumps for Bldg. 3540 emptied into the reservoir west of the building.

TABLE 11.5 Information on Storage Tanks for Petroleum Products at Site 2[a]

Location[b] (bldg. no.)	Material Stored	Capacity (gal)
3515	No. 2 fuel oil	2,000
3518	No. 2 fuel oil	2,000
3525	No. 2 fuel oil	5,000
3547	No. 2 fuel oil	5,000
Near 3500	No. 2 fuel oil	1,000
	No. 2 fuel oil	1,000
	No. 2 fuel oil	1,000
	Gasoline	5,000
	Gasoline	5,000
	Gasoline	14,000[c]
	Gasoline	9,400[c]
	Gasoline	9,400[c]

[a]The source also lists five additional aboveground tanks, four additional underground tanks, and a railroad car in the G-1 area. All these additional tanks for storing No. 2 fuel oil are reported to be unusable.

[b]Another reference (Appendix D Inventory of Above Ground Storage Facilities 1980) lists the following tanks for No. 2 fuel oil: Bldg. 3522, 1 tank; Bldg. 3549, 1 tank; 3540 area, 6 tanks; and 3538 area, 3 tanks.

[c]The source identifies these as aboveground tanks.

Source: Ludemann et al. 1981.

TABLE 11.6 Information on Storage of Nonpetroleum Materials at Site 2

Location (bldg. no.)	Material	Storage Method
3520	Explosives	Magazine
3521	Liquid propellant	Magazine
3523	Explosives	Magazine
3524	Explosives	Magazine
3542	Toxic/hazardous	Magazine
3522A	Liquid propane	Tank
3535	Propellant	Building
3549	Ammonia	Tank
3566	Fuel	Tank
3567	Oxidizer gas	Tank
3577	Propellant	Bunker

Sources: USATHAMA 1976; Anonymous 1980; Edson 1962.

TABLE 11.7 Information on PCB-Containing Transformers at Site 2

Location (bldg. no.)	PCB Content (ppm)	Physical State	Risk Potential
3501	211	Moderate	Slight
3501	160	Moderate	Slight
3501	136	Moderate	Slight
3501	194	Moderate	Slight
3501	350	Moderate	Slight
3501	345	Moderate	Slight
3553[a]	4,670	Poor	Moderate
3553[a]	4,484	Fair	Moderate

[a]These transformers may have been removed.

Source: PTA 1988a.

It was reported that after testing, rocket tanks were washed out and that the wash water, which contained whatever was left in the tanks, was poured onto the ground and allowed to flow down into the reservoir. This reportedly occurred once or twice per day from the late 1940s to the mid 1960s. Test cells in the area were reportedly drained 5-6 times per day. It was reported that the little pond in the area received runoff with chemicals from the rocket test area. Also a fish kill in the reservoir was reported in the mid 1960s.

The reported testing of JATO units in the area sometimes resulted in explosions leaving solid propellant on the ground. Otto fuel* was reported to have been tested near Bldg. 3505. It was also reported that buildings on the Site were demolished and then pushed into the wetlands. Dames & Moore (1989) reported the presence of a few abandoned drums along the eastern site boundary near the woods.

Analyses of aerial photos of the Site in 1951, 1963, and 1970 show several areas of cleared ground, possible staining or dark-toned material, and disturbance. An area of dark material or possible staining is indicated by the arrow labeled with a 1 in Fig. 11.4. This area is probably the same as the area in the 1970 photo, which resembles a burn area (Sitton 1989). Another area of staining noted in the 1951 aerial photo is marked with arrow 2 in Fig. 11.4.

11.3.2 Geology and Hydrology

No data are available on the detailed stratigraphy at the G1 area. In general, the lower slopes of the eastern side of the main valley at PTA contain 3-8 m (10-27 ft) of glacial till. Bedrock in the area consists of Precambrian gneiss (Dames & Moore 1989).

Surface soils in the area consist of the Adrian Series in the eastern part of the Site near the reservoir and the Rockaway Series elsewhere. Adrian soils are very poorly drained acidic soils with a permeability of 15 cm/h (6 in./h). Rockaway soils are moderately well drained upland soils consisting of gravelly or gravelly sandy loam. The soils are acidic and the permeability ranges from 1.5 to 5.0 cm/h (0.6 to 2.0 in./h) (USATHAMA 1976).

Three shallow monitoring wells (L, M, and N) were installed around the boundary of the Site (Fig. 11.2) from December 14, 1981, to February 7, 1982. The respective well depths are 12, 12, and 8 m (40, 40, and 27 ft) with screens at the bottoms of the wells. Well L samples the gneiss bedrock, and wells M and N sample the glacial drift. The depths to water measured in the wells soon after installation were 2.4 m (7.8 ft) in well L, 1.6 m (5.4 ft) in well M. and 1.8 m (6.0 ft) in well N (USAEHA 1984b; Gaven 1986, Attachment G; Dames & Moore 1989). The measured depths and the well elevations determined from topographic maps are consistent with the assumption that groundwater flow in the area is determined by the topography. This assumption gives the result that groundwater flow in the eastern part of the Site is north toward the reservoir. No

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*Otto fuel is a gel used in torpedoes; it contains propylene glycol dinitrate, di-n-butyl sebacate, and 2-nitrodiphenylamine.

groundwater elevation data are available for the western part of the Site. If topography determines groundwater flow in the western part, then the flow is toward the east. More data are needed on water elevations at more locations in the G-1 area.

11.3.3 Existing Contamination

No data are available on soil contamination at the Site. Sediment and surface water samples were taken in April and May 1988 at four locations on the Site: at the edge of a pond next to Bldg. 3534, at two locations along the outlet stream from the pond, and in another stream that carries runoff from the northwestern part of the Site (Dames & Moore 1989). One sediment and one surface water sample were collected from the reservoir in June 1988. The sampling locations are shown in Fig. 11.2. The April 1988 sediment samples were analyzed for purgeable organics and some constituents of solid propellants: nitrocellulose, nitrite, nitrate, barium, sulfate, and total chromium. The April 1988 surface water samples were analyzed for the same components as well as hydrazine, monomethyl hydrazine, and unsymmetrical dimethyl hydrazine. The June 1988 surface water and sediment samples were analyzed for volatiles, semivolatiles, explosives, metals, PCBs, cyanide, nitrate, nitrite, and some macroparameters. The positive results are listed in Tables 11.8 and 11.9. Data for the surface water and sediment samples collected in June 1988 from a location in Ames Brook near Site 1 and the PTA boundary are summarized in Table 11.3 (see Sec. 11.2.3).

The results of the measurements show very little contamination in the sediment samples for the analyzed parameters. Most organics were not detected. Toluene was present at a concentration of 0.0263 μg/g in the sediment sample taken from the pond. Methylene chloride was measured in all the sediment samples listed in Table 11.8. However, insufficient data are available to determine if this represents real contamination or is a measurement artifact due to incomplete drying of sample bottles, which were rinsed with methylene chloride. The quality assurance program (USATHAMA 1987a) followed by Dames & Moore (1989) includes a methylene chloride rinse of all glass sample bottles. Di-n-octyl phthalate at a concentration of 0.85 μg/g was found in the reservoir sediment sample (Table 11.9). Unknown volatile organics were also found in the samples (Dames & Moore 1989; York 1989a). Concentrations of these ranged up to 6.6 ppb in sample SD2-1, 7.7 ppb in sample SD2-2, 5.9 ppb in sample SD2-4, and 21.4 ppb in the reservoir sediment sample.

Concentrations of sulfate (342-637 ppm) were higher by factors of five to nine in the sediment samples taken from the pond and the entrance of the pond drainage to the reservoir than in the other two samples (<71 ppm) listed in Table 11.8. Sulfate was not detected in the reservoir sample. The reasons for these differences are not known. Nitrate (6.6 ppm) and arsenic (3.0 ppm) were found in the reservoir sediment sample. These values probably represent background concentrations. The reservoir sample was not analyzed for lead (York 1989a).

TABLE 11.8 Selected Results for Analysis of Purgeable Organics and Propellant Components in Sediment and Surface Water Samples from Site 2

Chemical Parameter[a]	Concentration in Sediment (μg/g)				Concentration in Surface Water[b] (μg/L)		
	SD2-1	SD2-2	SD2-3	SD2-4	SW2-1	SW2-2	SW2-3
Chromium	7.8	6.3	8.5	5.2	<3.3	<3.3	<3.3
Barium	31.9	26.7	35.1	21.4	<20	<20	<20
Sulfate	342	<71	637	<71	13,200	13,000	13,400
Methylene chloride	0.0656	0.0387	0.0580	0.0472	8.0	7.0	7.0
Toluene	0.0263	<5	<5	<5	<5	<5	<5
1,1-Dichloroethane	<5	<5	0.0014	<5	<5	<5	<5
Nitrate	<15	<15	<15	<15	<50	488	416

[a]Only those chemical parameters are listed for which positive results were obtained. Nitrocellulose, nitrite, most purgeable organics, and hydrazine and its derivatives (water samples only) were not detected.

[b]No data are available for sample SW2-4.

Source: Dames & Moore 1989.

TABLE 11.9 Selected Analytical Results for Sediment and Surface Water Samples Collected from the Reservoir Adjoining Site 2 in June 1988

Parameter[a]	Concentration in Sediment (μg/g)	Concentration in Water (μg/L)
Metals[b]		
Aluminum	2,900	86.3
Arsenic	2.99	4.70
Barium	64	1,070
Calcium	1,010	15,000
Iron	12,000	997
Lead	c	3.35
Potassium	267	<794
Magnesium	79	5,340
Manganese	1,540	339
Sodium	58.8	10,000
Zinc	70.6	11.2
Semivolatiles		
Di-n-octyl phthalate	0.851	<18
Unknowns	≤21.4	≤70
Other		
Nitrate	6.59	<50
Chloride	<32.6	20,000
Sulfate	<6.17	7,200

[a]Only those parameters are listed for which either the sediment or water sample showed a positive result.

[b]Samples were also analyzed for the metals antimony, arsenic, cadmium, cobalt, chromium, selenium, thallium, and vanadium.

[c]The parameter was not measured.

Sources: York 1989a, 1989b.

The data for the three surface water samples listed in Table 11.8 show methylene chloride in all the samples. However, it is not known if this represents real contamination or is a measurement artifact. Nitrate concentrations (416 and 488 μg/L) were higher in the water in the drainage ditch from the pond than in the pond itself (<50 μg/L). This suggests that contamination from explosives or propellants may be entering the ditch downgradient from the pond (Fig. 11.2). However, nitrate was not detected in the reservoir water sample. Lead (3.35 μg/L) and arsenic (4.7 μg/L) were found in the reservoir water sample (Table 11.9). These values are less than 10% of the drinking water limits of 50 μg/L for both lead and arsenic (40 CFR 141).

The above results suggest possible contamination of the soil and sediments by explosives and propellants at the Site. However, such a conclusion may be premature because it is possible that most of the parameters measured are not components of the propellants burned at the Site. In particular, Table A.9, which lists propellant components in general, and Table A.10, which lists components of solventless propellants (see App. A in Volume 1), show that nitrate was the only propellant component for which samples were analyzed. Other chemical parameters listed in the tables, such as lead and several phthalates, should have also been analyzed.

The sediment and surface water results obtained so far are insufficient, both in terms of sample locations and measured parameters, to determine whether the pond or reservoir is contaminated. Interviews with PTA personnel suggest that the pond is likely to be contaminated. The pond was reported to have been used as a dump and the flumes from the test stands may have emptied into the pond. PTA personnel also reported that waste from the liquid rocket facility was dumped into the pond (Gross et al. 1976).

The sump area near Bldg. 3521 may also be contaminated, since it received drainage from the rocket test area. Also, fish kills were reported to have occurred in the reservoir adjacent to the Site in the 1950s and mid-1960s (Gross et al. 1976). This suggests that the reservoir may have been heavily contaminated in the past.

The water quality data for Ames Brook, which drains the reservoir just north and downslope from the eastern part of the Site, shows that in 1975 copper, chromium, and cyanide were detected in the water. However, these contaminants were not detected in a sample collected in 1988 (details are given in Sec. 11.2.3). The lead concentration of 3.25 μg/L measured in the June 1988 water sample (Table 11.3) is similar to that measured in the reservoir (Table 11.9).

On several dates from 1982 to 1985, samples taken from wells L, M, and N were analyzed for metals and other inorganic chemical parameters. The results are summarized in Tables 11.10, 11.11, and 11.12 for wells L, M, and N, respectively. The data show that water in well N is less acidic and contains higher concentrations of several parameters than the water in wells L and M. In particular, the pH of water in well N ranges from 6.0 to 6.6, whereas the pH of water in wells L and M ranges from 4.8 to 6.0. Concentrations of chloride (88-299 mg/L), sodium (38-105 mg/L), total dissolved solids (344-938 mg/L), and total organic carbon (5.76-14.3 mg/L) in water from well N are higher than the corresponding concentrations in water from wells L and M (1.8-8.8 mg/L chloride, 2.5-12.0 mg/L sodium, 52-126 mg/L total dissolved solids, and up to 4.0 mg/L total organic carbon).

TABLE 11.10 Selected Analytical Results for Groundwater Collected from Well L on Various Sampling Dates (μg/L)[a]

Parameter	10/29/82	3/29/83	7/10/83	12/8/83	4/2/84	7/2/85
Antimony	-	-	-	-	-	<1
Arsenic	<5	9	-	<5	<5	<1
Barium	-	-	-	-	-	<100
Beryllium	-	-	-	-	-	<5
Cadmium	<1	<1	<10	2	<1	<5
Calcium	-	-	13,100	-	-	5,400
Chloride[b]	-	8,800	-	6,900	6,000	5,800
Chromium	3	10	<25	2	8	<25
Copper	39	<3	-	<3	4	<20
Cyanide	1	1	<10	<1	<1	<10
Fluoride	-	150	-	180	70	140
Iron	-	-	<100	59	65	92
Lead	10	9	<100	<3	4	<1
Magnesium	-	-	5,600	-	-	5,100
Manganese	-	-	44	49	16	26
Mercury	-	-	-	-	-	<1
Nickel	-	-	-	-	-	<40
Nitrate nitrogen	-	-	-	-	-	1,950
Phenols	-	7	-	2	7	<50
Selenium	9	<5	-	<5	<5	<1
Silver	-	-	-	-	-	<10
Sodium	-	-	6,100	9,500	12,000	5,200
Sulfate[b]	-	-	-	18,000	16,000	27,000
Thallium	-	-	-	-	-	<1
Zinc	350	33	-	7	18	7
pH (pH units)[c]	-	6.0	-	5.7	5.7	5.8
Specific conductance (μmho/cm)[c]	-	100	-	-	-	150
Temperature (°C)[b]	-	-	-	-	-	9
Total dissolved solids	-	-	-	94,000	86,000	126,000
Total organic carbon	-	-	-	ND	ND	3,550
Total organic halogens	-	-	-	-	-	<10

[a]Results are in μg/L except as noted for pH, conductance, and temperature; a hyphen means the parameter was not measured, and ND means not detected with detection level not reported.

[b]Values for chloride and sulfate are reported as μg/L in Caven (1986) for 10/29/82, 3/29/83, 12/8/83, and 4/2/84 and are much too small to be reasonable. Consequently, the values in Caven (1986) are assumed to be in mg/L and have been converted to μg/L for this table.

[c]Field measurements.

Sources: USAEHA 1984b; Pugliese 1985; Caven 1986, Attachment C.

TABLE 11.11 Selected Analytical Results for Groundwater Collected from Well M on Various Sampling Dates (μg/L)[a]

Parameter	10/29/82	3/29/83	7/10/83	8/4/83	12/8/83	3/28/84	3/11/85	7/2/85	9/30/85
Antimony	-	-	-	-	-	-	-	<1	<200
Arsenic	<5	<5	-	11	<5	<5	<1	<1	<1
Barium	-	-	-	-	-	-	<100	<100	<100
Beryllium	-	-	-	-	-	-	-	<5	<5
Cadmium	<1	<1	<10	3	1	<1	<5	<5	<5
Calcium	-	-	5,700	-	-	1	-	4,500	45,600
Chloride[b]	-	8,800	-	-	3,700	6,400	3,500	2,800	1,800
Chromium	3	2	<25	11	10	4	<25	<25	<25
Copper	150	<3	-	8	4	7	-	<20	<20
Cyanide	<1	<1	<10	<1	<1	<1	<10	<10	<10
Fluoride	-	120	-	-	260	220	180	150	110
Iron	-	-	510	-	11,000	12,000	83,500	106	1,610
Lead	6	4	<100	4	<3	4	4	<1	<1
Magnesium	-	-	1,300	-	-	-	-	2,200	600
Manganese	-	-	264	-	910	420	1,110	732	274
Mercury	-	-	-	-	-	-	<0.2	<1	<1
Nickel	-	-	-	-	-	-	-	<40	<40
Nitrate nitrogen	-	-	-	-	-	-	7,300	4,440	1,170
Phenols	-	6.0	-	6.0	1.0	5.0	<50	<50	<50
Selenium	8	<5	-	<5	<5	10	-	<1	<1
Silver	-	-	-	-	-	-	<10	<10	<10
Sodium	-	-	2,700	-	7,100	6,400	3,000	4,600	2,500
Sulfate[b]	-	-	-	-	8,200	12,000	40,000	19,000	<10,000
Thallium	-	-	-	-	-	-	-	<1	<100
Zinc	-	-	-	33	21	16	-	18	7
pH (pH units)[c]	-	5.0	-	-	4.7	4.8	4.5	4.8	5.7
Specific conductance (μmho/cm)[c]	-	110	-	-	-	-	125	80	79
Temperature (°C)[c]	-	-	-	-	-	-	-	10	12.5
Total dissolved solids	-	-	-	-	88,000	59,000	-	93,000	52,000
Total organic carbon	-	-	-	-	1,800	4,000	1,140	1,190	2,170
Total organic halogens	-	-	-	-	-	-	<10	<10	30

[a]Results are in μg/L except as noted for pH, conductance, and temperature; a hyphen means the parameter was not measured.

[b]Values for chloride and sulfate are reported in μg/L in Caven (1986) for 10/29/82, 3/29/83, 8/4/83, 12/8/83, and 3/28/84 and are much too small to be reasonable. Consequently, the values in Gaven (1986) are assumed to be in mg/L and have been converted to μg/L for this table.

[c]Field measurements.

Sources: USAEHA 1984b; Pugliese 1985; Caven 1986, Attachment C.

TABLE 11.12 Selected Analytical Results for Groundwater Collected from Well N on Various Sampling Dates (μg/L)[a]

Parameter	10/28/82	3/29/83	7/10/83	8/4/83	12/8/83	3/28/84	3/11/85	7/2/85	9/30/85
Antimony	-	-	-	-	-	-	-	<1	<200
Arsenic	8	<5	-	<5	<5	<5	13	<1	<1
Barium	-	-	-	-	-	-	380	<100	130
Beryllium	-	-	-	-	-	-	-	<5	<5
Cadmium	3	3	<1	2	3	<1	16	<5	<5
Calcium	-	-	42,500	-	-	-	-	41,300	57,000
Chloride[b]	-	88,000	-	-	52,000	71,000	163,000	299,000	277,000
Chromium	16	10	<25	12	9	4	102	<25	<25
Copper	330	120	-	100	78	4	-	<20	<20
Cyanide	<1	<1	<10	<1	<1	<1	<10	<10	<10
Fluoride	-	230	-	-	280	260	140	240	250
Iron	-	-	26,500	-	37,000	38,000	168,900	180	49,800
Lead	52	36	<100	26	20	3	144	<1	<1
Magnesium	-	-	19,300	-	-	-	-	15,000	14,400
Manganese	-	-	3,100	-	4,200	3,600	6,750	7,110	6,360
Mercury	-	-	-	-	-	-	<0.2	<1	<1
Nickel	-	-	-	-	-	-	-	<40	<40
Nitrate nitrogen	-	-	-	-	-	-	950	440	3,020
Phenols	-	10.0	-	9.0	4.0	7.0	<50	<50	<50
Selenium	7	<5	-	16	<5	<5	<1	<1	<1
Silver	-	-	-	-	-	-	<10	<10	<10
Sodium	-	-	38,500	-	85,000	68,000	50,100	87,100	105,000
Sulfate[b]	-	-	-	-	16,000	16,000	28,000	<10,000	<10,000
Thallium	-	-	-	-	-	-	-	<1	<100
Zinc	1,000	75	-	59	31	14	-	7	7
pH (pH units)[c]	-	6.6	-	-	6.4	6.4	6.1	6.3	6.0
Specific conductance (μmho/cm)[c]	-	500	-	-	-	-	975	1,475	1,400
Temperature (°C)[c]	-	-	-	-	-	-	-	15	17.0
Total dissolved solids	-	-	-	-	376,000	344,000	-	938,000	817,000
Total organic carbon	-	-	-	-	8,000	10,000	7,400	14,300	5,760
Total organic halogen	-	-	-	-	-	-	16	<10	39

[a]Results are in μg/L except as noted for pH, conductance, and temperature; a hyphen means the parameter was not measured.

[b]Values for chloride and sulfate are reported as μg/L in Gaven (1986) for 10/28/82, 3/29/83, 8/4/83, 12/8/83, and 3/28/84 and are much too small to be reasonable. Consequently, the values in Gaven (1986) are assumed to be in mg/L and have been converted to μg/L for this table.

[c]Field measurements.

Sources: USAEHA 1984b; Pugliese 1985; Gaven 1986, Attachment C.

Iron concentrations are much higher in wells M and N, with values ranging up to 169 mg/L in well N and 83.5 mg/L in well M, than in Well L with values ranging up to 0.092 mg/L. The highest values for wells M and N were measured in March 1985. Measurements of iron show very large concentration fluctuations, over a factor of 1,000, for water taken on different sampling dates. In particular, water taken from the three wells four months later in July 1985 contained much lower iron concentrations, ranging from 0.092 to 0.180 mg/L. It is not known whether these extreme differences represent real changes in the iron concentrations or measurement artifacts.

Nitrate concentrations in water from well M (up to 7.3 mg/L as N) are also higher than the concentrations in wells N (up to 3.0 mg/L as N) and L (1.95 mg/L as N — one measurement). It is possible that these values represent groundwater contamination from explosives decomposition or from wastewater containing nitrate (reported to be produced when the Site was active) having migrated down and entered the groundwater. It is not likely that the nitrate comes from fields, since there would be no reason for nitrate fertilizers to have been used in the area (no crop production has been reported). Data are not available on the locations of former septic tanks (if any) in the area. Building 3547, located about 300 feet north of Well M (Fig. 11.2), was designated as a latrine and heating building (Table 11.4).

The data in Tables 11.10-11.12 indicate that concentrations of several metals, such as copper, lead, and zinc, appear to be decreasing with time, especially in well N. Concentrations of chromium and phenols appear to be independent of sampling date (except for the high value of 0.102 mg/L measured in well N in March 1985). More data collected over a longer period of time are needed to see if these trends persist or are transitory.

The relatively high concentrations of sodium and chloride in water from well N compared to those in wells L and M suggest that the groundwater in the area of well N may be contaminated with salt used on roads during the winter. The source and nature of the levels of total organic carbon in well N are not known. Possibly, it and the other parameters found in the water come from materials dumped in the nearby pond.

Purgeable organics were measured in all three wells on three (well L) or four (wells M and N) dates in 1983 (USAEHA 1984b; Gaven 1986, Attachment G) and in well M in March, July, September, and October 1985 (Pugliese 1985). Method detection limits were 1 μg/L for all purgeables in the 1985 measurements and 1-10 μg/L for all purgeables in the 1983 and 1984 measurements. In December 1983, 2.7 μg/L chloroform was found in water taken from well L; no other purgeables were found. Traces of tetrachloroethylene and trichloroethylene were reported in water from well N in 1985. In December 1983, 1.6 μg/L chloroform was found; no other purgeables were found. Some of the 1983 measurements for well M show a trace of trichloroethylene and 4-6.1 μg/L 1,1,1-trichloroethane. The 1985 measurements show 3 μg/L 1,1,1-trichloroethane in water from well M in September 30 and October 1, 1985, and none in samples taken in March and July. No other purgeables were found in water from well M. Well M is discussed more in conjunction with Site 4.

Water samples were taken from wells L and N in April 1988 and analyzed for purgeable organics, chromium, barium, sulfate, nitrate, nitrite, nitrocellulose, and hydrazine and some of its derivatives (Anderson 1988a). Most species were not detected. Detected species included chromium at 7.7 μg/L in well L and 3.3 μg/L in well N, nitrate at >1 mg/L in well L and 0.37 mg/L in well N, and methylene chloride at 7 μg/L in wells L and N. Trichloroethylene and 1,1,1-trichloroethane were not detected at respective detection limits of 1.5 and 6.5 μg/L.

The concentration data for wells L, M, and N may not give a true picture of the contamination in the groundwater. These wells all draw water from screens that are several feet below the water table. In particular, the screen tops in wells L, M, and N are, respectively, 3.4 m (11 ft), 9.1 m (30 ft), and 4.3 m (14 ft) below the water table. Contaminants migrating down from the surface or near surface would have to diffuse downward several feet to be collected. It is even possible that groundwater flow would move contaminants in the top layers of groundwater past the well location before much downward diffusion occurred. As a result, concentrations of contaminants originating at or near the surface might be higher in the upper layers of groundwater than at the depths sampled.

11.3.4 Closure Plans

Revised RCRA closure plans for the concrete pad behind Bldg. 3517 include removal of loose dirt from the pad followed by berming and cleaning with high-pressure steam. Two chip samples will be taken from two locations 8 ft apart and 8 ft from three sides of the pad and analyzed for priority pollutant metals and PCBs. The process of washing and collecting chip samples will be repeated until the chip samples are clean. Six soil samples will be collected to a depth of 0.15 m (6 in.) around the perimeter of the pad and analyzed for priority pollutant metals, base neutral extractables, TPH, volatiles, PCBs, and, if necessary, EP toxicity for metals. Condensate samples will be collected and analyzed for priority pollutant metals and PCBs (ARDEC undated; Solecki 1989d).

11.3.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, then the proposed RI sampling plan may have to be modified as new data become available.

11.3.5.1 Phase I

A thorough walkover and field inspection of all the brush-, tree-, and grass-covered parts of the Site should be carried out to search for and remove any UXO, drums, and containers, whether buried or on the surface. Use of geophysical methods or a metal detector may aid in the search. Drums and containers should be sampled before removal.

A search should be made to locate all underground storage tanks. The search should include the area containing the underground tank farm reported in Edson (1962) (Fig. 11.2). Any tank with unidentifiable contents should be sampled and analyzed. The tank integrity should be tested if the tanks appear to be in a condition to withstand the tests. The contents of leaking tanks, corroded tanks, and tanks that will not be used should be removed. After removal of the contents, consideration should be given to closure of the tanks in accordance with all applicable state and federal regulations. For underground tanks, closure requires sampling and analyses of the surrounding soil (Gaven 1986, Attachment Q).

A total of 12 surface soil samples should be collected to a depth of 0.3 m (12 in.) from the following locations:

- Two samples from each of the two possibly stained areas marked with arrows in Fig. 11.4. Exact locations in each of the areas should be determined by field inspection.

- One sample immediately behind each of the former locations of the test stands in Bldgs. 3502, 3507, 3526, and 3540 (Fig. 11.2). Building 3502 was chosen because it contained large propellant tanks for testing turbopumps, Bldg. 3507 had a large motor room for testing of complete missiles, Bldg. 3526 was used for component and rocket testing, and the area behind Bldg. 3540 was excavated for attitude testing (Edson 1962). If the excavation still exists, the soil sample should be taken from the bottom of the excavation.

- Two soil or sediment samples should be collected from the outfalls of the flumes that were behind the test stands if the outfalls can be located. If the outfalls cannot be located, surface soil behind two additional test stands should be sampled.

- Soil or sediment samples should be collected from two locations in the ditch that carries runoff downgradient from Bldg. 3521.

All samples should be analyzed for explosives, TCL metals (including lead), TCL semivolatiles, herbicides, cyanide, fluoride, and nitrate.

Sediment and water samples should be collected from two different locations in the pond. Tentative locations are shown in Fig. 11.2. The sediment samples should be collected to a depth of 0.3 m (12 in.). The samples should be analyzed for TCL metals (including lead), TCL semivolatiles, explosives, herbicides, cyanide, nitrate, fluoride, gross alpha, and gross beta. These samples are needed because the list of parameters measured in the Dames & Moore samples was too limited (York 1989a, 1989b).

Sediment samples should be collected to a depth of 0.3 m (12 in.) from three locations in the reservoir (tentative locations are shown in Fig. 11.2) and analyzed for the same parameters as the pond sediment samples. These analyses should complement the one reservoir location already sampled (York 1989a, 1989b).

Sediment samples should be collected to a depth of 0.3 m (12 in.) from one location in each of the two streams on the Site (tentative locations are shown in Fig. 11.2) and analyzed for the same parameters as in the pond samples. These samples are needed for the same reason as the pond samples.

Soil borings should be drilled at the following locations:

- One boring in each of the two spill areas near Bldgs. 3513 and 3541. Analyze the samples for TCL volatiles and TCL semivolatiles.

- One boring in the sump by Bldg. 3521. Analyze each sample for TCL metals, TCL volatiles, TCL semivolatiles, nitrate, and fluoride.

One monitoring well should be installed near Bldg. 3521. The location is shown in Fig. 11.2. The well should be screened so that the screen extends partly above and partly below the water table.

Beginning at least two weeks after well installation, water samples should be drawn from the new well and from wells L, M, and N in two successive quarters and analyzed for macroparameters, explosives, TCL volatiles, TCL semivolatiles, TCL metals, pesticides, PCBs, nitrate, nitrite, cyanide, fluoride, gross alpha, and gross beta. These measurements will help to determine the groundwater quality at the site and if the elevated concentrations of total organic carbon (especially in well N) are due to natural causes (humic acids from plant material decay) or from activities carried out at the Site. Samples should be collected on the same day in all the wells, and water elevations should be measured at the time of sample collection.

Air sampling to test for airborne contamination is not needed in general because the Site is not used for testing. However, it may be needed if surface soils are found to be contaminated (see below).

11.3.5.2 Phase II

If the Phase I surface soil samples show significant contamination at any of the sampled locations, additional surface and subsurface soil (boring) samples would be needed to characterize the type and extent of contamination. Air samples to determine the presence of airborne contamination may also be needed. The sampling locations and parameter list depend on the results of the Phase I analyses.

Additional surface water and sediment samples will be needed from the pond, reservoir, and streams on the Site if the respective Phase I sediment samples show contamination. The locations of these samples, which would be needed to determine the type and extent of contamination, and parameter list to be analyzed depend on the results of the Phase I sample analyses.

If elevated levels of gross alpha or gross beta are found in any of the samples, additional samples and analyses would be needed to determine the extent of the contamination and the radionuclides responsible for the elevated activity.

The need for additional monitoring wells will depend on the results of the Phase I surface and subsurface soil, surface water, and groundwater analyses.

11.4 SITE 4 — REACTION MOTORS/ROCKET FUEL TEST AREA (3600 SERIES BUILDINGS)

11.4.1 Site History

Site 4, located uphill and immediately south of Site 2, contains 32 structures in an area of 7.2 ha (18 acres). The Site contains two groups of buildings. Figure 11.5 gives some details of the Site. Aerial photos of Sites 2 and 4 in 1962 and 1963 (Figs. 11.3 and 11.4) show the extent of cleared land around the upper part of the Site. The upper 1.6-ha (4-acre) area contains 9 structures and the lower area contains 23 structures (USACE 1984a; Gaven 1986, Attachment B; Dames & Moore 1989). Table 11.13 lists the functions of some of the buildings on the Site.

The upper part of the Site, which was completed in 1953, was used by Reaction Motors for the testing of large rocket engines. A tall building (No. 3618) with an associated excavated rectangular depression, about 18 by 4.6 m (60 by 15 ft), was used for testing large rocket engines with up to 136,000 kg (350,000 lb) thrust in any attitude. The water-filled depression, which was 20 m (65 ft) deep, was used to deflect and absorb the force of the rocket exhaust gases. Another adjacent test stand could accommodate rocket motors up to 23,000 kg (50,000 lb) thrust (Edson 1962). At present, the Site is inactive. PTA personnel have reported during interviews in 1976 that the 3600 area was used as an impact area and that it has been contaminated by liquid rocket fuel (Gaven 1986, Attachment B; Gross et al. 1976; Dames & Moore 1989). During 1989 interviews with ANL staff, PTA personnel reported that the water-filled basin by Bldg. 3618 was sealed with gunite in 1965 or 1966 to prevent leaking. Before that, material in the basin presumably leached into the ground.

Activity in the lower part of the Site probably started a few years prior to that in the upper part. Aerial photos show that a few buildings in the lower part of the Site were already present in 1951. By 1963, the lower part had greatly expanded to about its present size (Sitton 1989).

During interviews with PTA personnel, it was reported that testing of liquid rockets occurred in the lower part of the Site. Chemicals used in the area reportedly included ammonia, hydrogen peroxide, red fuming nitric acid, ethanol, aniline, CTF, nitrogen tetroxide, UDMH, hydrazine, and fluorine. Small amounts of these chemicals (about 1 pint per day) were reportedly dumped behind Bldgs. 3604, 3606, and 3607. The washing out of tested motors reportedly removed about 1 qt of remaining fuel. From 1951 to 1970, pipes reportedly were disconnected from once per week to 2-3 times per

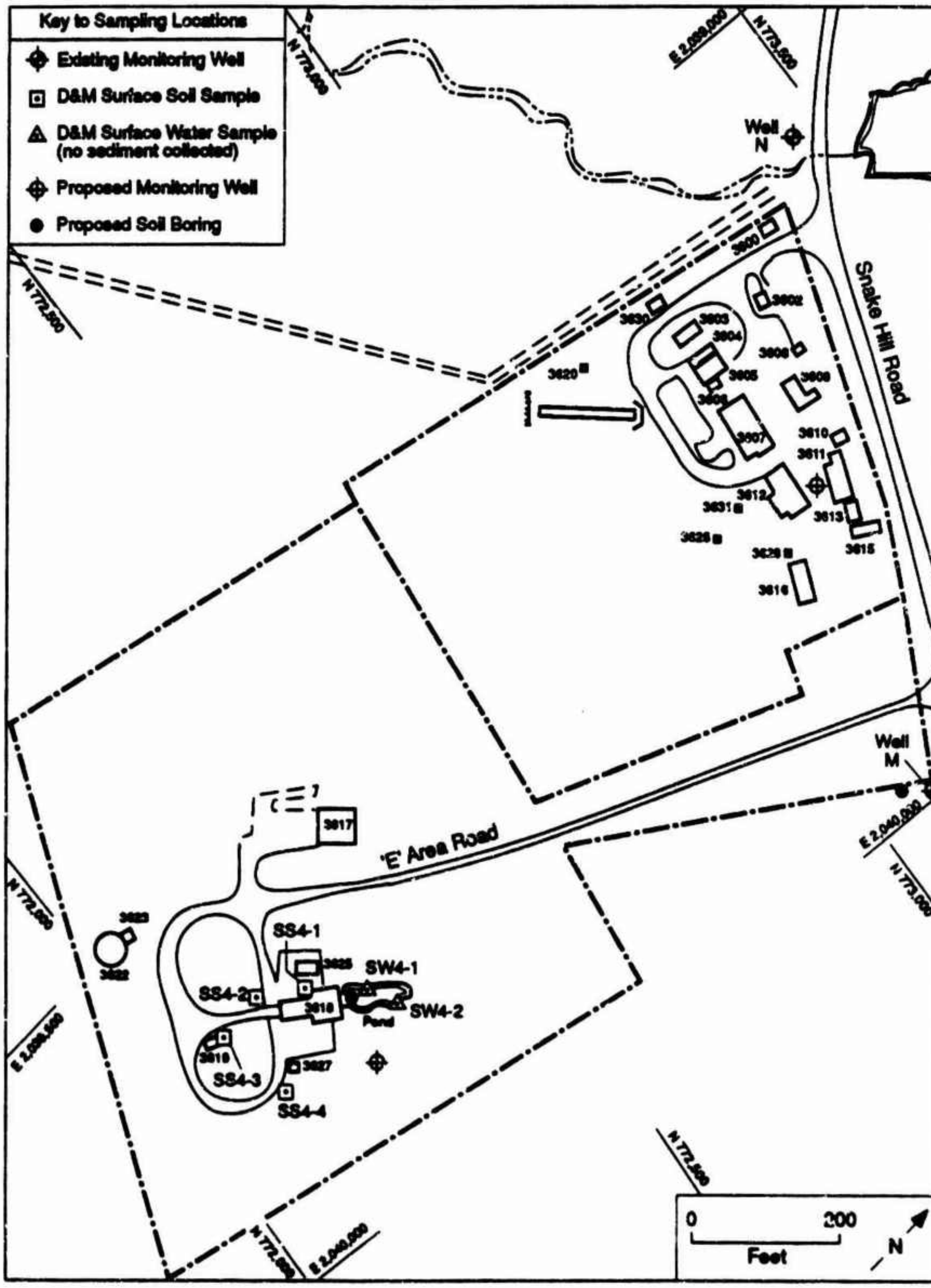

FIGURE 11.5 Layout of Site 4, Reaction Motors/Rocket Fuel Test Area (Sources: Map adapted from PTA 1975 and USACE 1984b; sampling locations from Dames & Moore 1989)

TABLE 11.13 Designations of Some 3600 Series Buildings at Site 4

Bldg. No.	Designation	Bldg. No.	Designation
3600	Inactive sentry station	3617	Inactive cond. house and test stand
3602	Inactive fuel storage		
3603	Inactive test stand	3618	Inactive test stand
3604	Inactive general storehouse	3619	Inactive liquid oxygen tank foundation
3605	Inactive control house		
3606	Inactive general storehouse	3620	Inactive propellant system facility
3607	Inactive test stand		
3608	Inactive boiler house	3622	Inactive water tank
3609	Inactive control room and whirl rig	3623	Inactive tank and boiler house
3610	Inactive acid storage	3625	Inactive test stand
3611	Inactive instrument shop	3626	Inactive observation turret
3612	Inactive foreign ordnance analysis bldg.	3627	Inactive turret
		3628	Inactive turret
3613	Inactive lunch room	3630	Inactive twin turret
3615	Inactive change house	3631	Turret
3616	Inactive environmental cond. bldg.		

Source: PTA 1975.

day, losing about 0.5 gal of propellant during each disconnect. It was reported that about 100 tests in which bullets were fired into cans containing 1 gal hydrazine occurred behind Bldg. 3601. Leakage onto the ground is reported to have occurred. A catch basin 20 ft long, 8 ft wide, and 4 ft deep reportedly collected runoff from the area behind Bldgs. 3601 and 3607. Metal containers of propellants or oxidizers were reportedly buried along the west side of the 3600 area in the 1950s.

The lower part of the Site also reportedly contained a rail gun in Bldg. 3607. During operation of the gun, clean water was reportedly used to slow the projectile. Spilling of the clean water probably did not result in any contamination. The location of a sewage treatment plant in the area, reported to be Bldg. 3647 in the interviews and Bldg. 3598 in the 1975 facilities directory, is not known. Apparently, Bldg. 3647 does not exist and Bldg. 3598 is reported in the 1988 real property inventory of PTA as a small (48 ft^2) general storehouse.

A 1980 summary of Site 4 storage tanks, including their capacity and contents, is given in Table 11.14. All tanks in the inventory were used to store No. 2 fuel oil or kerosene oil (Ludemann et al. 1981). A 1976 report notes that acids may be stored in Bldg. 3610 and fuels in Bldg. 3602 (Wingfield 1976). A 1962 survey lists 15 other tanks, on the upper part of the Site, containing helium, hydrogen peroxide, inhibited red-fuming nitric acid (IRFNA), mixed amine fuels, ammonia, etc. (Edson 1962).

TABLE 11.14 Information on Storage Tanks in the Site 4 Area

Bldg. No.	Description	Tank Capacity (gal)	Contents
3603	Test cell	1,000	No. 2 fuel oil
3607	Test cell	1,000	No. 2 fuel oil
3608	Test cell	550	No. 2 fuel oil
3611	--	550	No. 2 fuel oil
3617	Standby	5,000	No. 2 fuel oil
3623	Standby	1,000	No. 2 fuel oil
3612	EOD	550	Kerosene oil

Source: Ludemann et al. 1981.

A 1988 survey found several PCB-containing transformers at Site 4. Three in Bldg. 3602 contain 134-237 ppm PCBs and are listed as being in poor condition, which presents a severe risk potential. Each transformer contains 159 L (42 gal) of PCBs. Two transformers, one in Bldg. 3600D and the other in Bldg. 3623, containing 344 and 211 ppm PCBs, respectively, are listed as being in moderate condition, which presents a slight risk potential. The transformers contain 19 L (5 gal) and 11 L (3 gal) of PCBs, respectively (PTA 1988a).

Three buildings on the Site are listed as satellite accumulation areas for hazardous materials (Solecki 1989b). Two to five cans per month of paint and solvent aerosol cans are stored inside Bldg. 3607 in a cabinet on a concrete slab. Photographic chemicals (5-8 gal/mo) are kept outside of Bldg. 3611 in a steel box, and explosive-contaminated rages and solvents (1-2 gal/mo) from stripping and inerting of ordnance are generated from activities in Bldg. 3612 and stored in Bldg. 3101. No closure plans have been prepared for any of the buildings at Site 4, and none of the buildings have been or are yet scheduled for removal under TECUP.

11.4.2 Geology and Hydrology

As is the case with Sites 1-3, detailed geologic and hydrologic data are not available for Site 4. However, all Sites in the southern part of PTA are underlain by bedrock, which is Precambrian gneiss. The overlying glacial till is likely to be thin or absent in the upper part of the Site. The lower part of the Site, next to Site 3, probably contains from 3 to 8 m (10 to 25 ft) of till.

Surface soil at the Site consists of the Rockaway Series. These soils are moderately well drained acidic gravelly loam or gravelly sandy loam. Underlying these soils is a dense firm fragipan over which water tends to move laterally. Permeabilities of these soils range from 1.5 to 5.0 cm/h (0.6 to 2.5 in./h) (USACE 1984a; USATHAMA 1976).

The site slopes steeply to the north. Surface drainage from the high southern part of the Site where large rocket motors were tested would be expected to flow into the reservoir near Site 2 or into Ames Brook. An acid pit by well M is reported to have collected oxidizer runoff from the rocket test area (USACE 1984a).

Groundwater flow would be expected to follow the surface topography and flow north toward Ames Brook. If this is the case, then wells M and N are probably downgradient from the Site. However, more data are needed to determine the flow direction.

11.4.3 Existing Contamination

Soil samples were collected in April 1988 at four locations at Site 4 and analyzed for most of the TCL volatiles, a few of the TCL semivolatiles, nitrate, and nitrite. Figure 11.5 shows the locations of sample collection. Positive results were reported for methylene chloride (31.6-34.3 ppb) and unknowns (3.2-80 ppb) for all samples. No other chemical species were detected. Explosives and metals were not measured (Dames & Moore 1989). The data show no evidence for soil contamination at the Site. The methylene chloride concentration probably comes from incomplete drying of the sample collection bottles, which are required by quality assurance protocol to be washed with methylene chloride (Dames & Moore 1989; USATHAMA 1987a). More samples collected from more locations and analyzed for more parameters are needed to conclude that Site activities did not contaminate the soil.

Surface water samples were taken in April 1988 from two locations, north of Bldg. 3618 and from the pond that deflected rocket exhaust. Locations are shown in Fig. 11.5. The samples were analyzed for volatile organics, hydrazine and its derivatives, nitrite, and nitrate. Both samples contained nitrate at 338 μg/L (SW4-1) and 371 μg/L (SW4-2) and methylene chloride at 6-7 μg/L. Sample SW4-2 contained several unknowns at concentrations up to 2 μg/L. No other parameters were detected in the samples (Anderson 1988a). The data show no evidence of surface water contamination from the measured parameters. Sediment sampling was proposed for the pond (Dames & Moore 1989), but no results were reported.

The groundwater data for well M are discussed in Sec. 11.3.3. Concentrations of iron at 83.5 mg/L were found in the sample taken in March 1985; 4-6.1 μg/L 1,1,1-trichloroethane were found in samples taken in 1983 and 3 μg/L in samples taken on September 30 and October 1, 1985. None was found in samples taken in 1984 or March and July 1985. The presence of this organic suggests that groundwater contaminated by past activities at the upper part of the Site is migrating toward Ames Brook. However, more data from more wells are needed because insufficient data exist to conclude that well M is downgradient of the active area or Site 4.

11.4.4 Proposed RI Plan

11.4.4.1 Phase I

If it has not already been done, a thorough walkover and field inspection of the Site should be carried out to search for and remove UXO and other hazardous metal debris resulting from the 1926 Lake Denmark explosion. (Also, PTA personnel have reported that the Site was used as an impact area.) If appropriate, geophysical methods or a metal detector should be used to search for buried items. A geophysical survey should be carried out along the western edge of the 3600 area to search for the containers of propellant, which were reportedly buried there.

A search should be made to locate all underground storage tanks. Any tank with unidentifiable contents should be sampled and analyzed. The tank integrity should be tested if the tanks appear to be in a condition to withstand the tests. The contents of leaking tanks, corroded tanks, and tanks that will not be used should be removed. After removal of the contents, consideration should be given to closure of the tanks in accordance with all applicable state and federal regulations. For underground tanks, closure requires sampling and analyses of the surrounding soil (Gaven 1986, Attachment Q).

Six surface soil samples should be collected to a depth of 0.30 m (12 in.) from the following locations:

- Samples from two locations near the PCB-containing transformers in Bldg. 3602, which were reported to be in poor condition. These samples should be analyzed for PCBs.

- One sample from behind each of Bldgs. 3603, 3604, 3606, and 3607. These samples should be analyzed for TCL metals, TCL semivolatiles, explosives, propellants, fluoride, nitrate, and aniline. These samples are needed because small amounts of chemicals were reportedly dumped behind these buildings and Bldg. 3603 was a test stand.

Sediment samples should be collected from two locations in the depression north of Bldg. 3618 and analyzed for explosives, propellants, TCL metals, TCL volatiles, TCL semivolatiles, fluoride, nitrate, nitrite, gross alpha, and gross beta. Contamination would be expected because of the large amounts of rocket exhaust, which must have impinged on the pond in the depression.

If the catch basin reported to collect runoff from Bldgs. 3601 and 3607 can be located, sediment core samples should be collected from two locations in the basin. The samples should be taken to the bottom of the basin or to a depth of 0.6 m (2 ft), whichever comes first, and analyzed for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, explosives, propellants, PCBs, nitrate, nitrite, fluoride, gross alpha, and gross beta. If there is water in the basin, one sample should be taken and analyzed for the same parameters.

Determinations of the gross alpha and gross beta activities are included to survey for radioactivity. Relatively little is known about the activities at this large Site.

Two soil borings are needed. One should be located just below the outlet of the depression north of Bldg. 3618 and the other should be located in the center of the acid pit by well M. Approximate locations are shown in Fig. 11.5. Samples from the borings should be analyzed for explosives, propellants, TCL metals, TCL volatiles, TCL semivolatiles, fluoride, nitrate, nitrite, gross alpha, and gross beta.

Two additional monitoring wells are needed: one located in the upper part near Bldg. 3618 and the other in the lower part between Bldgs. 3611 and 3612. Suggested locations are shown in Fig. 11.5. The purpose of the wells is to determine if groundwater contamination exists in the area of large rocket motors testing and to monitor possible contamination that may have originated in the lower part or have migrated down from the upper part of the Site. The new wells should be screened so that the screened interval extends partly above and mostly below the water table. Data from these wells, wells M and N, and the wells proposed for Site 2 will all serve to give information on groundwater flow and possible contamination in the area.

Beginning at least two weeks after well completion, water samples should be taken from the two new wells and analyzed for explosives, propellants, TCL metals, TCL volatiles, TCL semivolatiles, pesticides, PCBs, cyanide, fluoride, nitrate, nitrite, gross alpha, gross beta, and macroparameters. Water elevations should be measured when samples are taken for analyses on the same date in each quarter. The sampling dates should coincide with those for the new wells for Site 2 and wells M and N (Sec. 11.3.4).

Because the Site is inactive, testing for airborne contamination is not needed in Phase I sampling.

11.4.4.2 Phase II

If the geophysical survey finds buried containers along the western edge of the Site, these should be excavated, sampled, and disposed of appropriately. Soil borings should be drilled at the locations of any containers that appear to have leaked or where the soil is stained. The number of borings will depend on the number of containers and the leakage. Samples should be collected at depths below that at which the containers were buried. The parameters to be analyzed should depend on the contents of the containers.

The need for additional soil borings on the site will depend on the results of the surface soil sampling and the sediment analyses for the depression in the upper part of the Site. If the analyses of the Phase I surface soil samples show the presence of contamination, then additional surface soil samples may be needed to determine its extent. Air samples to test for airborne contamination may also be needed.

If the sediment samples show contamination in the catch basin, then soil borings would be needed to determine the extent of migration of contamination. The need also depends on whether the basin is lined, which retard the migration of contaminants down to the groundwater.

If elevated values of the gross beta or gross alpha activities are found in any of the samples, then additional analyses would be needed to identify the isotopes responsible for the activity.

11.5 SITE 175 — BUILDING 3801, HELICOPTER MAINTENANCE

11.5.1 Site History

The Site is located on Snake Hill Road between Picatinny Lake and Lake Denmark (Fig. 11.6). Building 3801 is reported to be used regularly for helicopter maintenance.

11.5.2 Geology and Hydrology

The Site is situated on a gentle slope of an unnamed mountain. The local geology on the Site is not known. It is estimated that the Site is underlain by glaciofluvial types of silts, sands, and gravels; a till; and Precambrian gneiss.

Soil on the Site belongs to Rockaway Series (Wingfield 1976). The soil is moderately well drained, commonly underlain by a gravelly loam or gravelly sandy loam. A dense firm fragipan is present in the lower part of the subsoil. Groundwater has a tendency to move laterally over the fragipan.

The hydrology condition under the Site is not known. Groundwater flow is estimated to follow the land topography.

11.5.3 Existing Contamination

During interviews, PTA personnel reported that greases, oils, and JP4 fuel were used in the building. The building has floor drains, which lead to a swamp northeast of the building. Drums were reportedly stored outside. No more information is available to ANL.

11.5.4 Proposed RI Plan

11.5.4.1 Phase I

A field inspection should be conducted around the building to locate areas with signs of contamination and to locate the drain outfall in the swamp. One surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each visibly contaminated area and analyzed for TCL volatiles and TCL semivolatiles. The drums

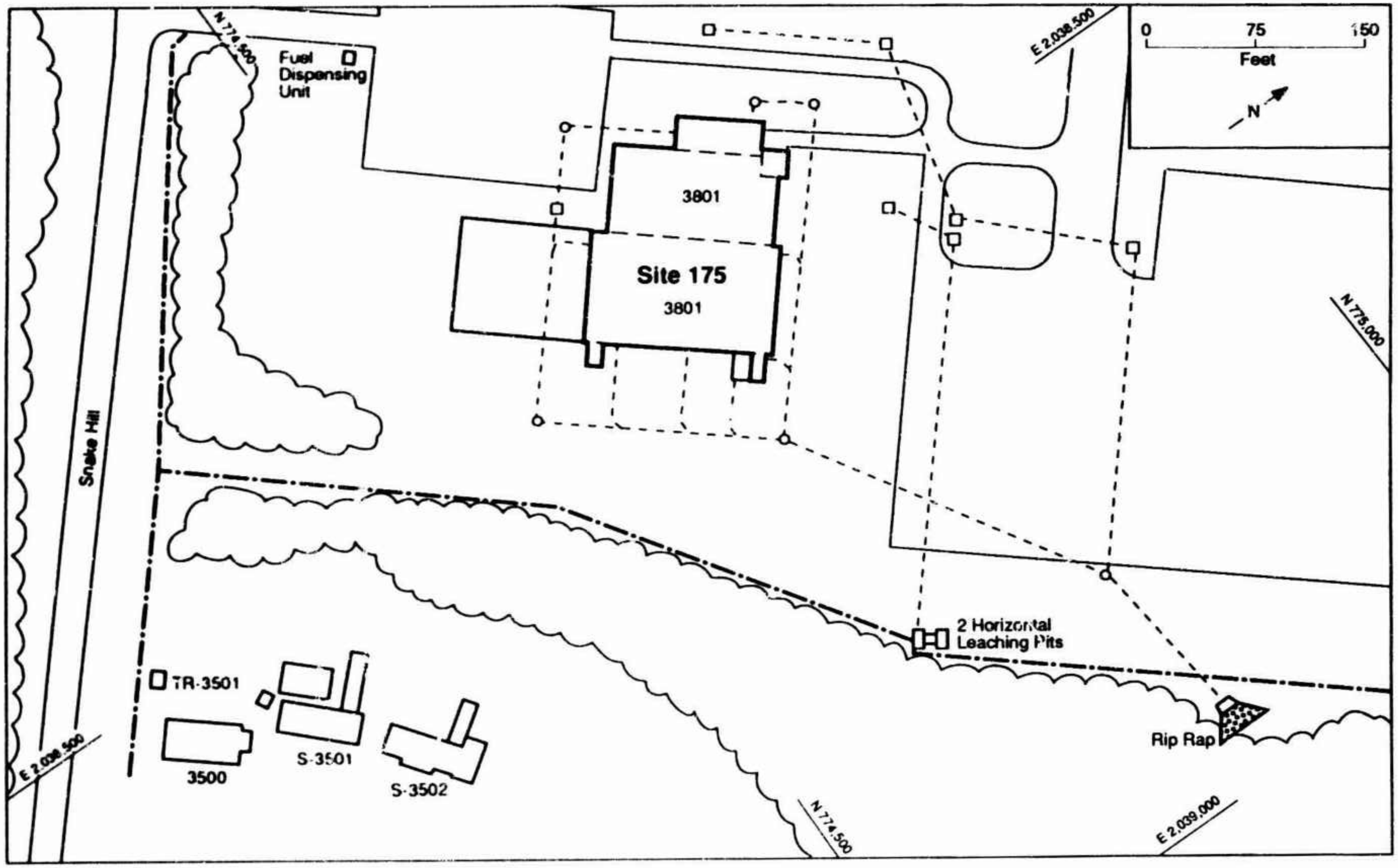

FIGURE 11.6 Layout of Site 175, Helicopter Maintenance at Building 3801 (Source: Adapted from USACE 1984b)

stored outside the building should be inspected for leaks. If a leaky drum is located, its contents should be sampled. Also, one surface soil sample should be collected to a depth of 0.3 m (1 ft) near each leaky drum and analyzed for TCL volatiles and TCL semivolatiles. In addition, two surface-water samples and two sediment samples should be collected to a depth of 0.3 m (1 ft) from the swamp area receiving the Site effluent and analyzed for TCL volatiles and TCL semivolatiles. If contamination is not indicated, no further action is needed.

11.5.4.2 Phase II

If significant contamination is found, additional samples should be collected to delineate the extent of the contamination. The locations and types of samples depend on the Phase I results.

12 AREA K: NAVY HILL

12.1 INTRODUCTION

Area K contains five Sites on the east central part of the Arsenal. A reaction Motors Rocket Fuel test Site is included along with an old sewage treatment plant. The 1926 explosion occurred in the Area. Possible contaminants include rocket fuel components, PCBs, metals, and used oil.

12.2 SITE 3 — REACTION MOTORS/ROCKET FUEL TEST AREA (1500 SERIES BUILDINGS)

12.2.1 Site History

Site 3, the Reaction Motors/Rocket Fuel Test Area (1500 series buildings), is located in the northern part of PTA on Hart Road. Most of the 12-ha (30-acre) Site consists of forest, although swampy areas are also present. Functions of some of the 36 buildings reported to be on the Site are listed in Table 12.1. Figure 12.1 shows the locations of buildings and other details of the Site that existed in 1975. A reservoir is located about 60 m (200 ft) northeast of the Site. The reservoir drains through a drainage channel to the pond on Site 2 (USACE 1984a; Gaven 1986, Attachment B; Dames & Moore 1989).

A series of aerial photos of the Site area taken every few years from 1940 on show no activity in 1940. By 1951, buildings and activity were visible in the main part of the Site. The large berm shown in Fig. 12.1 was already present. The smaller satellite area in the western part of the Site first appeared in the 1963 photo, which is shown in Fig. 12.2. The Site area was masked out in the 1957 photo (Sitton 1989). The arrow in Fig. 12.2 locates an area that appears stained and excavated in the 1951 aerial photo.

The Site was used for rocket testing and other purposes. Exhausts from the rocket test firings impinged on the rock paved area in back of the buildings. Rocket test firing at the Site ceased in the late 1960s. The eastern part of the Site was reported to be used for the mixing, baking, pressing, and filling of various types of pyrotechnic compounds. The static test area for rocket engines is located in the western part of the Site. The Site is currently active and is used for testing of various types of munitions and solid fuel engines containing nitroglycerin and magnesium. Shells containing depleted uranium (DU) and beryllium have been tested near Bldg. 1505. Chemical components used at the site include oxidants such as nitrates and chromates; organics such as acetone, ethyl alcohol, and methyl ethyl ketone; and binders such as vinyl acetate, polystyrene, and epoxy. In 1976, it was reported that Bldgs. 1504A, 1507, 1507B, 1508, 1512B, 1519, and 1520 may contain toxic or hazardous materials. UXO debris resulting from the 1926 Lake Denmark explosion may be on the Site (USATHAMA 1976; Gagas 1980a, 1980b; Gaven 1986, Attachment B; Ward 1988; Dames & Moore 1989).

TABLE 12.1 Designations of Buildings in 1975 in the Site 3 Area

Bldg. No.	Designation	Bldg. No.	Designation
1500	Water tower	1510A	Storage
1500A	Pump house	1510B	Storage
1501	Electronic equipment facility	1510D	Inactive sentry station
		1511	Conditioning
1502	Compressor house	1512	Pyrotechnics lab
1503	Power conditioning	1512A	Gas cylinder storage
1504	Storage and field office	1512B	Magazine
		1513	Pyrotechnics and metals bldg.
1504A	Magazine		
1505	Fire control	1514	Chemical storage bldg.
1505A	Test stand	1515	Elec. and photo. research lab
1505B	Test stand		
1505C	High-explosive set-back device test	1516	Steam meter road
		1517	Pump house, vacuum
1505D	Thrust stand	1517A	Altitude chamber
1505E	Spin test facility	1518	Test chamber
1505F	Spin test facility	1519	Magazine
1506	Loading	1520	Magazine
1507	Magazine	1521	Component preparation bldg.
1507B	Magazine	1522	Latrine
1508	Magazine	1527	Acid storage
1509	Pyrotechnics lab	1528	Fuel storage
1509A	Storage	1529	Storage
1510	Pyrotechnics office		

Source: PTA 1975.

During interviews in 1980, PTA personnel reported that Bldg. 1501 contained 3 boxes with cotton waste and about 4 kg (10 lb) of beryllium metal and 400 lb of asbestos in burlap bags in poor condition (Vogt 1980). Picatinny personnel reported during 1989 interviews with ANL staff that discharges from Bldg. 1509 enter the swamp by the building. Oils and similar materials were reported to be dumped off the north-northeast end of Bldg. 1518 until 1960. It was also reported that spraying the Site area with pesticide for weed control occurred in the past possibly two times per year. Small amounts (milligram quantities) of beryllium metal and mist were reportedly spilled in the area. Before 1960, rocket engines being tested reportedly blew up.

Several buildings in the Site area are used to temporarily store hazardous waste or materials. A summary of the types and amounts of waste generated on the Site annually is given in Table 12.2. Building 1511 is scheduled for removal under TECUP (Solecki 1989b).

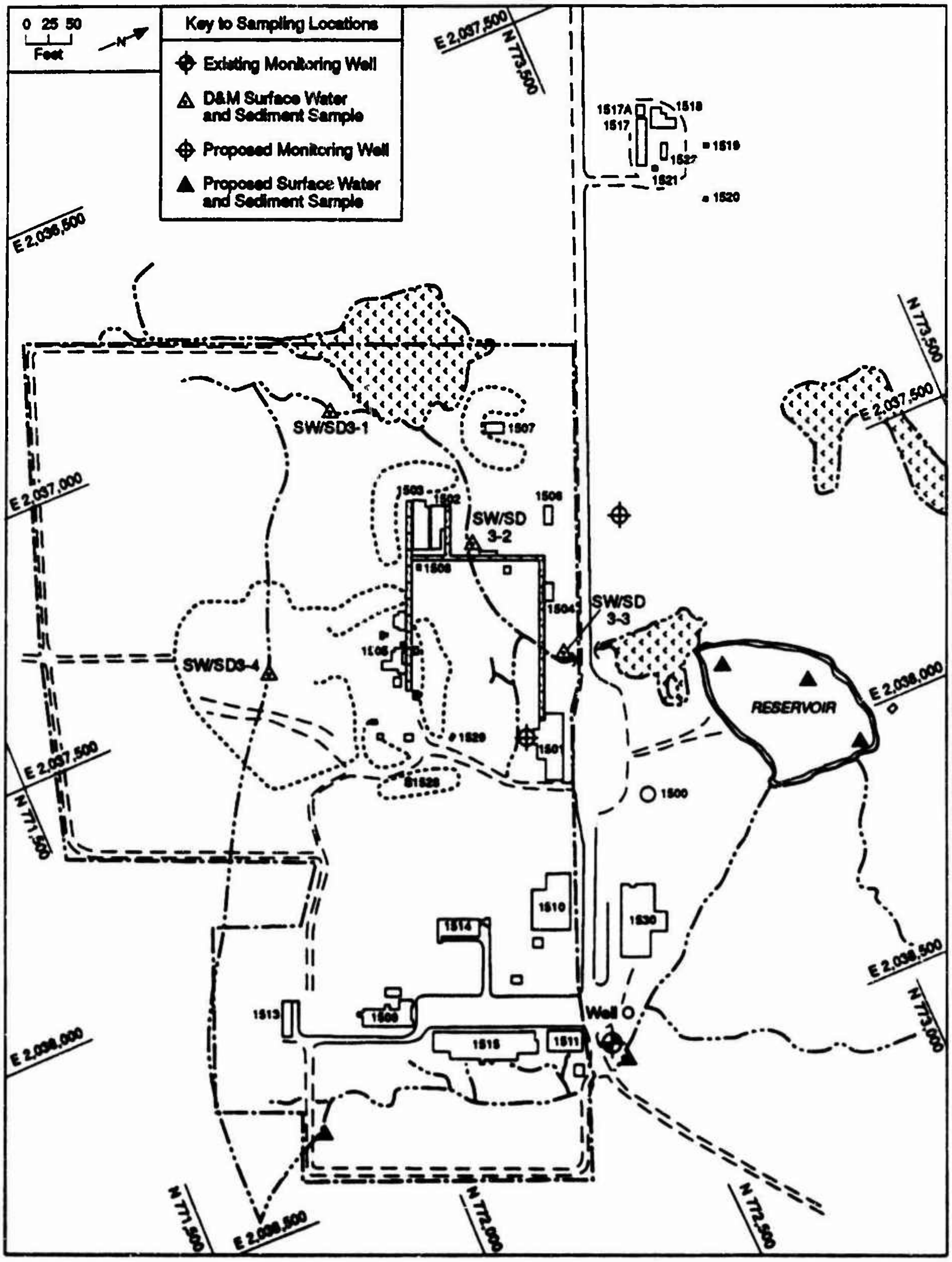

FIGURE 12.1 Layout of Site 3, the Reaction Motors/Rocket Fuel Test Area (1500 series buildings) (Sources: Map adapted from PTA 1975 and USACE 1984b; sampling locations from Dames & Moore 1989)

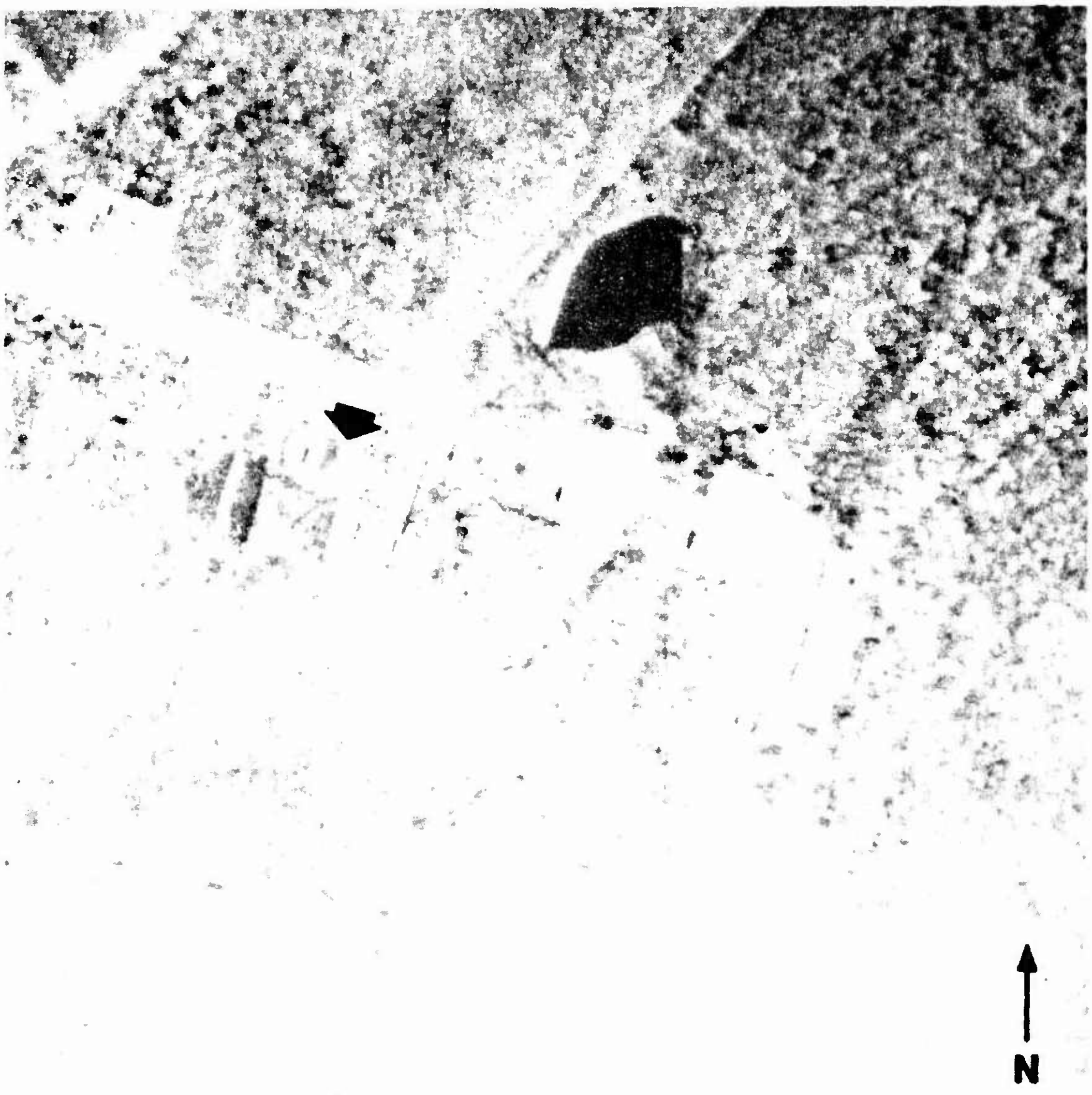

FIGURE 12.2 Aerial Photograph of Site 3 in May 1963 (the arrow indicates the apparently excavated and stained area shown in a 1951 photo) (Source: Sitton 1989)

Closure plans have been prepared by ARDEC (undated) for Bldgs. 1515 and 1518. These buildings will be closed in accordance with New Jersey hazardous waste regulations because they never had interim status. Building 1515 contains offices and laboratories for testing of flares and pyrotechnic materials. It also has a hearth room containing a pit in which flares are burned. Residues are periodically removed from the hearth. The facility is currently in use. Building 1518 contains two steel high-altitude test chambers for the testing of flares. The chambers are periodically cleaned out by washing residues off the chamber walls. Wash water went into a drain and then to a drainpipe. The south chamber was last used about 15 years ago; the north one remains in use (ARDEC undated).

TABLE 12.2 Summary of Types and Annual Amounts of Hazardous Material or Waste Generated in the 1500 Area

Location (bldg.)	Storage Class	Hazardous Material or Waste: Type	Hazardous Material or Waste: Amount Generated	Comments
1501	Satellite	Oily rags	14 lb/yr	Generated from shop activity.
1505	Satellite	Acetone	4 gal/yr	Generated by test activity.
1506A	90 Day	Scrap explosive	50 lb/yr	Stored in red cans in storage shed. Scrap generated at test firing range.
1506	Satellite	Acetone	15 gal/yr	Loading Building.
1508	90 Day	Oily rags Acetone Acetic acid	14 lb/yr 4 gal/yr 10 gal/yr	
1509	Satellite	Pyrotechnic waste in motor oil	5 lb in 48 gal/yr	Generated from pyrotechnic item processing.
		Rags contaminated with oil and pyrotechnics	300 lb/yr	Rags stored outside on wood pallet.
1512	Satellite	Photo fixer Photo developer 35-mm film	3 gal/yr 3 gal/yr 200 ft/yr	Stored inside building. Generated from R&D.
1514	90 Day	Excess chemicals	500 lb	Stored inside. Generated from storage area.
1515	Satellite	Vacuum oil (from maintenance)	5 gal/yr	From portable machines used in building.
		Pyrotechnic waste (Poison B solid NOS)	16 lb/yr	Generated and stored at flare tunnel.

TABLE 12.2 (Cont'd)

Location (bldg.)	Storage Class	Hazardous Material or Waste: Type	Hazardous Material or Waste: Amount Generated	Comments
1515 cont'd	Waste Management Area (Pit)	Pyrotechnic residue (aluminum oxide, magnesium oxide, heavy metals, - nonhazardous)	15 lb/yr	Stored in flare tunnel. Analyzed and awaiting disposal.
1518	Waste Management Area	Pyrotechnic residue (aluminum oxide, magnesium oxide, heavy metals)	6 lb/yr	From vacuum chamber. Used 4-5 times per year. Residue analyzed and awaiting disposal.

Source: Solecki 1989b.

A recent plant survey listed three PCB-containing transformers at Site 3. One is on a pad near Bldg. 1503. In the past, the transformer, with 1,493 ppm PCBs, was leaking (there is soil staining under the transformer). It has been repaired and is scheduled to be replaced in 1990 with a non-PCB transformer. Another transformer containing 99 ppm PCBs is mounted on a pole near Bldg. 1512. It is listed as in moderate condition with a slight risk potential. The third transformer is on a pole near Bldg. 1501. It contains 111 ppm PCBs and presents a moderate risk potential (PTA 1988a; Solecki 1990; Reibel 1990).

12.2.2 Geology and Hydrology

The bedrock underlying the Site is Precambrian gneiss. No information is available on the thickness of glacial till overlying the bedrock at the Site; however, Dames & Moore (1989) is reported that gentler slopes of the eastern side of the main valley at PTA contain 3-8 m (10-25 ft) of till.

Surface soils in most of the Site consist of the Rockaway Series, a moderately well drained acidic gravelly loam or gravelly sandy loam. The lower part of the soil is a dense fragipan over which groundwater tends to move laterally. Permeabilities range from 1.5 to 5.0 cm/h (0.6 to 2.5 in./h). The western part of the Site contains surface soils of the Ridgebury Series. This soil is a poorly drained acidic soil with a very stony loam surface and an underlying fragipan. Permeabilities are the same as for the Rockaway Series (USATHAMA 1976).

Surface contours of the Site show that the ground slopes downward toward the north. A drainage ditch in the western portion of the Site carries surface water northeast from the site into the nearby reservoir (Fig. 12.1). Another drainage ditch east of the Site carries surface water northwest into the nearby reservoir. The presence of permanent surface water on the Site (possibly groundwater discharge) is indicated by the areas of swamp (USACE 1984b; Dames & Moore 1989).

No information is available on the direction of groundwater flow at the Site. If the flow followed the surface topography, then groundwater would flow northward. Observations from well O, located about 120 m (400 ft) east of the Site along Hart Road (Fig. 12.1) on the 265-m (870-ft) elevation contour, show a depth to groundwater of 1.2 m (3.9 ft). No other monitoring wells have been installed near the Site (USAEHA 1984b).

12.2.3 Existing Contamination

In 1980, testing of modified M 422 rounds, which contained rings of beryllium metal, contaminated an area of the Site near Bldg. 1505 with beryllium metal. Seven soil samples were collected in the area and analyzed for beryllium. Five of the samples contained concentrations of 0.6-1.9 ppm, one sample contained 6.8 ppm, and one contained 30.9 ppm beryllium. A replicate analysis of the most contaminated sample gave a value of 10.7 ppm beryllium. A background sample contained 1.0 ppm beryllium. Figure 12.3 shows the area sampled and the location of the background sample (Gagas 1980a, 1980b; Hanson 1980).

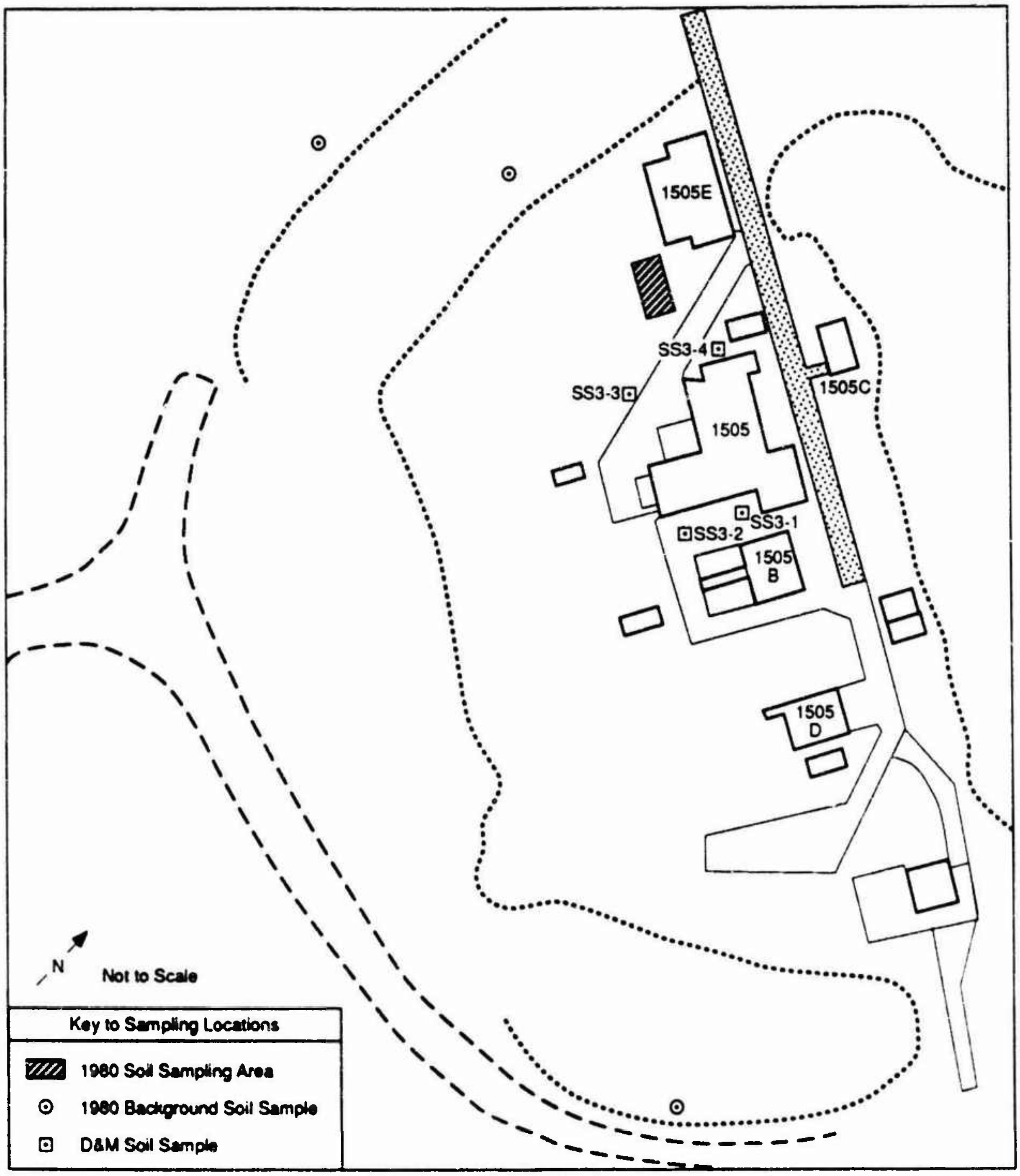

FIGURE 12.3 Soil Sampling Locations near Building 1505 at Site 3 (Source: Adapted from Hanson 1980)

The data suggest that some beryllium contamination may be present in the soil. It is not clear whether the contamination is due to contact between pieces of beryllium metal and soil particles or the possible presence of beryllium compounds in the soil resulting from the test firings.

Soil samples were taken at four different locations around Bldg. 1505 in April 1988 and analyzed for chromium, barium, sulfate, nitrocellulose, nitrite, and nitrate. The sampling locations are shown in Fig. 12.3. Chromium was found in all the samples at concentrations ranging from <1.3 ppm in sample SS3-4 to 31 ppm in sample SS3-3. Nitrate was found in only one sample, SS3-1, at a concentration of 25.2 ppm. Nitrocellulose at a concentration of 310 ppm was found in soil sample SS3-2 but not detected in the other samples (Anderson 1988a). The presence of nitrocellulose in the one soil sample suggests that uncombusted rocket propellants may contaminate the soil where rocket motors and propellants were tested. In particular, the data suggest that propellants were not completely combusted during testing.

Surface water and sediment samples were taken in April 1988 at four locations (Fig. 12.1) and analyzed for chromium, barium, sulfate, nitrocellulose, nitrite, and nitrate. Chromium and barium were the only species detected in all the sediment samples; concentrations ranged from 4.6 to 9.8 ppm for chromium and from 19 to 33 ppm for barium. The other parameters were not detected in any of the sediment samples.

Nitrate was found at concentrations ranging from 0.393 to 0.523 mg/L (as NO_3) in surface water samples SW3-1 through SW3-3. Nitrite was not detected in these samples. Nitrate (and nitrite) were not measured in sample SW3-4. Sulfate was found at concentrations from 11.5 to 15.4 mg/L in samples SW3-1 through SW3-3, and 13,000 mg/L sulfate was found in sample SW3-4. This is an extremely high concentration in that it is higher than the other values by factors of more than 1,000; as a result, the SW3-4 location should be sampled again to verify the value. Nitrocellulose was not detected in any of the water samples at a detection level of 0.55 mg/L. Chromium was detected at concentrations of 3-4.8 μg/L in samples SW3-3 and SW3-4 but not detected in the other samples. Nitrite was not detected in any of the samples in which it was measured. Barium was found at concentrations up to 22.7 μg/L in samples SW3-2 and SW3-3 but not detected in the others.

Except for sulfate in sample SW3-4, the data show no evidence of surface water contamination. However, more data are needed on background concentrations of nitrate to see if the measured values are at background levels or represent contamination. Also, measurements of other chemical parameters such as volatile organics and other metals are needed.

The only well at the Site is well O located near Bldg. 1530 (Fig. 12.1). Results of measurements on concentrations of metals and other parameters in water samples taken from the well in 1983 and 1985 are summarized in Table 12.3. The samples taken in March 1985 show elevated concentrations of iron (138 mg/L) and manganese (3.5 mg/L); the samples taken in 1983 and on other dates in 1985 show much lower iron and manganese concentrations, up to 0.77 mg/L iron and 0.4 mg/L manganese. Most other metals were not detected. In 1983, one sample was analyzed for purgeable organics; none were detected (USAEHA 1984b).

TABLE 12.3 Selected Analytical Results for Groundwater Collected from Well O on Various Sampling Dates (mg/L)[a]

Parameter	7/12/83	3/11/85	7/2/85	9/30/85
Antimony	ND	ND	<0.001	<0.200
Arsenic	ND	0.003	<0.001	<0.001
Barium	ND	<0.10	<0.100	<0.100
Beryllium	ND	ND	<0.005	<0.005
Cadmium	<0.01	<0.005	<0.005	<0.005
Calcium	11.9	ND	2.3	6.2
Chromium	<0.025	0.035	<0.025	<0.025
Chloride	ND	5.3	6.2	2.7
Copper	ND	ND	<0.020	<0.020
Cyanide	<0.010	<0.010	<0.010	<0.010
Fluoride	ND	0.54	0.47	0.37
Iron	<0.10	138.1	0.769	0.770
Lead	<0.10	0.231	<0.001	<0.001
Magnesium	1.4	ND	2.1	1.2
Manganese	0.4	3.51	0.232	0.139
Mercury	ND	<0.0002	<0.001	<0.001
Nickel	ND	ND	<0.040	<0.040
Nitrogen, Nitrate	ND	<0.1	0.79	.098
Phenols	ND	<0.05	<0.050	<0.05
Selenium	ND	<0.001	<0.001	<0.001
Silver	ND	<0.010	<0.010	<0.010
Sodium	11.9	7.1	6.5	6.3
Sulfate	ND	12	<10	<10
Thallium	ND	ND	<0.001	<0.100
Zinc	ND	ND	<0.005	0.011
pH (pH units)[b]	ND	6.8	7.2	7.1
Specific conductance (μmho/cm)[b]	ND	100	100	77
Temperature (°C)[b]	ND	ND	12	17.5
Total dissolved solids	ND	ND	103	86
Total organic carbon	ND	1.81	5.58	2.32
Total organic halogens	ND	<0.010	<0.010	0.020

[a]Results are in mg/L except as noted for pH, conductance, and temperature; ND means the parameter was not detected.

[b]Field measurements.

Sources: USAEHA 1984b; Pugliese 1985.

The location of well O is such that it very likely does not sample groundwater downgradient from the Site. Also, although the screened interval is not known for this well, it is likely to be below the top of the water table. This would be the case for a screen extending from the bottom of the 8.8-m (29-ft) deep well (Dames & Moore 1989). As a result, concentrations of contaminants migrating down from the surface in the general area of the well could be higher in the top region of the groundwater than at the sampled depths (see Sec. 3.3). Because of this aspect and the location of the well, more monitoring wells are needed on or near the Site to determine the direction of groundwater flow and to measure concentrations of contaminants in water downgradient from the Site.

12.2.4 Closure Plan

RCRA closure plans have been prepared for Bldgs. 1515 and 1518 (ARDEC undated).

For Bldg. 1515, the closure plan prescribes the following actions:

- Wash the walls, floors, ceiling, hearth(s), exhaust stack, and trench with detergent and rinse with water. Analyze the wash water for EP toxic metals.

- Collect and analyze 10 wipe samples on cleaned areas. Locations, analytes, and other details are given in ARDEC (undated).

- Collect a core sample from and a soil boring sample beneath the floor of the hearth. Analyze the samples for EP toxic metals.

For Bldg. 1518, the closure plan prescribes the following actions:

- Remove powdery residue from the inside of the chambers, wash them with detergent, and rinse them with water.

- Analyze wash water for EP toxic metals.

- Collect and analyze five wipe samples from each of the two chambers. Locations, analytes, and other details are given in ARDEC (undated).

Collect one sediment sample from the outfall location of the drainpipe from Bldg. 1518 (if the outfall can be located). Analyze the sample for priority pollutant metals and fluoride.

12.2.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, the RI sampling plan may be modified as new data become available.

12.2.5.1 Phase I

If it has not already been done, a thorough field inspection of the Site should be done to locate UXO and other metal debris from the 1926 Lake Denmark explosion. If appropriate, geophysical survey methods or metal detectors should be used to search for buried UXO, drums, and containers. Particular attention should be paid to forested and other uncleared areas. UXO, drums, and containers should be removed and disposed of appropriately with the drums and containers sampled before removal.

A search should be made to locate all underground storage tanks. Any tank with unidentifiable contents should be sampled and analyzed. The tank integrity should be tested if the tanks appear to be in a condition to withstand the tests. The contents of leaking tanks, corroded tanks, and tanks that will not be used should be removed. After removal of the contents, consideration should be given to closure of the tanks in accordance with all applicable state and federal regulations. For underground tanks, closure requires sampling and analyses of the surrounding soil (Gaven 1986, Attachment Q).

A total of nine surface soil samples should be collected to a depth of 0.3 m (12 in.) from the following locations:

- Two samples from the former stained area marked with an arrow in the 1983 aerial photo (Fig. 12.2). The exact sampling locations will be determined by field inspection using the 1951 aerial photo as a guide (Sitton 1989). These samples should be analyzed for TCL metals, TCL semivolatiles, explosives, herbicides, PCBs, cyanide, fluoride, nitrate, gross alpha, and gross beta.

- One sample behind each of the locations of the test stands in Bldgs. 1505A, 1505B, 1505C, and 1505D. Exact locations will be chosen by field inspection. Samples are needed from these locations because the list of parameters analyzed by Dames & Moore (1989) in the soil samples collected in the same area was so limited. The samples should be analyzed for the parameters listed above.

- One sample from the area of the waste storage pallet outside Bldg. 1509 (Table 12.2). The exact location will be determined by field inspection. Stained areas should be sampled. The samples should be analyzed for explosives, TCL volatiles, TCL semivolatiles, TCL metals, fluoride, and nitrate.

- Two samples by the north-northeast end of Bldg. 1518. The exact locations will be determined by field inspection. Analyze for TPH, TCL metals, and TCL volatiles and TCL semivolatiles. Samples are needed near Bldg. 1518 because of the dumping reported by PTA personnel.

Sediment and surface water samples should be collected from two locations in the drainage channel in the eastern part of the Site and from locations SW/SD3-2 and SW/SD3-3 sampled by Dames & Moore (1989). Sampling locations are shown in Fig. 12.1. The samples should be analyzed for explosives, TCL metals, herbicides, TCL volatiles, TCL semivolatiles, PCBs, fluoride, cyanide, nitrate, gross alpha, and gross beta. The water samples should also be analyzed for the macroparameters. The Dames & Moore locations should be resampled because the list of parameters analyzed for in the original samples was insufficient. A water sample should also be taken from location SW/SD3-4 and analyzed for sulfate, as a check on the previously measured high value.

Sediment and surface water samples should also be collected from three locations (Fig. 12.1) in the reservoir downgradient from the site and analyzed for explosives, TCL metals, herbicides, TCL volatiles, TCL semivolatiles, PCBs, fluoride, cyanide, nitrate, macroparameters (water samples only), gross alpha, and gross beta. These analyses are needed because no sediment or water quality data are available for the reservoir. (The samples collected at the reservoir outfall by Dames & Moore [1989] were not analyzed).

Two more monitoring wells are needed to assess the direction of groundwater flow and the extent of groundwater contamination at the Site. Tentative locations of the wells are given in Fig. 12.1. The wells should be screened so that the screened interval extends partly above and mostly below the water table.

Beginning at least two weeks after well completion, samples should be taken in two successive quarters from the two new wells and well O and analyzed for TCL volatiles, TCL semivolatiles, TCL metals, pesticides, PCBs, explosives, cyanide, fluoride, nitrate, gross alpha, gross beta, and macroparameters. Water elevations should be measured when the samples are taken. All wells should be sampled on the same day in each quarter.

To test for airborne contamination, air samples should be collected during dry periods behind Bldg. 1505 in the summer and fall and following the testing of solid fuel engines. The samples should be analyzed for explosives, TCL metals, and TCL volatiles.

12.2.5.2 Phase II

If the Phase I surface soil samples show contamination at any of the samples locations, additional surface soil samples would be needed to characterize the type and extent of contamination. Additional air samples may also be needed. The sampling locations and parameter list depend on the results of the Phase I analyses.

Additional surface water and sediment samples will be needed from the reservoir and streams on the Site if the respective Phase I sediment samples show contamination. The locations of these samples, which would be needed to determine the type and extent of contamination, and the analytes would depend on the results of the Phase I sample analyses.

If elevated levels of gross alpha or gross beta are found in any of the samples, additional samples and analyses would be needed to determine the extent of the contamination and the radionuclides responsible for the elevated activity.

The need for soil borings and additional monitoring wells will depend on the results of the Phase I surface soil, sediment, surface water, and groundwater analyses.

12.3 SITE 48 — BUILDINGS 3314 AND 3315, 90-DAY WASTE ACCUMULATION AREAS

12.3.1 Site History

Building 3315 is located next to the firehouse in the east central part of PTA. Figure 12.4 gives details of the Site. The building, which was constructed in 1931 for use as a self-help vehicle maintenance shop, is also used for storage and training by the fire department. Vehicle maintenance activities at the building involved the use of oils, greases, and degreasing agents. Two 55-gal drums of waste oil, which will be transferred to Bldg. 3100 for off-post disposal, are stored outside the building. The Site generates waste at the rate of 38.7 L/mo (10 gal/mo) each of used motor oil and transmission and brake oils and 11 kg/mo (25 lb/mo) each of oily rags, oil filters, and oily absorbent materials. These are all stored outside on wooden pallets. During peak use of the garage, during the spring and fall, the rate of generation of waste is as high as 100 gal/mo (Gaven 1986; Anderson 1988b; Reibel 1988; Foster Wheeler 1988b; Solecki 1989c).

At present, Bldg. 3315 is used as a less-than-90-day accumulation area for waste oil. RCRA closure plans have been prepared for this Site by Foster Wheeler because PTA cannot document that hazardous wastes have been stored at the building for less than 90 days at all times in the past. The closure is scheduled to be a clean closure (Gaven 1986; Anderson 1988b; Foster Wheeler 1988b).

Building 3314, which was built in 1940, was used for maintenance and storage. After 1980, waste automotive oil, oil filters, oil-soaked rags, and other wastes from vehicle maintenance activities in Bldg. 3315 were stored in the building. There is no documentation of the amounts stored or the duration of storage. Storage of materials in the building stopped in 1986. A closure plan has been prepared for Bldg. 3314 because hazardous wastes were stored in the building in the past for more than 90 days. The closure is scheduled to be a clean closure (PTA 1975; Foster Wheeler 1988a). Both Bldgs. 3314 and 3315 are to be closed in accordance with New Jersey hazardous waste regulations because they never had interim status.

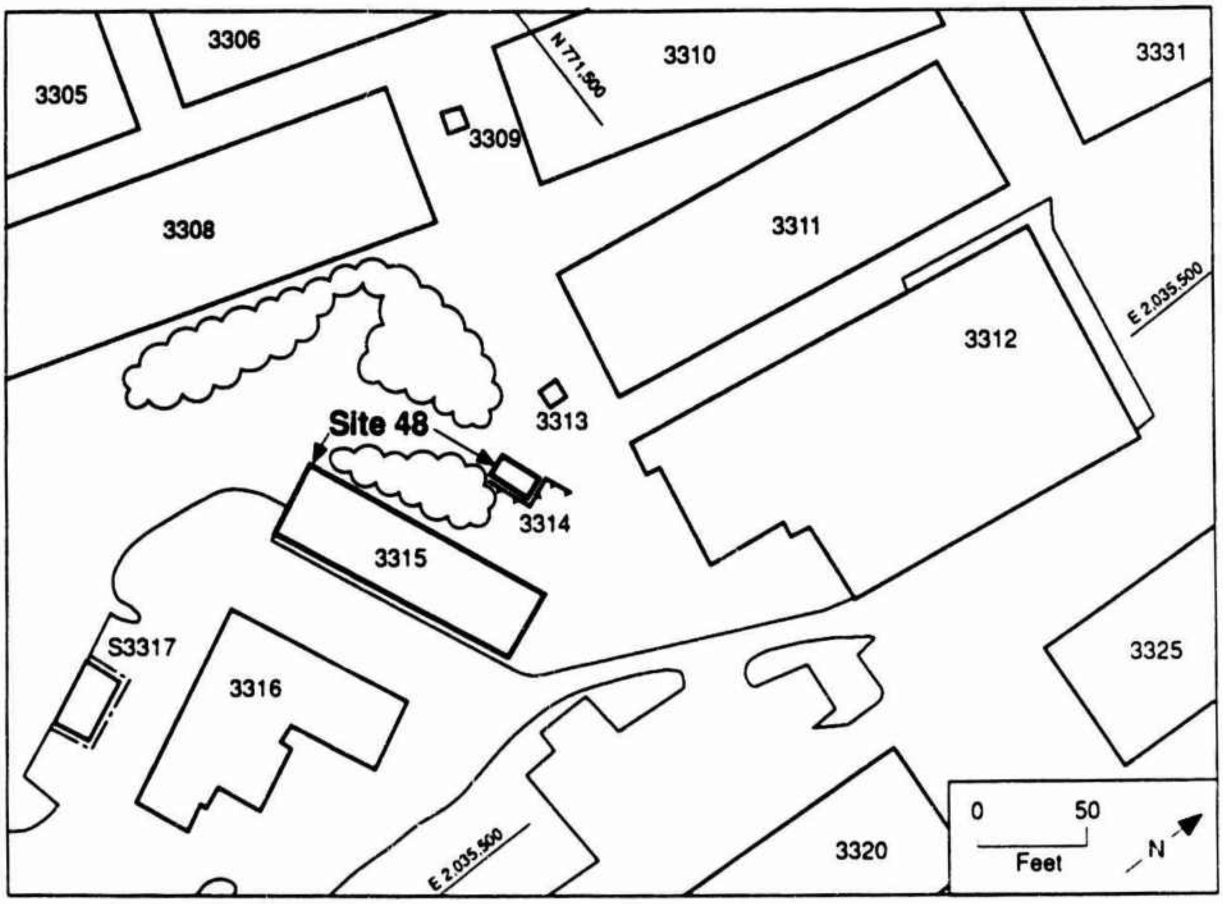

FIGURE 12.4 Layout of Site 48, 90-Day Accumulation Areas at Buildings 3315 and 3314 (Source: Adapted from USACE 1984b)

12.3.2 Geology and Hydrology

Bedrock underlying the Site consists of Precambrian gneiss. Regional studies suggest that the glacial till overlying the bedrock is from 3 to 8 m (10 to 25 ft) thick at the Site. The surface soils belong to the Rockaway Series. These consist of moderately well drained acidic upland soils with permeabilities ranging from 1.5 to 5.0 cm/h (0.6 to 2.0 in./h). Subsoils are gravelly loam or gravelly sandy loam. Underlying these is a dense fragipan over which water tends to move laterally (USATHAMA 1976; Dames & Moore 1989).

Surface water runoff would be expected to flow off the site downslope to the northwest. No data are available on the depth to or flow direction of groundwater at the Site.

12.3.3 Existing Contamination

No data are available on existing contamination of the soil surface water runoff or groundwater at the Site. Field inspection of the Site indicated the existence of a small area of stained soil near the building.

12.3.4 Closure Plan

The revised RCRA closure plan for Bldg. 3315 includes transfer of all stored hazardous waste to Bldg. 3100 for temporary storage until off-post disposal. One surface soil sample should be taken to a depth of 0.15 m (6 in.) from the area beneath the storage pallet that is visibly the most stained. The sample should be analyzed for priority pollutant metals, EP toxicity for metals (if necessary), and TPH. A soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from the same location and analyzed for VOCs. Additional soil samples would be needed if the soil is found to be contaminated (Foster Wheeler 1988b, 1989; Solecki 1989a).

The revised RCRA closure plan for Bldg. 3314 includes sealing the entire building and high-pressure steam cleaning the walls and floor. Two samples of the condensate and rinsate will be collected and analyzed for priority pollutant metals. Chip samples will be taken from two locations in the floor of the building and analyzed for priority pollutant metals (Foster Wheeler 1988a, 1989; Solecki 1989a).

12.3.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If clean closure is not possible, the proposed RI plan may have to be modified as new data become available.

12.3.5.1 Phase I

In addition to the closure plan sampling, soil samples should be taken to a depth of 0.3 m (12 in.) at several locations outside Bldgs. 3314 and 3315. One sample should be collected from beneath each drain pipe that projects through the building walls and drips outside on the ground, as well as from each area of soil staining. (This includes areas around the storage pallet but excludes the area under the pallet because this area is included in the closure sampling plan.) Exact locations will be determined by field inspection of the areas around each building. Areas most likely to be contaminated should be sampled. The soil samples should be analyzed for TCL volatiles, TCL semivolatiles, lead, and chromium.

12.3.5.2 Phase II

The need for additional soil samples will depend on the results of the analyses of the Phase I surface sampling program. Additional sampling may also be needed if clean closure is not possible for either building.

12.4 SITE 172 — PARKING AREA ACROSS FROM BUILDING 3328

12.4.1 Site History

Building 3328 and a large parking area across the street on Lake Denmark Road are located southeast of Picatinny Lake in the central region of PTA, about halfway between the lake and the southeastern PTA boundary. A map of the Site is shown in Fig. 12.5. Building 3328 was built in 1939 as a storage building. It has been used as a general-purpose warehouse and a calibration facility, and was recommended for use as a meteorological laboratory. Its estimated life, as of 1971, was until 2000.

12.4.2 Geology and Hydrology

The elevation at the Site is 980 ft above MSL. Soils in the area belong to the Ridgebury and Rockaway Series, and the underlying bedrock is Precambrian gneiss. Land contours in the area indicate that surface water and runoff from the Bldg. 3328 area would flow either east toward the 1500 area, with its nearby reservoir, or west toward Picatinny Lake.

12.4.3 Existing Contamination

During interviews with ANL staff, PTA personnel reported that the parking area across from Bldg. 3328 was made to look old by spilling oil on it for an inspection during the Vietnam War. All types of oil, possibly some with PCBs, were spilled.

12.4.4 Proposed RI Plan

12.4.4.1 Phase I

The parking lot and area around Bldg. 3328 should be visually inspected for staining. Two asphalt chip samples should be collected from each stained area on the parking lot. Four surface soil samples should be collected to a depth of 0.3 m (1 ft) from each stained area near the parking lot.

The chip and surface soil samples should be analyzed for PCBs. If no PCBs are detected in any of the samples, no further work is necessary.

12.4.4.2 Phase II

If significant concentrations of PCBs are found in the Phase I samples, then one soil boring should be drilled at the location of each contaminated sample on or next to the paved area. Samples should be collected from the borings and analyzed for PCBs.

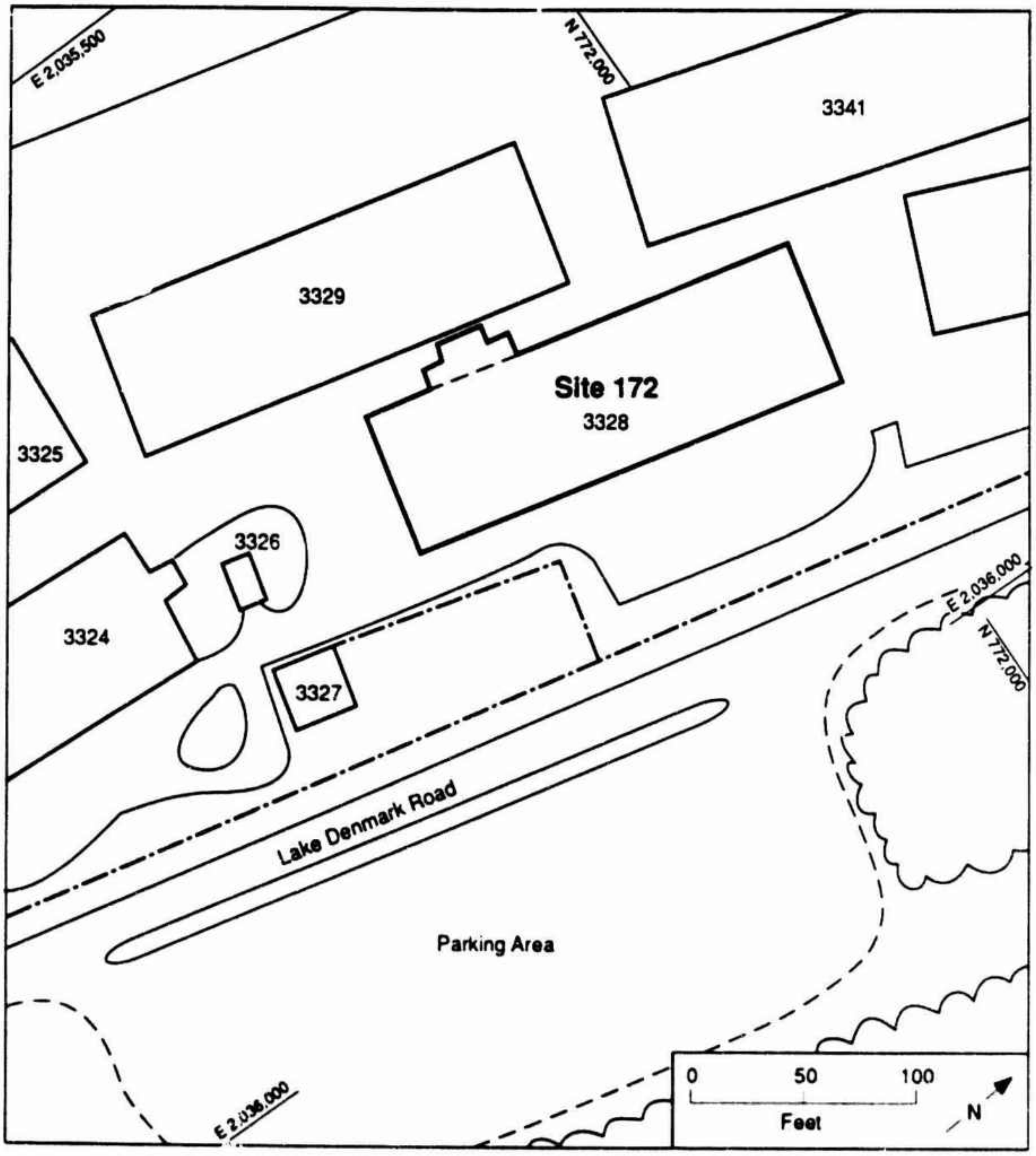

FIGURE 12.5 Layout of Site 172, the Parking Area across from Building 3328 (Source: Adapted from USACE 1984b)

12.4.4.3 Phase III

If the subsurface soil samples show significant concentrations of PCBs, then monitoring wells should be installed to determine whether PCBs have migrated into groundwater.

12.5 SITE 173 — BUILDING 3404

12.5.1 Site History

Building 3404 is located east of Picatinny Lake in the central region of PTA. A map of the Site is shown in Fig. 12.6. Building 3404 was built in 1952 as a maintenance shop. Its early use is not known, but it has been used as a chemistry laboratory and as an administration and supplies building.

The closure plan for Bldg. 3404 (Foster Wheeler 1988a) indicates that its use has changed several times since it was built. The building was originally designated as a solid propellants laboratory, but no records of its use before 1977 are available. From about 1977 to 1987, it was used to store packaging supplies (wood, paper, cardboard boxes, etc.) in preparation for mechanical testing, which never was implemented. In 1987, all laboratory equipment and furniture was removed and replaced by metal shelving. Since then, Bldg. 3404 has been used by the National Guard to store field equipment (e.g., uniforms, electronics, and radio equipment).

PTA has claimed an exemption from RCRA permitting requirements for Bldg. 3404 because hazardous wastes will not be stored in the building for more than 90 days in the future. The building will be closed under New Jersey hazardous waste regulations because it never had interim status.

12.5.2 Geology and Hydrology

The surface elevation at Site 173 is 925 ft above MSL. Soils in the area belong to the Ridgebury and Rockaway Series, and the underlying bedrock is Precambrian gneiss. The contour of the surrounding area is such that surface water and runoff from the vicinity of Bldg. 3404 would probably flow east toward two small reservoirs in the 1500 and 3500 areas.

12.5.3 Existing Contamination

No information is available on the extent of contamination at the Site. Based on the known history of the Site, potential contaminants include energetics and the types of chemicals normally found in a chemistry laboratory.

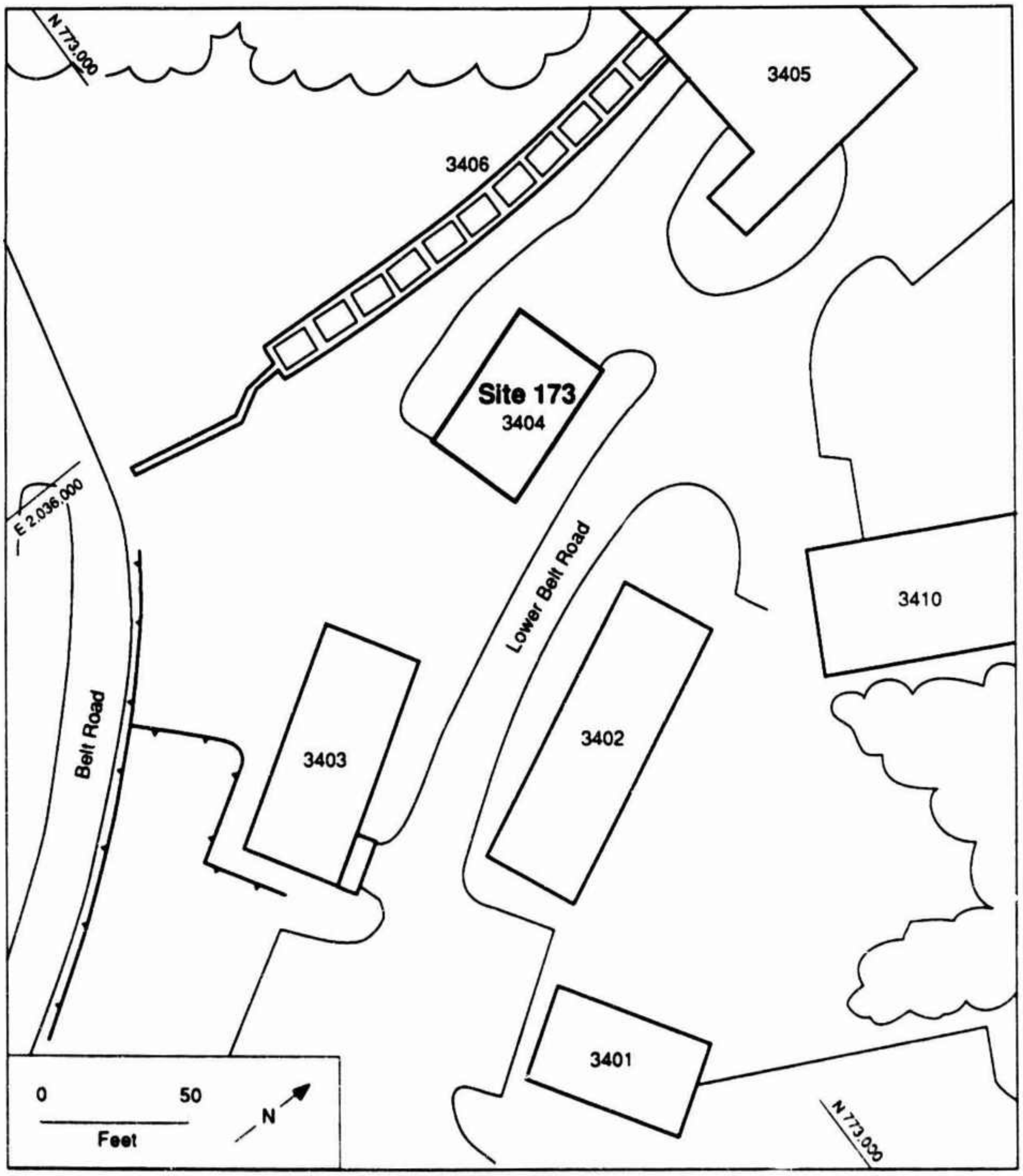

FIGURE 12.6 Layout of Site 173, Building 3404 (Source: Adapted from USACE 1984b)

12.5.4 Closure Plan

The revised RCRA closure plan for Bldg. 3404 includes sealing off the building and cleaning it with steam. Two rinsate grab samples and seven chip samples will be collected and analyzed for priority pollutant metals. Closure does not involve any sampling outside the building (Foster Wheeler 1988a, 1989; Solecki 1989a).

12.5.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of the building be impossible, the RI plan will be modified as new data become available.

12.5.5.1 Phase I

The exterior perimeter of the building should be visually inspected. If the building appears to be clean, no further work is necessary.

If areas of stained soil or signs of spills are found, then one surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each stained area and analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

12.5.4.2 Phase II

If significant contamination is found in the surface soil samples, then one soil boring should be drilled in each contaminated area. Samples should be collected from the borings and analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

12.6 SITE 174 — BUILDING 3420, OLD SEWAGE-TREATMENT PLANT

12.6.1 Site History

The Site is located near the northeastern end of Belt Road off the end of William Street (Fig. 12.7). Building 3420 is an old sewer plant with three sludge-holding beds.

12.6.2 Geology and Hydrology

The building is situated on a gentle hill slope adjacent to a broad valley. The geologic and hydrologic conditions on the Site are not clear. It is estimated that the Site is covered with fluvial sands and gravels overlying a till and then Precambrian Gneiss bedrock. The thickness of the Quaternary deposits is not known, nor are the hydrogeologic conditions under the Site.

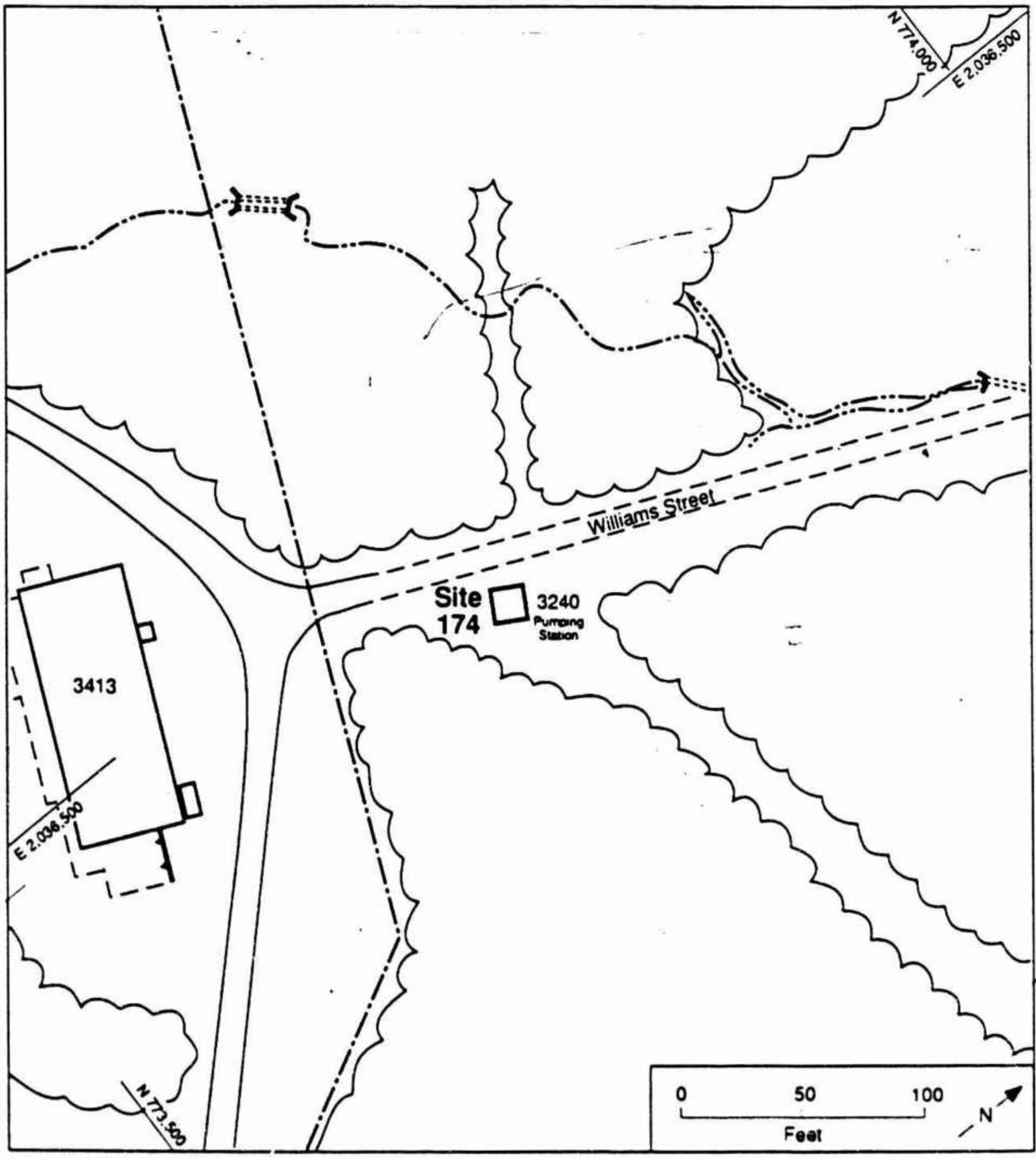

FIGURE 12.7 Layout of Site 174, Old Sewage-Treatment Plant at Building 3420 (Source: Adapted from USACE 1984b)

12.6.3 Existing Contamination

There is no information regarding any contamination on the Site.

12.6.4 Proposed RI Plan

12.6.4.1 Phase I

A field inspection is needed to determine the boundaries of the three sludge-holding beds. Then, two sludge samples should be taken from each holding bed (six samples total). Also, one drive-point water sample should be collected topographically downgradient of each bed (a total of three samples). All of these samples should be analyzed for TCL volatiles, TCL semivolatiles, TCL metals, explosives, cyanide, PCBs, gross alpha, and gross beta.

12.6.4.2 Phase II

If contamination is found in any of the Phase I samples, one additional sample from each sludge bed should be tested for TCLP leachability. Additional sludge, soil, and water samples may be needed to delineate the extent of the contamination.

If elevated levels of gross alpha or gross beta are found in any of the samples, additional samples and analyses would be needed to determine the extent of the contamination and the radionuclides for the elevated activity.

13 AREA L: EXPLOSIVES MANUFACTURING

13.1 INTRODUCTION

Area L is a large Area located in the eastern part of the Arsenal. Activities at the 25 Sites in the Area are mainly related to explosives manufacturing. Two shell burial areas and a pesticide storage building are included among the Sites. Potential contaminants include explosives, pesticides, and waste oil.

13.2 SITE 5 — SHELL BURIAL AREA (NEAR BUILDING 3150)

13.2.1 Site History

Site 5, with an area of 0.6 ha (1.5 acres), is located on Gately Road near the Gymnasium, Bldg. 3150, in the east central part of PTA. Figure 13.1 shows some details of the Site. Both Sites 5 and 6 initially were craters created by the detonations of explosives in magazine storage buildings in the July 1926 Lake Denmark explosion. The craters were used as burial areas for about 23 t (25 tons) of explosive devices (projectiles, mines, depth charges, etc.) resulting from the Lake Denmark explosion. The area was used for munitions disposal until 1945. Records on the amounts or types of explosive devices buried at the Site were not kept. The depth at which the UXO are buried is not known. However, the burial depth is estimated to be about 6 m (20 ft). The Site is now secured by a chain-link fence and is posted with warning signs. The Site is covered with a dense forest of young trees (Gaven 1986).

13.2.2 Geology and Hydrology

Bedrock under the Site consists of Precambrian gneiss. The depth of glacial till at the Site, which was recorded in the well logs for nearby wells DM5-1 and DM5-2, ranges from 3.6 m (12 ft) at the location of well DM5-1 to more than 6 m (20 ft) at the location of well DM5-2. The till at the well locations consists of 10-30% gravel mixed with silt, clay, and sand. Locations of the wells and other details of the Site are shown in Fig. 13.1 (Dames & Moore 1988, 1989).

Surface soils at the Site belong to the Hibernia Series. These are characterized as somewhat poorly drained loamy upland soils formed in glacial till that is derived from granite gneiss. The soils are acidic and have a permeability of 1.5-5.0 cm/h (0.6-2.0 in./h) (USATHAMA 1976).

The Site slopes to the northeast, which is also the expected direction of flow for surface runoff. No drainage channels are present on the Site. Measurements of depths to groundwater at the time of well installation in March 1988 gave values of 3.6 m (12 ft) in well DM5-1 and 1.6 m (5.2 ft) in well DM5-2 (Dames & Moore 1989). Groundwater elevations for the three wells (Fig. 13.1) indicate that the flow is in the general

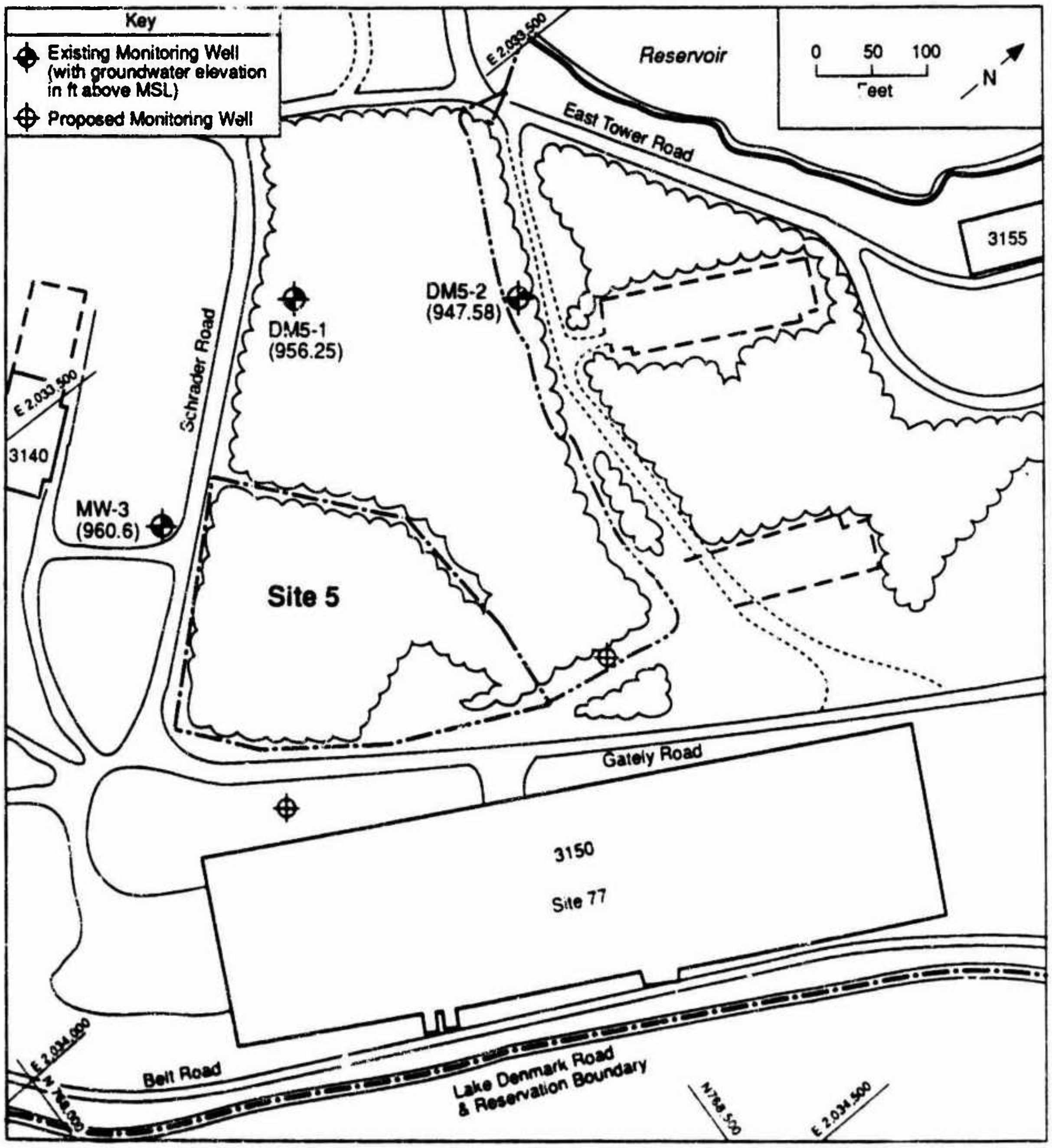

FIGURE 13.1 Layout of Site 5, the Shell Burial Area (Sources: Map adapted from USACE 1984b; well locations from Dames & Moore 1989)

northerly direction. Groundwater elevations at more locations are needed to determine the direction of groundwater flow.

13.2.3 Existing Contamination

No data are available on soil or surface water contamination at the Site. Data on concentrations of inorganic chemicals in water taken from wells MW-3, DM5-1, and DM5-2 are summarized in Table 13.1. The data show that most species were either not detected or were present at concentrations that were well below applicable drinking water quality limits. The only exception is the water sample taken from well MW-3 in May 1981, which contained 6.2 mg/L nitrate (as N). This value is close to the drinking water limit of 10 mg/L. Cadmium (0.63 μg/L), copper (2.77 μg/L), nickel (6.81 μg/L), and zinc (39.8 μg/L) were detected in water taken from well DM5-2. The measured concentrations are close to the corresponding detection limits. These species were not detected in any other samples taken from the other wells (USAEHA 1984b; Dames & Moore 1989).

The data in the table show that iron concentrations fluctuate widely. However, the increased concentration levels in December 1983 and April 1984 may be associated with the lower pH values, which tend to make metals more soluble.

Concentrations of purgeable organics were measured in water from well MW-3 taken in March, May, and July 1981; March, July, and December 1983; and April 1984. The July 1981 sample contained 1 μg/L ethyl benzene, 8 μg/L xylenes, 8 μg/L trimethyl benzenes, and 3 μg/L tetramethyl benzenes. The March 1981 sample contained a trace of methylene chloride. No other purgeable organics were detected on any sampling date (USAEHA 1984b; Gaven 1986, Attachment G).

Samples taken from wells MW-3, DM5-1, and DM5-2 in April and May 1988 were analyzed for volatile organics and explosives. From 7 to 9 μg/L methylene chloride was detected in all three wells. No other organics or explosives were detected in the well water (Dames & Moore 1989). Detection of methylene chloride may result from incomplete drying of sample collection bottles (USATHAMA 1987a; Dames & Moore 1989). Xylenes, which were detected in July 1981 in well MW-3, were not detected in 1988 (at a detection limit of 5 μg/L). The tri- and tetramethyl benzenes were not measured in 1988, and ethylbenzene was not detected at a limit of 5 μg/L.

The data suggest that detectable concentrations of some organics and metals may be present at some times in groundwater in the area. However, the positive results are close to the detection limits and good background concentration levels are not available, so it is not possible to conclude that the source of the detected analytes is the shell burial ground. Also, the screens in wells DM5-1 and DM5-2 begin 1.8 m (6 ft) and 1.2 m (4 ft), respectively, below the water table and extend down for a distance of 3 m (10 ft) (Dames & Moore 1989), so the discussion given in Sec. 11.3.3 may apply here also. The screen for well MW-3 extends from 6.1 m (20 ft) to 11.6 m (38 ft).

TABLE 13.1 Selected Analytical Results for Groundwater Samples Collected from Wells near Site 5 on Various Dates[a]

Chemical Parameter	Unit	Well MW-3 5/81	7/81	7/83	12/83	4/84	5/88	DM5-1, 5/88	DM5-2, 5/88
Arsenic	µg/L	<10	<10	-	<5	<5	<4.7	<4.7	<4.7
Barium	µg/L	<300	-	-	-	-	<20	<20	<20
Beryllium	µg/L	<25	-	-	-	-	<0.5	<0.5	<0.5
Cadmium	µg/L	<5	<10	<10	<1	1	<0.35	<0.35	0.63
Chromium	µg/L	<25	<25	<25	5	13	4.3	<3.3	<3.3
Copper	µg/L	<25	<25	-	8	11	<2.5	<2.5	2.77
Chloride[b]	mg/L	26	14	-	10	65	-	-	-
Calcium	mg/L	12	-	15.9	-	-	-	-	-
Cyanide	µg/L	<10	<10	<10	<1	<1	-	-	-
Aluminum	mg/L	<1.0	-	-	-	-	-	-	-
Antimony	µg/L	<500	-	-	-	-	<20	<20	<20
Iron	µg/L	<100	<100	<100	3,200	9,300	<41	205	1,060
Lead	µg/L	<5	<5	<100	21	5	<15	<15	<15
Magnesium	mg/L	2.31	-	4.6	-	-	-	-	-
Mercury	µg/L	<0.2	<0.2	-	-	-	<0.728	<0.72	<0.72
Manganese	µg/L	72	<30	<30	42	63	5.88	6.2	195
Nickel	µg/L	<100	<100	-	-	-	11	<4	6.81
Nitrate	mg/L	6.2 (as N)	-	-	-	-	0.537 (as NO_3)	0.471 (as NO_3)	0.432 (as NO_3)
Nitrite (as NO_2)	µg/L	-	-	-	-	-	<20	<50	<50
Fluoride	µg/L	90	-	-	55	80	-	-	-
Phenols	µg/L	<10	-	-	7.0	13.0	-	-	-
Potassium	µg/L	<500	-	-	-	-	-	-	-
Silver	µg/L	<10	-	-	-	-	<10	<10	<10
Sodium	mg/L	17	-	8.5	12	25	-	-	-
Thallium	µg/L	<500	-	-	-	-	<7.9	<7.9	<7.9
Tin	µg/L	<1,000	-	-	-	-	-	-	-
Zinc	µg/L	<15	44	-	30	71	215	<25	39.8
Sulfate[b]	mg/L	12	-	-	18	14	10.6	15.1	20.5
Total dissolved solids	mg/L	92	-	-	109	176	-	-	-
Total organic carbon	µg/L	<1,000	-	-	ND	ND	-	-	-
Selenium	µg/L	<5	-	-	<5	<5	<2.5	<2.5	<2.5
pH	pH	7.9	7.2	-	6.2	6.2	-	-	-

[a]A hyphen means the parameter was not measured, and ND means the parameter was not detected with detection limit not reported.

[b]The chloride and sulfate values are given in Caven (1986) as µg/L for 12/83 and 4/84 and are too small to be reasonable. Consequently, the values in Caven (1986) are assumed to be in mg/L and have been converted to µg/L for this table.

Sources: USAEHA 1984b; Dames & Moore 1989; Caven 1986, Attachment C.

13.2.4 Proposed RI Plan

13.2.4.1 Phase I

Soil and surface water sampling are not needed at this Site because the munitions are all buried at depth. It may be worthwhile to carry out a geophysical survey of the Site to determine the areal extent of the buried munitions, providing the munitions are not buried too deeply to be detected and the survey activities would not endanger the safety of the workers (e.g., by causing buried munitions to explode).

Two new monitoring wells are recommended at the Site. Suggested locations of the new wells are shown in Fig. 13.1. One well is located to give background concentrations for the Site. The other well is located to better define the direction of flow of groundwater and to monitor concentrations of contaminants in groundwater around the Site. For these wells, the screens should be sufficiently long so that they are partly above and mostly below the water table to allow sampling of groundwater at and below the possible 6-m (20-ft) burial depth of the munitions.

Beginning at least two weeks after well completion, water samples should be taken on two successive quarters from the new wells and wells MW-3, DM5-1, and DM5-2 and analyzed for explosives, propellants, nitrate, fluoride, TCL metals, TCL volatiles, TCL semivolatiles, and macroparameters. Water elevations should be measured at the time of sample collections, which should be on the same date each quarter.

13.2.4.2 Phase II

No activities are needed for Phase II of the sampling program. Since the Site is fenced, it is not likely that further actions are necessary to close the Site. However, a final determination of necessary further actions, if any, should await the results of the geophysical survey (if it is feasible and useful to carry out a survey) and the groundwater monitoring program. For example, if buried munitions are found outside the fenced area, then the munitions should be removed or the fence should be extended to enclose the area.

13.3 SITE 6 — SHELL BURIAL AREA (NEAR BUILDING 3100)

13.3.1 Site History

The shell burial area located near Bldg. 3100 is one of the two Sites at PTA used for burial of about 25 tons of explosive devices (i.e., mines, depth charges, and projectiles) from the 1926 Lake Denmark explosion (USAEHA 1979b). The U.S. Navy continued to dump explosives in the burial area until 1945. No records were kept as to the types and quantities of ordnance dumped.

Site 6 is about 2 acres in size and is located about 1,800 ft east of the southern outlet of Picatinny Lake. It is fenced, covered with trees and grass, and posted with warning signs. The Site map is provided in Fig. 13.2.

Based on the Site history, the contaminants of major concern consist of explosives, propellants, and heavy metals. VOCs are of concern as they may be contributed from upgradient sources.

13.3.2 Geology and Hydrology

Site 6 is located near the bottom of the foothills that cover the eastern portion of the PTA. The topography is moderately steep. The surface soils are classified as Rockaway, which are deep, moderately permeable, and well drained soils of the uplands (Wingfield 1976). The subsoil is commonly gravelly loam or gravelly sandy loam. The lower part of the subsoil is a dense, firm fragipan. Water has a tendency to move laterally over the fragipan. Figure 13.3 is a geologic cross section of Site 6, as interpreted from soil borings in the study area.

The water table occurs from 10 ft below the ground surface at the northern edge to 60 ft at the southern edge. These levels probably do not remain constant throughout the year because of seasonal fluctuations in precipitation.

Based on available well level data, groundwater flow in the water-table aquifer appears to be westerly to northwesterly toward Green Pond Brook. It is likely that some small component of vertical flow also exists in the area. However, horizontal flow is dominant, as expected in water-table aquifers such as those existing at Site 6.

13.3.3 Existing Contamination

13.3.3.1 Soil

No data are available on soil contamination at Site 6.

13.3.3.2 Groundwater

Site 6 is being monitored by a network that consists of four wells: DM6-1, DM6-2, DM6-3, and MW-5. The locations of these wells are shown in Fig. 13.2. Well DM6-1 was intended to be the upgradient well and the rest downgradient wells. The construction data for these wells are shown in Table 13.2 and their monitoring data in Table 13.3.

Well MW-5 is located near the intersection of Main Road and Belt Road. It was monitored between 1981 and 1984 for inorganics and purgeable organics. Several metals and organics were occasionally detected in samples: cadmium (up to 2 μg/L), chromium

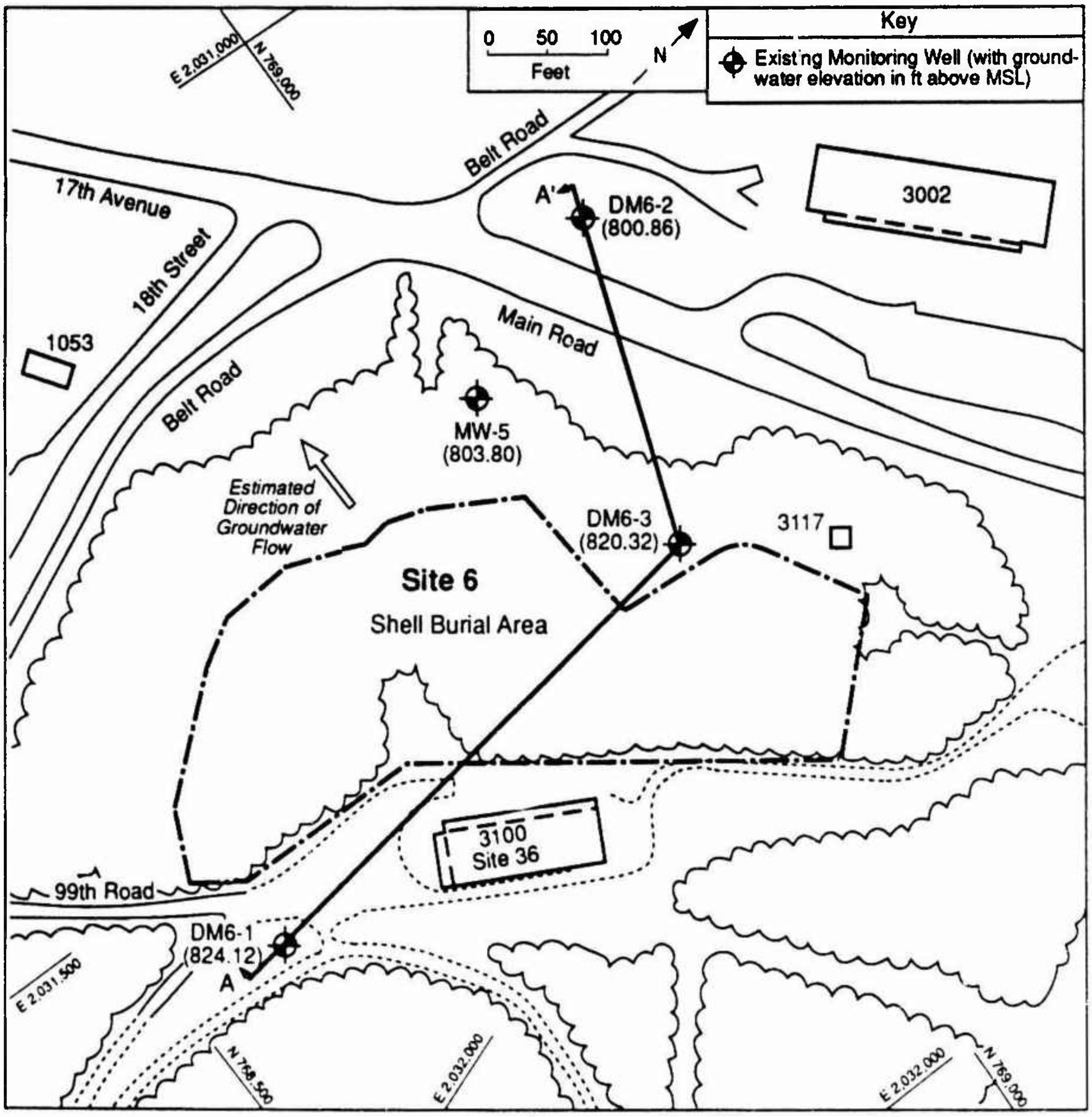

FIGURE 13.2 Layout of Site 6, the Shell Burial Area near Bldg. 3100 (Sources: Map adapted from USACE 1984b; well locations from Dames & Moore 1989)

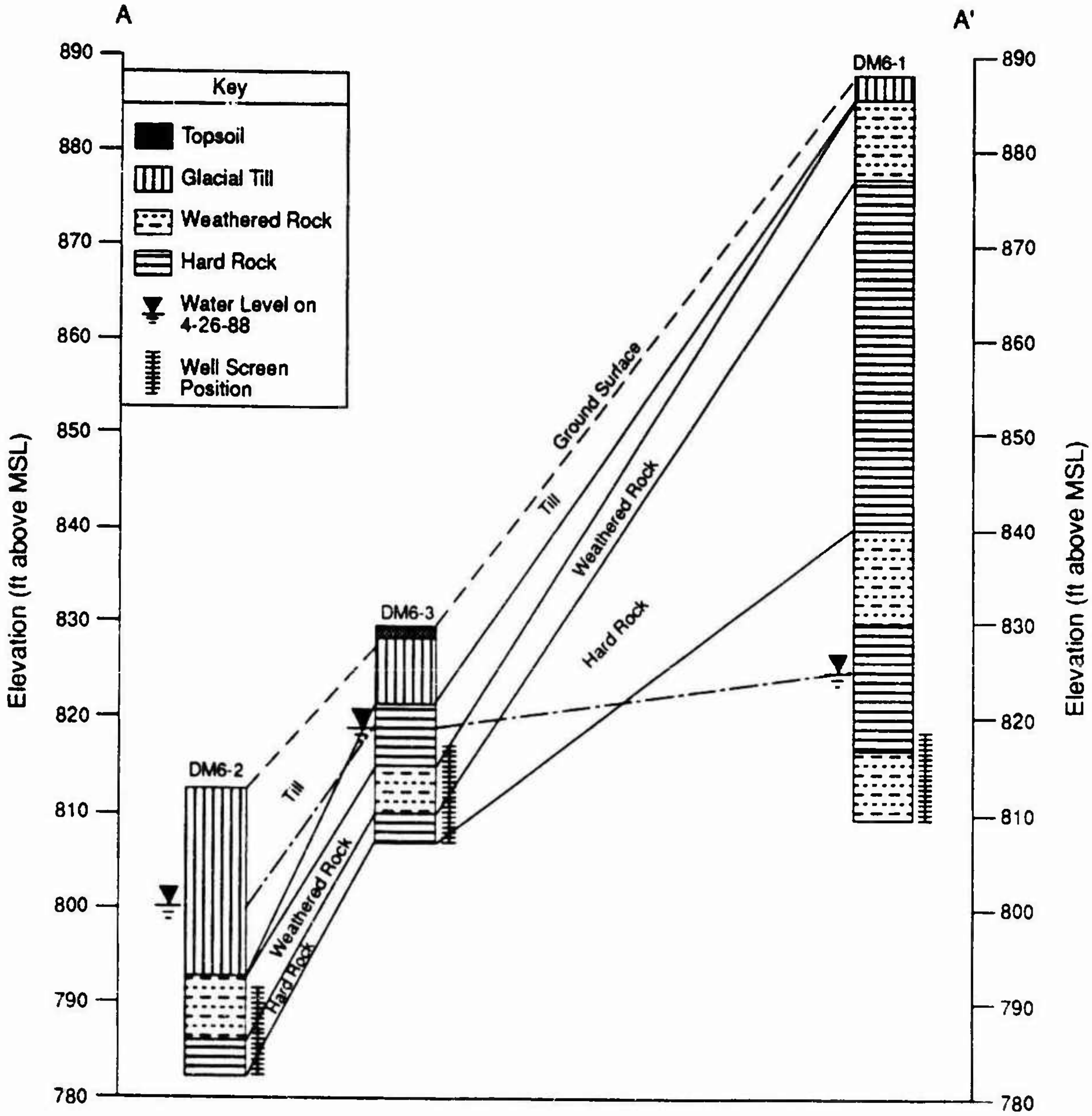

FIGURE 13.3 Geologic Cross Section of Site 6 (Source: Based on Dames & Moore 1988)

TABLE 13.2 Well Data for the Site 6 Area

		Dames & Moore Wells[c]		
Parameter[a]	Well MW-5[b]	DM6-1	DM6-2	DM6-3
Date drilled	3/9/81	2/2/88	2/8/88	1/27/88
Water surface elevation (ft)[d]	803.80	824.12	800.86	820.32
Total depth (ft)	20.4	78	30	22
Ground surface elevation (ft)	-	887.01	812.8	829.2
Top of casing elevation (ft)	814.65	888.99	814.38	831
Screen depth, top (ft)	9.8	68	20	12
Screen depth, bottom (ft)	20.4	78	30	22
Geologic unit	Stratified drift	Granitic gneiss	Sand and granite to bedrock	Glacial till to bedrock
Soil sampling method	-	Split spoon, cuttings		

[a]All wells have a casing diameter of 4 in. and a PVC screen.

[b]Sources: USAEHA 1981b; Sargent et al. 1986.

[c]Source: Dames & Moore 1988.

[d]Measured on April 26, 1988.

(up to 48 μg/L), copper (up to 83 μg/L), lead (up to 53 μg/L), toluene (up to 4 μg/L), and phenol (up to 8 μg/L). Other compounds that were sporadic in occurrence were tetrachloroethylene (5 μg/L), 1,1,1-trichloroethane (4 μg/L), and carbon disulfide (95 μg/L). Trichloroethylene (TCE) was almost consistently detected, but its level appeared to be decreasing from the initial measurement in 1981. Tetrahydrofuran was also consistently detected at concentrations up to 85 μg/L. Explosive-related compounds were analyzed in 1981, but not detected (USAEHA 1981b).

Dames & Moore sampled all four wells in April and May 1988, analyzing the samples for indicator inorganics, heavy metals, VOCs, and explosives. The upgradient well (DM6-1) had 30 μg/L of trichloroethane and 1.9 μg/L of nitrobenzene. The downgradient wells, in general, showed little contamination, except that 0.3 μg/L of 2,4-DNT in well MW-5 was detected. TCE in MW-5 was below the detection limit.

TABLE 13.3 Groundwater Data for Site 6 (μg/L)

Parameter	1988 Data DM6-1	DM6-3	DM6-2	MW-5	Previous Data (MW-5)	MCL
Cadmium	0.7	BDL	0.4	BDL	BDL-2	10
Chromium	BDL	BDL	BDL	BDL	BDL-48	50
Lead	BDL	BDL	BDL	BDL	BDL-53	50
Nitrate	302	323	582	496	-	10,000
Sulfate	18,400	22,000	27,000	27,000	24,000-38,000	
Tetrachloroethylene	30	BDL	BDL	BDL	ND-5.0	
Trichloroethylene	BDL	BDL	BDL	BDL	ND-29.0[a]	5
1,1,1-TCE	11.3	BDL	BDL	BDL	ND-4.0	(0)
1,1-Dichloroethane	ND	ND	ND	ND	ND-11.8	
Phenols	-	-	-	-	5.0-8.0	
Nitrobenzene	1.9	BDL	BDL	BDL	-	
2,4-DNT	BDL	BDL	BDL	0.3	-	(0.16)
Other explosives	BDL	BDL	BDL	BDL	-	

[a]Six of eight samples from 1981-1984 were above detection level.

Sources: Sargent et al. 1986; Dames & Moore 1989.

13.3.4 Proposed RI Plan

13.3.4.1 Phase I

Although the available groundwater data indicate no major contamination at existing wells, the amount of data is limited and the impact of Site 6 is still uncertain. The shells have been buried at this Site for more than 60 years. As a result of flushing and degradation, subsurface contaminant migration from the Site may have been substantially reduced. However, it is also probable that the present well network is not capable of monitoring the contaminant migration because the locations of downgradient wells may not be exactly on the path of the contaminated groundwater plume.

Aquifer tests should be conducted for three of the existing wells: DM6-1, DM6-3, and MW-5. The static water level for all four wells on the Site should be measured quarterly for one year. The resulting data can be used for assessing the groundwater flow regime and for siting additional wells.

The four existing wells should be sampled quarterly for two quarters. Samples should be analyzed for all TCL volatiles, TCL metals, explosive and propellant compounds, nitrate, nitrite, ammonia, and all macroparameters.

The contaminant sources upgradient of the Site (such as Site 36, see Sec. 13.7) should also be carefully assessed. The groundwater samples from the upgradient well DM6-1 were found to contain tetrachloroethylene and nitrobenzene (Sec. 13.3.3). The source of these contaminants should be identified through additional field inspection, personnel interviews, sampling, and monitoring.

13.3.4.2 Phase II

After the well monitoring is completed, the results obtained for Site 6 should be reviewed. The new aquifer test and groundwater level data should indicate if the local groundwater flow should be reassessed. If the groundwater flow in the area is in a direction drastically different from the northerly direction initially assumed, a new water table well should be installed. The exact location of this well will be determined by the aquifer test and groundwater level data. If warranted by the data, an additional monitoring program and a Site remediation plan may be proposed.

13.4 SITE 17 — NORTHERN TETRYL PIT

13.4.1 Site History

Site 17 is one of two reported locations where there were pits receiving wastewater discharges prior to 1945 from tetryl (2,4,5-trinitrophenylmethylnitramine) manufacturing operations. (The other location is designated as Site 18, which is discussed in Sec. 3.5.) Tetryl is a detonator for explosives. Information about tetryl production at PTA is very limited. No records are available to indicate the composition and amount of waste discharged into either area.

Major sources of wastewater in the manufacture of tetryl, however, could include cooling water, chemical spills, tank cleaners, wash water from tetryl purification, and water and sellite solutions used for floor washing and equipment cleanup. Major pollutants in these wastewaters are tetryl, sulfate, sulfite, nitrate, and acidity (low pH) (U.S. Army 1978). Due to the easy access of the area and the possibility of other wastes being dumped here in the past, other contaminants such as metals, VOCs, and semivolatiles, also may be of concern.

The Site map is shown in Fig. 13.4. The Site is located off 18th Avenue. Analyses of historic aerial photographs identified a total of four small pits in this area (see Fig. 13.4) (Sitton 1989). Two unlined circular pits were located northwest of 18th Avenue, both approximately 10 ft in diameter and 3-5 ft deep. The southernmost of these two pits existed as early as 1940; the other appeared between 1940 and 1951. Both pits, located south of 18th Avenue, were identified in 1940, but had apparently been filled by 1951; they are currently not visible. Site 17 is unfenced and overgrown with numerous small trees and exhibits no visible effects of contamination.

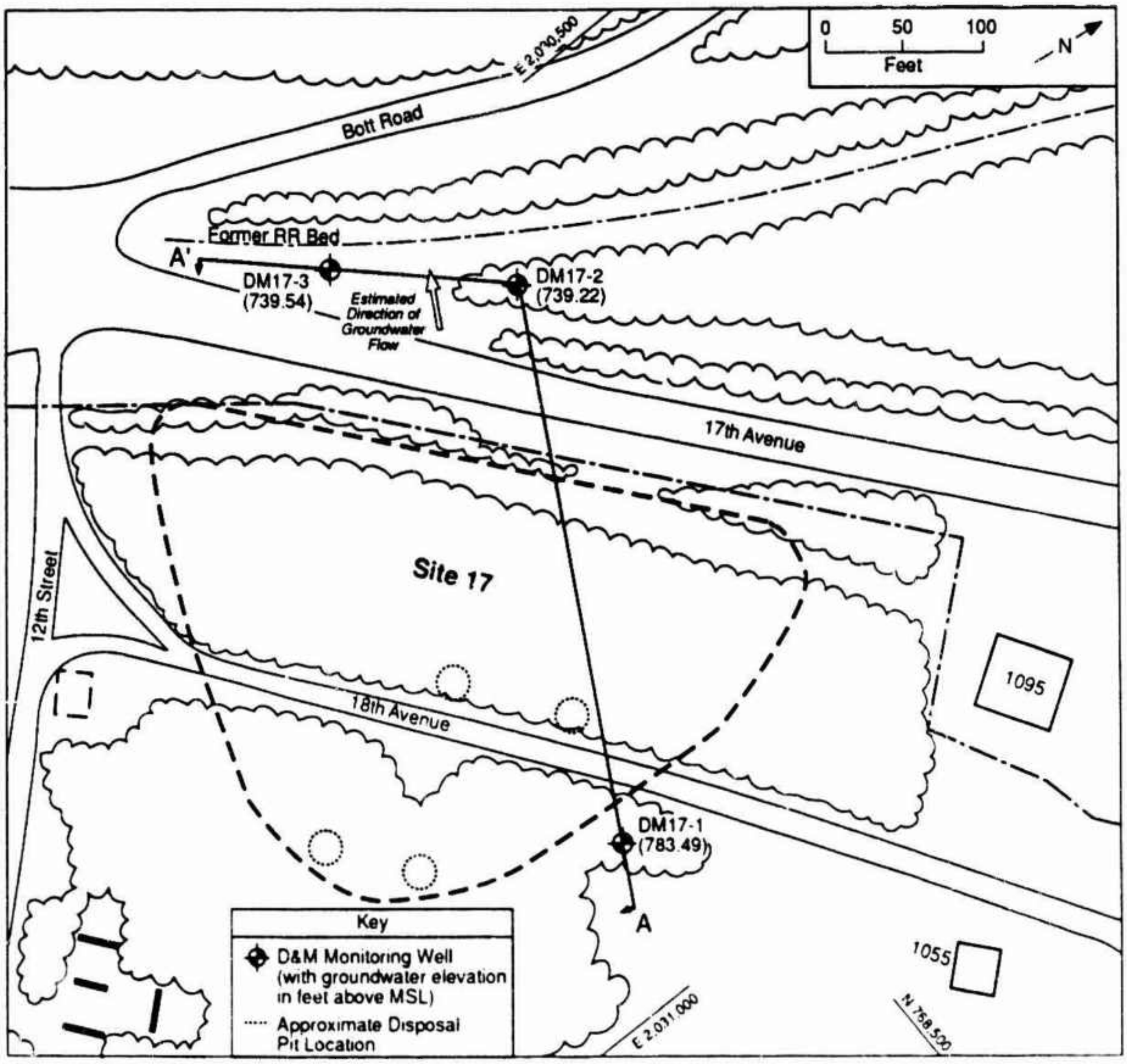

FIGURE 13.4 Layout of Site 17, the Northern Tetryl Pit (Source: Map adapted from USACE 1984b; well and pit locations from Dames & Moore 1989)

13.4.2 Geology and Hydrology

Site 17 is located approximately 1,800 ft southeast of Green Pond Brook. It is on a rocky hillside that occupies the eastern portion of the PTA and slopes toward the brook. The topography is moderately steep. The surface soils are classified as Rockaway, which are deep, moderately permeable, and well-drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam. The lower part of the subsoil is a dense firm fragipan. Groundwater has a tendency to move laterally over the fragipan (Wingfield 1976).

Wells DM17-2 and DM17-3 show that the water-table aquifer northwest (downgradient) of the study area is about 25 ft below the land surface. The geologic formation, to 40 ft deep, is generally glacial till. Well DM17-1, located to the southeast (upgradient) of the Site, has a water table depth of 30 ft below the land surface. Drilling indicates glacial till for the first 25 ft and hard rock thereafter. Figure 13.5 shows a geologic cross section interpreted from well borings in the study area.

Groundwater flow in the water-table aquifer appears to be westerly to northwesterly toward Green Pond Brook, based on the available well level data. It is likely that some small component of vertical flow exists in the area.

13.4.3 Existing Contamination

13.4.3.1 Soil

No data on soil contamination at Site 17 are available.

13.4.3.2 Groundwater

Site 17 is being monitored by a network consisting of three wells, DM17-1, -2, and -3. The locations of these wells are shown in Fig. 13.4. The construction data of these wells are shown in Table 13.4.

Well DM17-1, located near Eighteenth Avenue opposite the pits, is 42 ft deep and screened in the bedrock. Wells DM17-2 and -3, situated between Seventeenth Avenue and Bott Road, are screened in glacial till and are about 40 ft deep. Based on recent water level measurements, well DM17-1 would provide upgradient contaminant data; the other two wells would provide downgradient data.

Dames & Moore (1989) sampled all three wells on May 2, 1988, and analyzed the samples for explosive-related compounds. No explosives were detected at detection limits ranging from 0.26 μg/L for 2,6-DNT to 4.73 μg/L for RDX.

13.4.4 Proposed RI Plan

13.4.4.1 Phase I

The amount of available groundwater data, both chemical and hydrogeological, for the Site is still limited. To ascertain the current status of the Site, existing monitoring wells should continue to be monitored for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrite, nitrate, and macroparameters. In addition, the existing wells should be utilized to study the groundwater flow regime. This can be done through quarterly aquifer tests of two selected wells (DM17-1 and -3) and static well water level measurements for all three wells for a period of one year.

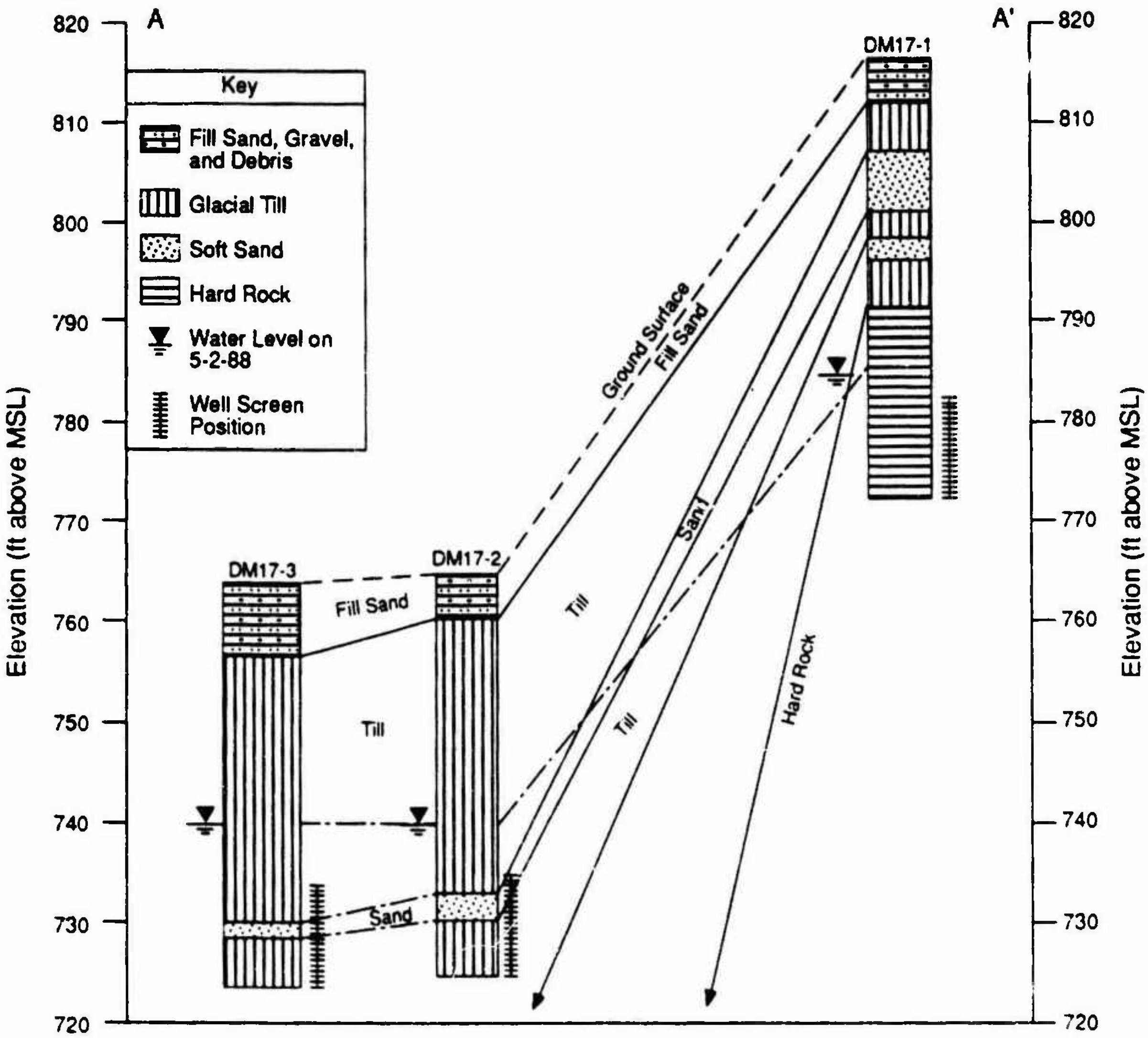

FIGURE 13.5 Geologic Cross Section A-A' at Site 17 (Source: Based on Dames & Moore 1988)

13.4.4.2 Phase II

If new groundwater data indicate significant contamination, the chemistry of soils in and surrounding the tetryl pits must be characterized. Borings should be drilled at the center of each of the four pits. Soil boring samples should be collected over 2-ft intervals from the top, pit bottom, and bottom of each of the borings. In addition, two surface soil samples will be taken from one foot deep at a location outside and downgradient from the four pits. Soil samples should be tested for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrates, nitrites, ammonia, and sulfate. Additional wells should be installed if warranted by the Phase I data.

TABLE 13.4 Well Data for Site 17

Parameter[a]	DM17-1	DM17-2	DM17-3
Date drilled	1/22/88	1/15/88	12/29/87
Water surface elevation (ft)[b]	783.44	739.22	739.54
Total depth (ft)	42	40	40.5
Ground surface elevation (ft)	814.8	764.4	763.4
Top of casing elevation (ft)	816.96	766.39	765.06
Screen depth, top (ft)	32	30	30.5
Screen depth, bottom (ft)	42	40	40.5
Geologic unit	Bedrock	Glacial till	Glacial till

[a]For all wells, additional information was available: casing diameter, 4 in.; screen type, PVC; and soil sampling method, split spoon.

[b]Measured on May 2, 1988.

Source: Dames & Moore 1988.

13.5 SITE 18 — SOUTHERN TETRYL PIT

13.5.1 Site History

This is one of the two areas at PTA where pits were reportedly used to receive tetryl-containing waste discharges. The other area, Site 17, is discussed in Sec. 13.4. The reported location of Site 18 is between Upper X.H.E. Road and 19th Avenue (see Fig. 13.6). During interviews with ANL staff, PTA personnel reported that unlined pit(s) received discharges of wastes from tetryl manufacturing operations from before World War II to 1945. The exact location of the pit(s) is unknown. However, there is a depression on the west side of Bldg. 1031. This depression may likely be the southern tetryl pit (Solecki 1989b).

13.5.2 Geology and Hydrology

The study area is located on the upland of the foothills that occupy the eastern portion of PTA. The topography of the locality is moderately flat; the land slopes toward an intermediate stream called Robinson Run. Topographic maps show that this stream is downgradient and would receive runoff and seepage from the Site.

The soils in the study area are classified in the Rockaway Series, which are generally deep, moderately permeable, and well-drained soils of the uplands. The subsoil

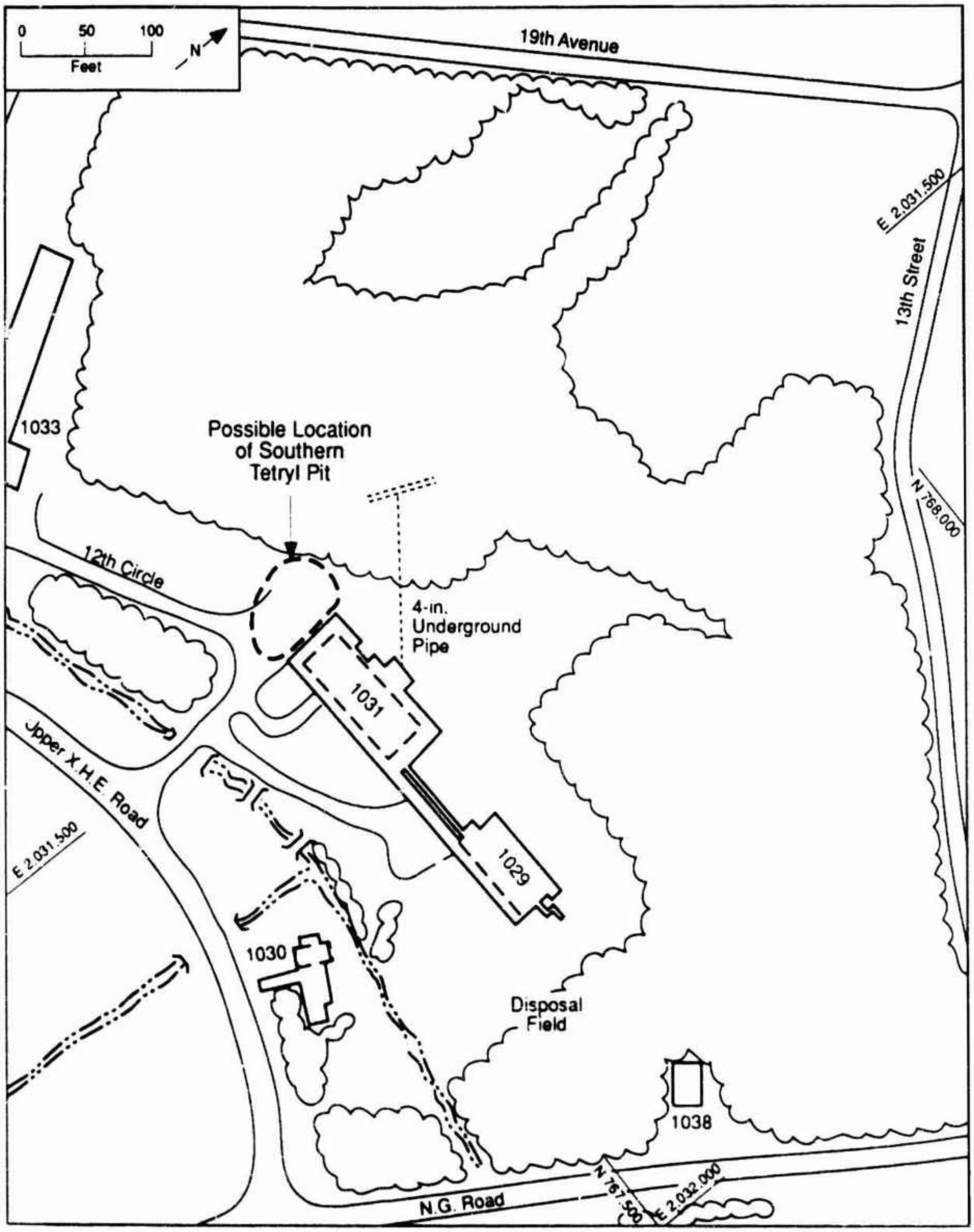

FIGURE 13.6 Layout of Site 18, the Southern Tetryl Pit (Source: Adapted from USACE 1984b)

is commonly gravelly loam or gravelly sandy loam. The lower part of the subsoil is a dense firm fragipan. Groundwater has a tendency to move laterally over the fragipan (Wingfield 1976).

No specific geological information is available for Site 18, but its geology could resemble that of Sites 6 and 17, which are about 900 ft from Site 18. Based on the information from soil borings at these two Sites, the water table is from 10 to 30 ft below the land surface, and the glacial till and soil mantel are from 20 to more than 40 ft thick (Dames & Moore 1988).

Groundwater in the water-table aquifer appears to flow in a southerly direction toward Robinson Run, based on ground surface contours. It is likely that some small component of vertical flow exists in the area.

13.5.3 Existing Contamination

There has been no monitoring of any kind at Site 18. Tetryl production operations in this area may have generated a large volume of liquid wastes. Reportedly, the waste streams were discharged directly into the depression on the west of Bldg. 1031.

The NJDEP Site inspection report indicated that leaky drums were present in Bldg. 1031 and there was a strong acid smell (Gaven 1986). In addition, detail plat 57 for PTA (USACE 1984b) indicates a "disposal field" between Bldgs. 1029 and 1038 (see Fig. 13.6). The nature of disposal activities on the field is unknown.

13.5.4 Proposed RI Plan

Although available groundwater data for Site 17 show essentially no contamination, there is no guarantee that Site 18 is free from contamination. The quantity and composition of wastes generated and the methods of waste disposal in these areas may have differed. Unlike Site 17, which is situated in a relatively steep area, the topography of Site 18 is flat. Waste materials, if any, in Site 18 may have remained on the Site longer. For the same reason stated in Sec. 13.4, the contaminants of concern for Site 18 are explosives, heavy metals, VOCs, semivolatiles, sulfate, nitrite, ammonia, and acidity.

13.5.4.1 Phase I

The exact location of the tetryl pit should be identified. The pit could be the depression near Bldg. 1031. The surface of the pit area may have undergone some disturbance over the years, and the former appearance of the pits may not be apparent. PTA employees or former employees who are knowledgeable about the operations in this area could be interviewed to pinpoint the location. Geophysical surveys using such techniques as EMI (electromagnetic inductance) and GPR (ground penetrating radar) could be also conducted to identify the exact location of the pit.

Once the pit is located, a soil boring should be drilled in the pit area. The boring should extend from the surface, through the apparent bottom of the pit to the water table or bedrock, whichever comes first. Soil samples should be collected over a 0.6-m (2-ft) interval from the top, pit bottom, and bottom of the boring and analyzed for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrite, nitrate, sulfate, and ammonia.

To the east of Bldg. 1029 and west of Bldg. 1038, there is an area indicated as a disposal field on detail plat 57 (USACE 1984b) (see Fig. 13.6). Electromagnetic geophysical surveys and soil gas surveys should be conducted in this area for an indication of waste disposal and soil contamination.

13.5.4.2 Phase II

If the geophysical and/or soil gas survey results indicate significant contamination, surface and subsurface soil sampling in the waste disposal area should be conducted to determine the nature and extent of contamination in that area.

13.5.4.3 Phase III

The need for additional soil sampling and surface-water and groundwater sampling will be determined as a result of the sampling and surveys conducted under Phases I and II.

13.6 SITE 35 — BUILDINGS 1361A, 1363A, 1364, AND 1365, NITROGLYCERIN PROCESSING AREA

13.6.1 Site History

The complex in the 1350-70 building area was formerly used for nitroglycerin production. Although the area (see Fig. 13.7) has been inactive since 1983, several items of environmental concern exist. Near Bldg. 1363A are two outdoor aboveground storage tanks (200 and 2,000 gal) used to neutralize mixed sulfuric and nitric acid. Inside Bldg. 1365 are two additional aboveground stainless steel tanks (575 and 300 gal) used to receive (via pipeline) spent acids from the manufacture of nitroglycerin in Bldg. 1362 (not indicated on map). Spent acids are stored in these tanks prior to disposal. In addition, a catch basin was found outside Bldg. 1361A. Past operations may have left behind waste materials in these areas. Contaminants of environmental concern are acids, explosives, solvents, and heavy metals.

The two storage tanks in Bldg. 1365 are to be closed in accordance with New Jersey hazardous waste regulations because they never had interim status.

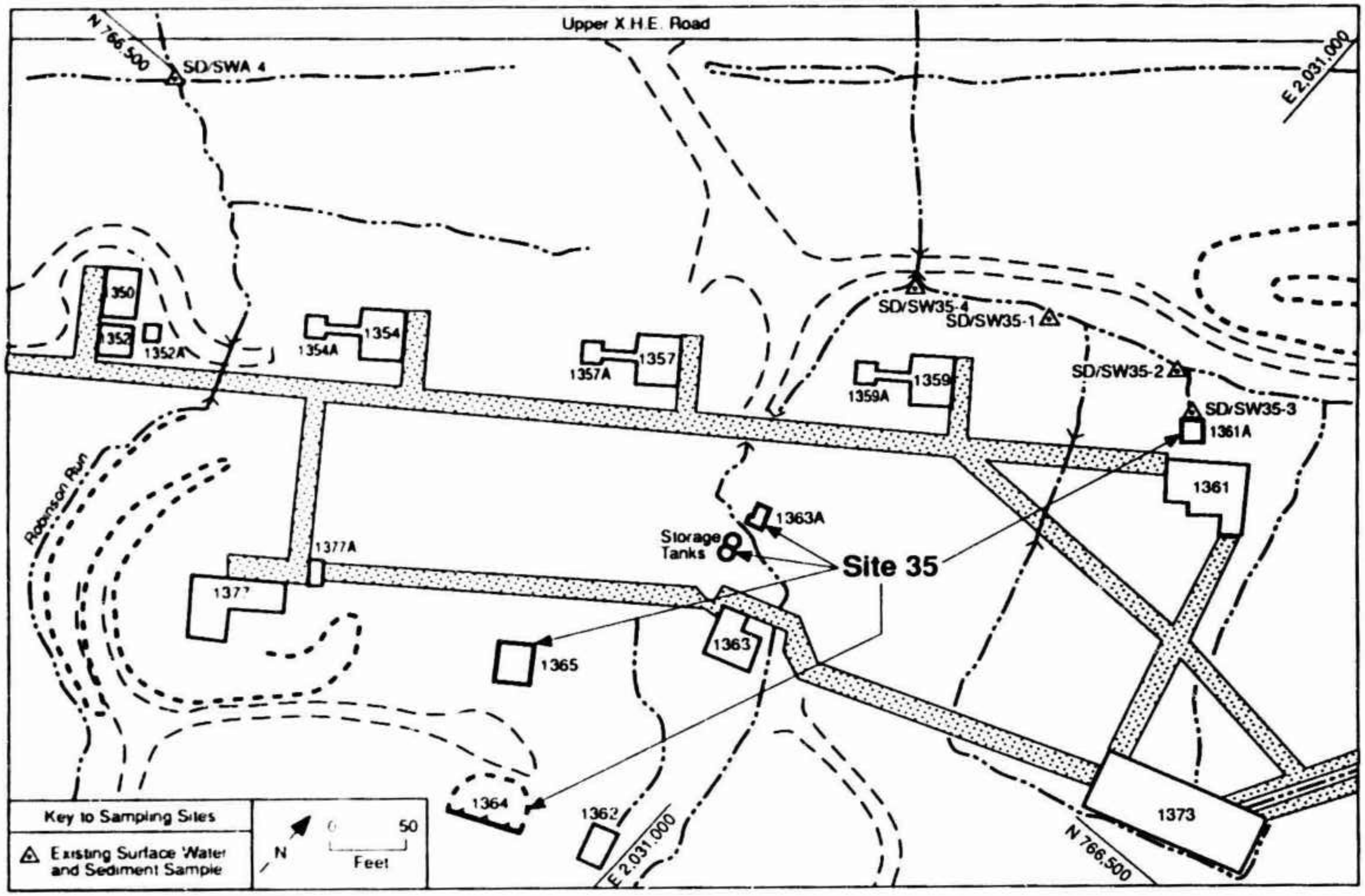

FIGURE 13.7 Layout of Site 35, the Spent Acid Tanks near Bldgs. 1363A and 1365 (Source: Adapted from USACE 1984b)

13.6.2 Geology and Hydrology

The study area is on the upland of the foothills occupying the eastern portion of the Arsenal. The ground throughout this area is swampy, suggesting poor drainage and very shallow groundwater. The local topography is moderately flat, sloping toward the right arm of an intermediate stream, Robinson Run. Topographic maps indicate that, since this stream is downgradient, it would receive runoff and seepage from the Site.

The occurrence of a marshy area indicates that groundwater is shallow and that the complex is a groundwater discharge area. The marshy area may be also caused by soils of low permeability. Shallow groundwater is likely to be topographically controlled. Based on the ground surface contour, the groundwater flow should be north toward the right arm of Robinson Run. It is likely that some small component of vertical flow exists in the area. However, horizontal flow is dominant, as expected in water-table aquifers existing in this general area.

13.6.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that catch basins are outside Bldgs. 1361A and 1363A and that a stagnant water pool is near Bldg. 1364. Reportedly, acids were spilled outside Bldgs. 1363A and 1365.

13.6.3.1 Surface Water Quality

On April 26, 1988, Dames & Moore collected four surface and four sediment samples from a small drainage ditch that traverses Site 35 northwest of Bldgs. 1361 and 1359. The sample locations are shown in Fig. 13.7. Samples were analyzed for nitrite, nitrate, sulfate, and nitroglycerin (NG). The results, given in Table 13.5, indicate that the levels of nitrate and sulfate in surface water and sediments are comparable to the natural background observed in the Arsenal. Two sediment samples, SD35-3 and -4, contained relatively low nitroglycerin concentrations, 0.78 and 0.7 ppm, respectively, with both concentrations slightly above the detection limit of 0.5 ppm. Nitroglycerin was not detected in the surface water samples.

13.6.3.2 Soil and Groundwater

There has been no soil or groundwater monitoring at Site 35.

13.6.4 Closure Plan

As stated in Sec. 13.6.1, the two storage tanks in Bldg. 1365 will be undergoing RCRA closure. The revised closure plan includes the following actions. An air bomb sample and a liquid sample will be collected from each tank for nitrate and VOC (liquid sample only) analyses. The results will be used as a basis to determine appropriate safety procedures for closure of these tanks. The tanks will be flushed with water until the

TABLE 13.5 Selected Analytical Results for Surface Water and Sediment Samples from Site 35[a]

Sample	Nitrate	Sulfate	NG
Surface water (µg/L)			
SW35-3	372	30,000	BDL
SW35-2	274	23,000	BDL
SW35-1	>1,000	19,400	BDL
SW35-4	293	18,600	BDL
Sediment (ppm)			
SD35-3	BDL	487	0.78
SD35-2	BDL	88	BDL
SD35-1	BDL	BDL	BDL
SD35-4	BDL	210	0.70

[a]BDL means below detection limit. Nitrite (NO_2) concentrations were all BDL.

Source: Dames & Moore 1989.

nitrate concentration is below the detonation level and then steamed out to remove remaining organics. Following decontamination, the tanks will be moved to the burning ground and flashed off to remove residual explosives before they are classified as 5X scrap metal and disposed of according to regulations (Foster Wheeler 1988b; Solecki 1989a).

13.6.5 Proposed RI Plan

The proposed phased sampling plan will be carried out independently of implementation of the closure plan.

13.6.5.1 Phase 1

A field inspection should be carried out to identify areas with signs of contamination and to locate the reported catch basin and water pool.

For each basin and water pool located, one surface water sample and one sediment sample should be collected. In addition, from each area showing signs of contamination, surface soil samples should be taken at depth intervals of 0.15 to 0.3 m (6 to 12 in.). These samples should be analyzed for nitrates, sulfates, explosives, and TCL metals.

The contents of the tanks near Bldg. 1363A should be sampled and removed, and the tanks decontaminated and disposed of by following the same procedures as those proposed for the tanks in Bldg. 1365. In addition, geophysical surveys should be conducted to identify locations of underground piping on the Site.

13.6.5.2 Phase II

As the new data collected under Phase I become available, it is recommended that, if surface soil contamination is confirmed, additional samples be taken to determine the extent of contamination. If necessary, plans for monitoring the surface water and groundwater in the area should also be developed.

13.7 SITE 36 — BUILDING 3100, HAZARDOUS AND NONHAZARDOUS WASTE STORAGE AREA

13.7.1 Site History

13.7.1.1 Past Use

Building 3100 is located on 99 Road, southeast of the Site 6 (shell burial ground) boundary. The Site map is shown in Fig. 13.8. The building has a floor area of 5,384 ft^2, with a concrete foundation, concrete walls, and cement asbestos roofing. Built in 1942 as an ordnance storage facility for the U.S. Navy, the building was used for this purpose until 1955 when the Naval Rocket Laboratory converted it into a test and environmental facility. The facility consisted of an assembly and disassembly area for rocket motors, both liquid- and solid-fueled, four environmental boxes (two cold and two hot), and several vibrators. After vibration in a hot, normal, and cold environment, rocket motors would be taken to test area "D" and fired. After firing, the various motors would be taken back, disassembled, and checked for leaks, muzzle burn-out, and body changes (Anderson 1988b).

The Army acquired the building in 1962 and turned it over to the Technical Services Directorate in 1963. The Directorate used the facility until 1967, when all test equipment was phased out and moved to Bldg. 3109 (Anderson 1988b).

The Division of Engineering and Housing (DEH) acouired the building in 1981 and used it to store various hazardous wastes such as oils, acids, bases, oxidizers, and producers. In 1987, the building was turned over to the Logistics Management Branch (Anderson 1988b).

13.7.1.2 Current Status

Building 3100 was included in the RCRA Parts A and B permit application by PTA (Foster Wheeler 1988d). Currently, the building is divided into two areas, hazardous

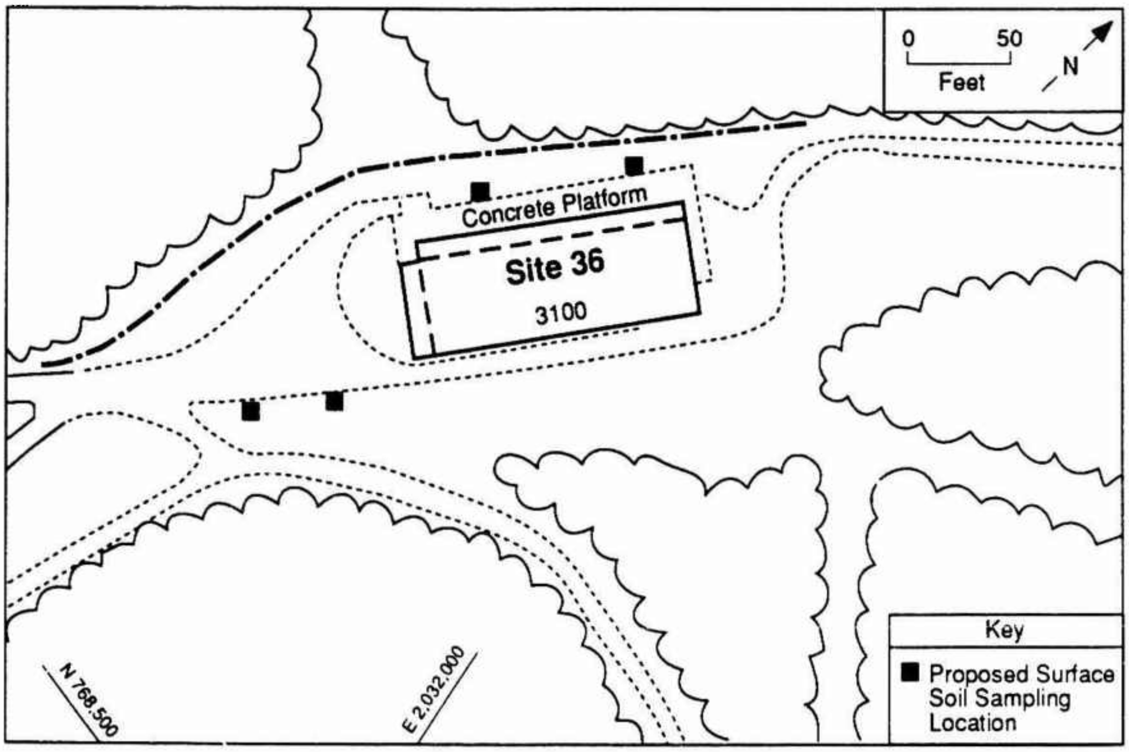

FIGURE 13.8 Layout of Site 36, the Hazardous and Nonhazardous Waste Storage Area at Building 3100 (Source: Adapted from USACE 1984b)

and nonhazardous. The front side of the building (adjacent to the dock) is separated into five bays with an office adjacent to bay 5 (see Fig. 13.9). These bays, which are devoted to hazardous waste storage, have a floor space of about 3,000 ft^2 and a maximum storage capacity of 772 drums. In bay 1, the floor and walls are not sealed, but the walls are painted. In bays 2, 3, 4, and 5, the floors are sealed and the walls are sealed to a height of 8 in. (Anderson 1988b).

The RCRA Part B permit application includes continuing the use of part of Bldg. 3100 for hazardous waste storage. The application includes the following modifications: floor surface improvements to storage bays and loading dock; door replacement; addition of a loading dock apron; addition of curbing at dock; installation of one concrete block wall; modification and/or replacement of lighting, security alarm, telephone, plumbing for eyewashes, and shower; and repair of plumbing. Detailed descriptions of these modifications are provided in the Part B application. Once all modifications are completed, hazardous wastes will be stored in different bays according to their characteristics: bay 1, oxidizers; bay 2, toxics; bay 3, bases; bay 4, acids; and bay 5, waste oils.

The rest of the building is not designated for hazardous waste storage and is used for office space or nonhazardous waste storage. The floors and walls in nonhazardous waste areas are not sealed.

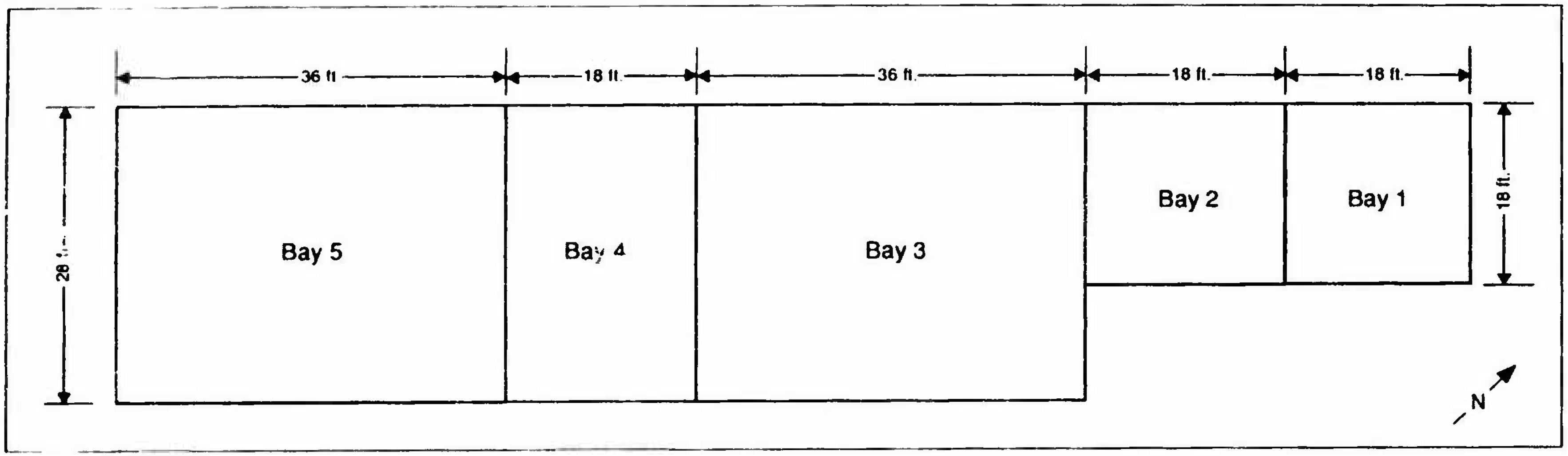

FIGURE 13.9 Floor Plan for Building 3100 (Source: Adapted from Foster Wheeler 1988b)

The exterior of the building is cemented and painted (white). Adjacent to the south end of the building is a cooling tower and an insulated tank (about 5 ft in diameter and 10 ft long), which was used to store water/ethylene glycol.

13.7.2 Geology and Hydrology

Site 36 is located near the foot of the ridges on the east boundary of PTA. The topography in the vicinity is moderately steep. The surface soils are classified as Rockaway, i.e., deep, moderately permeable, and well-drained soils of the uplands. Subsoil is commonly gravelly loam or gravelly sandy loan. The lower part of the subsoil is a dense firm fragipan. Water has a tendency to move laterally over the fragipan (Wingfield 1976).

The depth of water table is about 60 ft, according to a recent measurement at well DM6-1, which is about 200 ft southwest of the building (Dames & Moore 1988). The groundwater level likely does not remain constant throughout the year due to seasonal fluctuations in precipitation.

Groundwater flow appears to run west to northwest toward Green Pond Brook, based on the available well level data for wells at Site 6. Although a small degree of vertical flow is likely, horizontal flow appears to be dominant, as expected in water-table aquifers in this area. Local surface water generally flows west, based on topography.

13.7.3 Existing Contamination

Due to disposal problems of hazardous wastes through DRMO, some of the drums containing waste were stored for an extended period in Bldg. 3100, resulting in the leakage of the drums. From 1984 to 1987, drums containing waste oil leaked, causing minor spills on the dock and inside the building (bays). Immediate corrective action was taken to clean up the spills, and no contamination to ground or surface water occurred (Anderson 1988b).

Before 1980, there is no record of any spills of hazardous materials and hazardous waste occurring inside or outside the building. However, past EPA inspection indicated that oil spills could have occurred both on the loading platform and in the parking area (Anderson 1988b).

There are no data concerning soil or surface and groundwater contamination of Site 36. However, at Site 6 (shell burial ground), which is downgradient and immediately northwest of Bldg. 3100, four monitoring wells are presently in place since this Site appears to be downgradient of Bldg. 3100 (see Fig. 13.2). Limited groundwater data from these wells (see Sec. 13.3.3) show little contamination by VOCs and explosives in both upgradient and downgradient wells. Based on their relative locations, past operations at Site 36 may have contributed to groundwater contamination at Site 6.

13.7.4 Proposed RI Plan

13.7.4.1 Phase I

Spills and drum leakage in the past could have caused soil contamination in the area. Contaminants of environmental concern are organics, explosives, propellants, heavy metals, cyanides, and nitrates. A field inspection should be conducted to locate signs of contamination around the loading platform, parking lots, drain outfalls, and ditches. It is proposed that four surface soil samples be collected, two from near the platform and two from the parking area. Suggested sampling locations are shown in Fig. 13.8, but site inspection should be conducted to determine actual locations. These samples will be taken to a depth of 0.15 m (6 in.). Additional samples are to be collected from open drains (if present) and areas with signs of contamination. All samples should be analyzed for explosives, propellants, TCL volatiles, TCL semivolatiles, TCL metals, cyanides, and nitrates.

13.7.4.2 Phase II

If an area is found to be contaminated, soil borings should be drilled and additional surface and subsurface soil samples collected to determine the extent of the contamination. Depending on the soil sampling results, groundwater monitoring may be needed. Locations of monitoring wells should be determined based on the existing wells at Site 6.

13.8 SITE 41 — BUILDING 1094, LAB-PACK REPACKING FACILITY

13.8.1 Site History

13.8.1.1 Past Use

Building 1094 is located on Belt Road opposite Site 6 (shell burial ground). The Site map is shown in Fig. 13.10. The building was constructed in 1942 and was used as a screening and pulverizing building. In 1981, it was modified for repacking and storage of various toxic chemical wastes and spent reagents from R&D operations in PTA. The conversion consisted primarily of installing new doors, an explosion-proof electrical system, an active purge system in the main storage area, and a system for spill containment with berms and trench drains leading to an underground stainless steel tank. Wooden shelving was installed along the building perimeter for storage of small containers of flammable hazardous liquids (Anderson 1988a).

Four distinct areas within Bldg. 1094 are shown in Fig. 13.11. Each area has painted plywood shelving to support the waste containers. The floor of this building is constructed of 6-in.-thick, 3,000-psi concrete, sealed with two coats of epoxy. The foundation is made of concrete, the walls are made of hollow tiles, and the roof is made

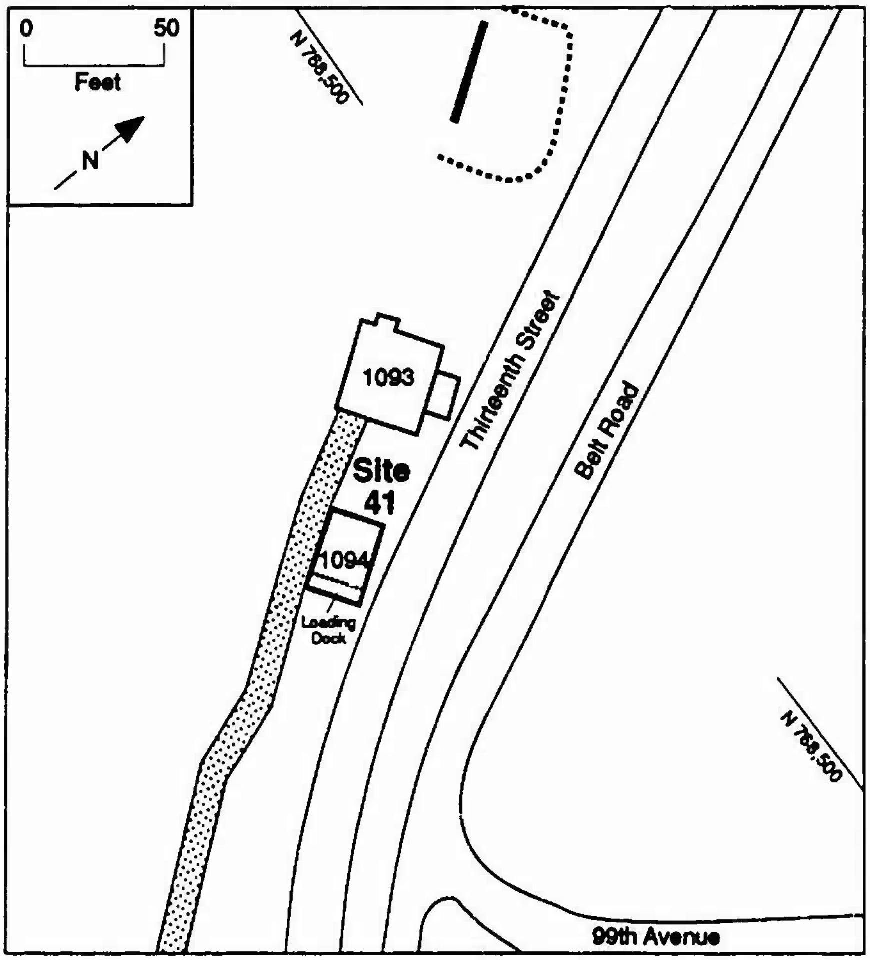

FIGURE 13.10 Layout of Site 41, the Lab-Pack Repacking Facility at Building 1094 (Source: Adapted from USACE 1984b)

of composite shingles. A curb 6 in. high surrounds the floor, except for the doorway, where a 3-in. curb provides containment. Two berms 4 in. high divide areas 1 and 3 and areas 2 and 4. The containment volume provided by the curbing is about 2,270 L (600 gal). Combined with the volume of the tank, the containment capacity is 4,160 L (1,100 gal).

13.8.1.2 Current Status

The facility was included in the RCRA Part A and B permit application by PTA (Meyer 1985; Foster Wheeler 1988d). To upgrade it to RCRA compliance, the building will be improved by replacing all existing signs and shelves, refurbishing the floor with an epoxy coating, replacing the sprinkler system with an upgraded halon fire-extinguishing system, constructing berms and curbs to prevent spills, and removing asbestos (Foster Wheeler 1988d).

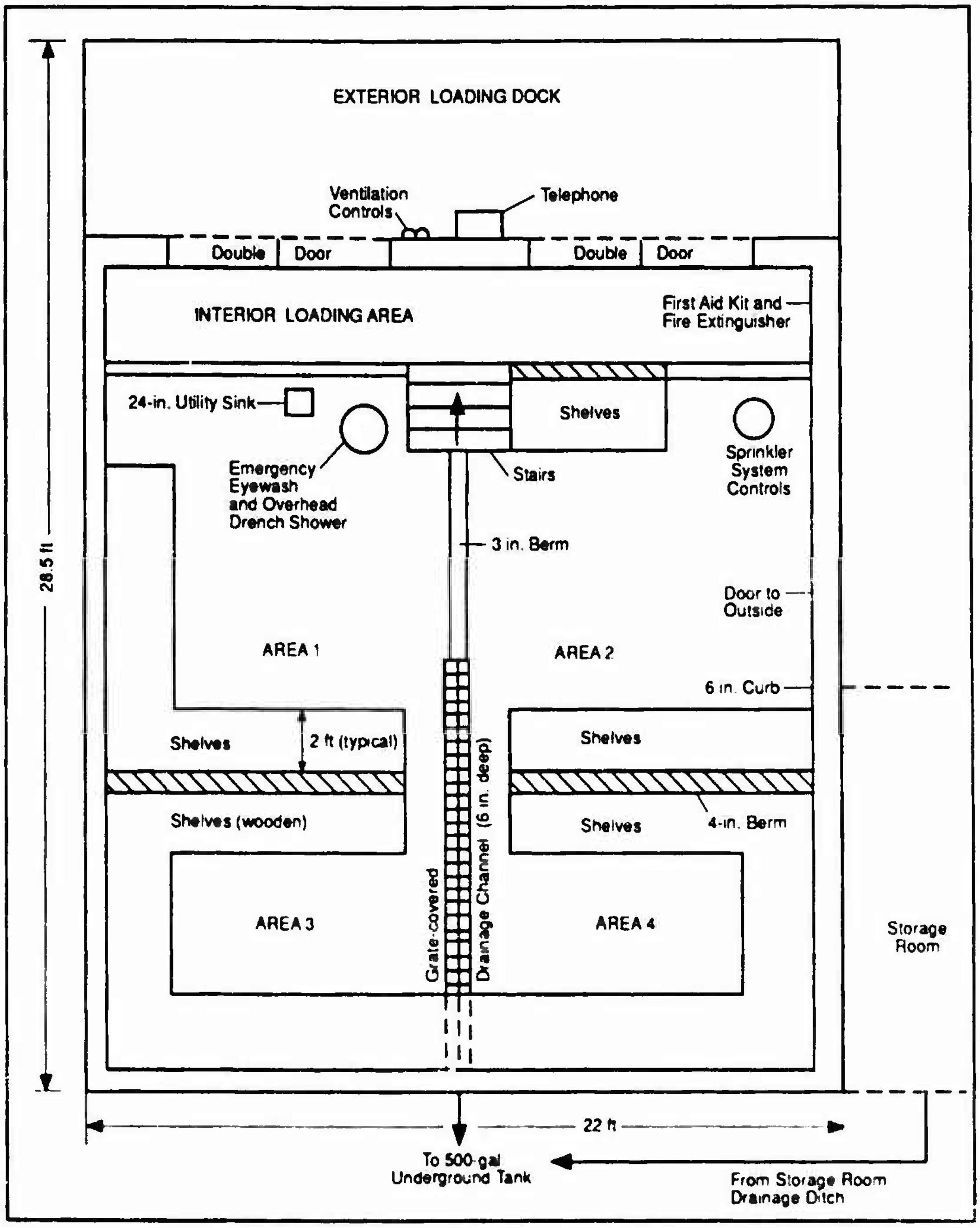

FIGURE 13.11 Floor Plan of the Container Storage Area in Building 1094 (Source: Adapted from Foster Wheeler 1987a)

As a lab-pack repacking facility, small quantities of a wide variety of waste chemicals are handled and stored in Bldg. 1094 prior to shipment off post. Individual wastes (mainly old chemicals or chemicals no longer used at PTA) are stored in small containers, usually in volumes of less than 5 gal. These small containers are then packed in 55-gal drums, along with absorbent material, for off-post disposal. The total volume of the wastes stored in the building varies; however, shelf space is available for about 1,982 gal of waste. Also included in the building is a 500-gal, below-grade stainless steel storage tank, located just outside the west wall of the building. This tank is used to receive, via floor drains, any spills of hazardous materials within the building. Attached to this structure is a storage room that has been used to temporarily contain 55-gal drums of lab-packs prior to disposal off post. Space is available to store about 16 drums, allowing for adequate aisle spacing. A drainage channel covered by grating used to contain spills. This channel also empties into the 500-gal stainless steel tank (Foster Wheeler 1988d).

Dry wastes are delivered occasionally to Bldg. 1094, usually in a wooden box with dovetail corners and a secured lid. These wastes are placed in heavy plastic bags, sealed, and then placed in boxes. Management practices for handling dry wastes are identical to those involving liquids.

Hazardous wastes stored in Bldg. 1094 are grouped together by their physical and chemical characteristics, according to facility standards in NJAC 7:26-9.4. The segregation of incompatible wastes is based on EPA guidelines (EPA 1980).

Prior to storage, each container is sealed to prevent the leakage of waste materials. Also, labels indicating the contents and dates are affixed to the containers. Containers are grouped according to the compatibility of the wastes. The containers are stored inside, so that they do not come in contact with any precipitation.

13.8.2 Geology and Hydrology

Site 41 is located on the foothills occupying the eastern boundary of PTA. The topography in the vicinity of the Site is moderately steep. The surface soils are classified as Rockaway, which are deep, moderately permeable, and well-drained soils of the uplands. Subsoil is commonly gravelly or gravelly sandy loam. The lower part of the subsoil is a dense firm fragipan. Water has a tendency to move laterally over the fragipan (Wingfield 1976).

There are no soil borings directly associated with Site 41. The depth of the water table ranges between 6 and 12 m (20 and 40 ft) below ground surface, based on recent well level measurements at well DM17-1, which is about 90 m (300 ft) northwest of the Site, and well DM6-3, which is about 240 m (800 ft) east of the building (Dames & Moore 1988).

Groundwater flow appears to be in a west to northwest direction toward Green Pond Brook, based on the available well level data for wells on Sites 6 and 17. It is likely that some small component of vertical flow exists. However, horizontal flow appears to be dominant, as is expected in water-table aquifers in this area. Surface water flow appears to be in a northwest direction toward Bldg. 1093, based on local topographic contour.

13.8.3 Existing Contamination

There is no record of any spills of hazardous materials and hazardous waste in the interior or exterior of the building. However, past EPA inspections indicated that oil spills may have occurred outside the building in the parking area (Anderson 1988b). PCB spills occurred in 1983-1984 on the loading dock.

There are no data concerning soil or surface and groundwater contamination at Site 41. However, Site 17 (northern tetryl pits) is about 500 ft northwest (also downgradient) of the Site. Three monitoring wells are presently in place for Site 17. Available groundwater data for these wells, discussed in Sec. 18.3, indicate a general lack of contamination.

13.8.4 Proposed RI Plan

As indicated in Sec. 13.8.1, Site 41 has been in use since 1942. It is an ongoing hazardous waste storage facility, presently operated under RCRA regulation. Spills of oil, PCBs, and other chemicals may have occurred near the building. The proposed RI sampling is described below.

13.8.4.1 Phase I

Two surface soil samples should be collected to a depth of 0.15 m (6 in.) from the parking area, and two samples should be collected from the loading dock area. A field inspection should be conducted to determine the sample locations. Additionally, one soil sample should be collected from each area that shows signs of contamination, as well as from each drain outfall located. These samples should be analyzed for PCBs, herbicides, insecticides, TCL volatiles, TCL semivolatiles, TCL metals, and TCLP leachability (if necessary).

13.8.4.2 Phase II

If an area is found to be contaminated, soil borings should be drilled to the water table or bedrock, whichever comes first, and soil samples collected and analyzed for parameters to be decided based on the Phase I results.

Depending upon the soil sampling results, groundwater monitoring may be proposed. The monitoring network could be designed in conjunction with that in place for Site 17.

13.9 SITE 42 — BUILDING 3114, PCB STORAGE FACILITY

13.9.1 Site History

13.9.1.1 Past Use

Building 3114 is located on 172 Road, opposite an unnamed pond that feeds the right arm of Robinson Run. The Site map is shown in Fig. 13.12. The building was constructed in 1934 on a concrete foundation that previously supported a storage building destroyed in the 1926 explosion. It has brick walls, cement asbestos roofing, and a floor area of 5,559 ft^2. The primary purpose of the building was for the storage of ammunition and projectiles. Other historical information pertaining to the building prior to 1950 is vague, as the only available information is in the HABS/HAER Inventory and Master Plan Data Book (Anderson 1988b).

In 1949, the mission of the U.S. Naval Depot changed, and it became the U.S. Naval Rocket Test Station. The mission called for the manufacture, environmental testing, and test firing of standard and experimental liquid and solid rocket motors. The Army acquired the building in the 1960s. Building 3114 became the storage building for acid oxidizers and red- and white-fuming nitric acids. The acids were stored in stainless-steel drums, which were reinforced with extended metal rings that made the drums easier to handle. This type of storage lasted for about 15 years (Anderson 1988b).

In 1982, at the direction of the PTA Environmental Office, Bldg. 3114 became the storage area for PCB oils and transformers containing PCB oils (Anderson 1988b).

13.9.1.2 Current Status

Building 3114 underwent renovation to meet NJAC regulations for the storage of PCBs in summer 1988 (Anderson 1988b). The PCB storage facility is currently managed to comply with regulations for the storage of hazardous waste for disposal (40 CFR 761.65). The Part B permit application was filed in November 1988 (Foster Wheeler 1988d).

The PCB-contaminated oil storage area in Bldg. 3114 is a rectangular space having an area of 240 m^2 (800 ft^2); the area is surrounded by a curb 7 in. high. The east side of the building is constructed of brick and mortar walls (see Fig. 13.13). Three sides of the containment area are open, with the curb separating the containment area from the remainder of the building. In addition, a 7-in. curb has been constructed around the building's interior perimeter as the combined containment area for PCB transformers and non-PCB waste oil. An unlined concrete floor forms an impermeable base for the entire containment area. Any cracks in the floor have been repaired. The floor is designed without a slope or drainage system. The top of the area is the roof of the building. The total containment volume for PCB oil storage is about 2,200 gal, and that for the PCB transformers and non-PCB oils is about 21,000 gal (Foster Wheeler 1988d).

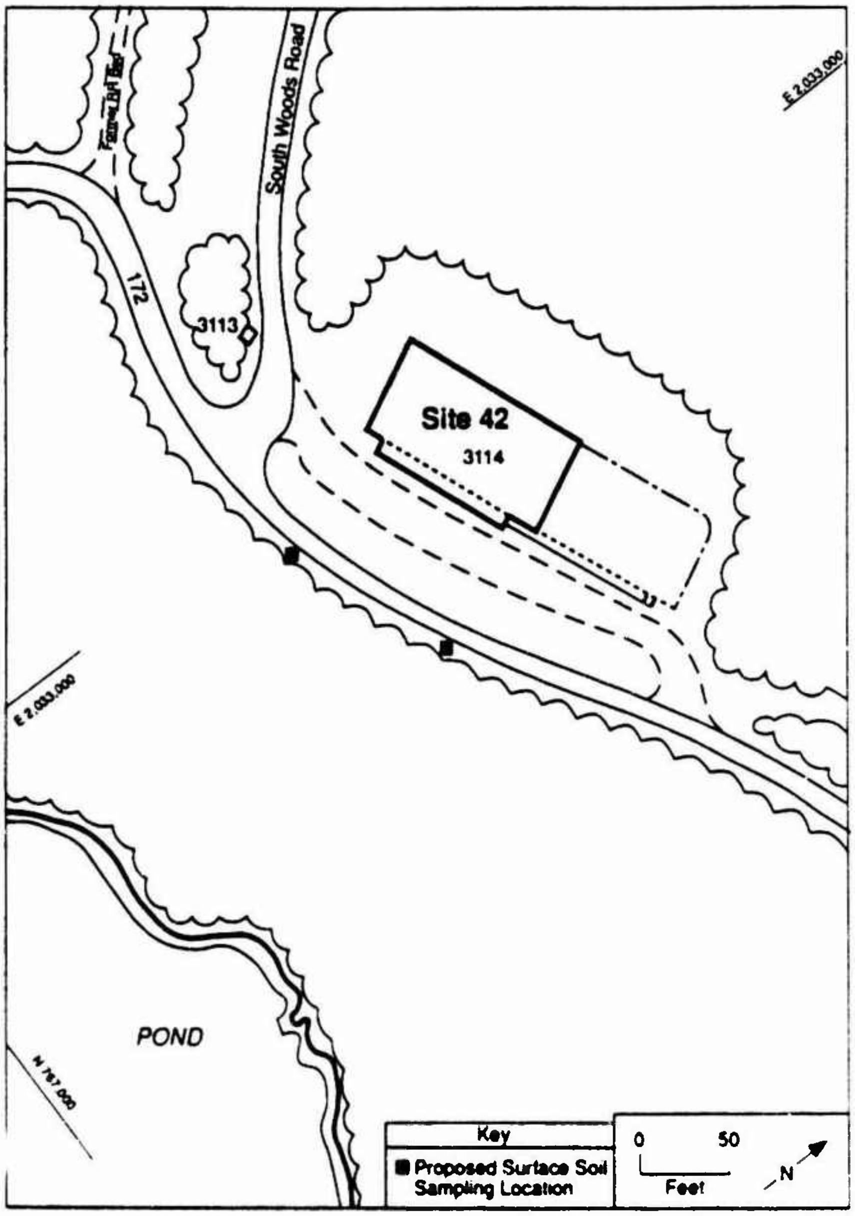

FIGURE 13.12 Layout of Site 42, the PCB Storage Facility at Building 3114 (Source: Adapted from USACE 1984b)

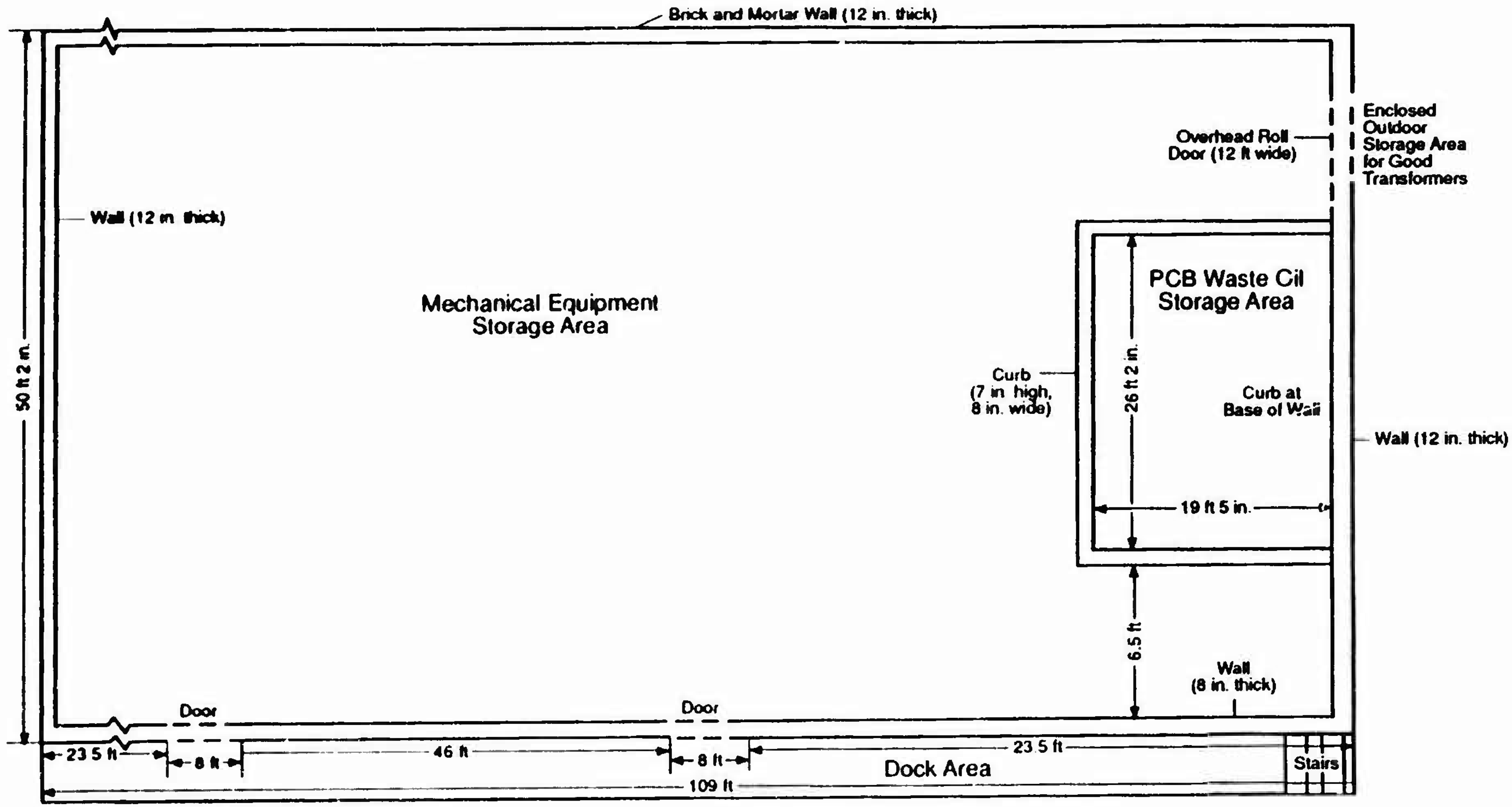

FIGURE 13.13 Floor Plan of Building 3114 (Source: Adapted from Foster Wheeler 1987a)

13.9.2 Geology and Hydrology

Site 42 is located on the foothills that occupy the eastern boundary of PTA. The topography in the vicinity of the Site is moderately steep. The surface soils are classified as Rockaway, which are deep, moderately permeable, and well-drained soils of the uplands. The subsoil is commonly gravelly or gravelly sandy loam. The lower part of the subsoil is a dense firm fragipan. Water has a tendency to move laterally over the fragipan (Wingfield 1976).

There are no soil borings directly associated with Site 42. The water table depth could be between 10 and 40 ft below ground surface, based on recent well level measurements at Site 6, which is located about 1,300 ft northwest of the building. Surface water and groundwater flows appear to be in a southerly direction toward an unnamed pond, based on the topographic contour (see Fig. 13.12).

13.9.3 Existing Contamination

There have been instances of minor PCB spills from leaking drums and leaking PCB transformers in and outside the building. In 1984, a limited PCB spill cleanup was performed by ET&ERO. On March 25, 1988, a capacitor leak resulted in a spill of 1 pt of PCB-contaminated oil. Cleanup actions were completed according to NJDEP regulations (Anderson 1988b).

The building once had a container containing a small quantity of U-238. The area has been checked, and found to be free of radioactive contamination (Ward 1988).

Reportedly, soils in some areas outside the building were contaminated with waste oils and paved over. No measurements have been made that are pertinent to chemical contamination of the soil, surface water, and groundwater at Site 42. Contaminants of major concern are PCBs, explosives, propellants, metals, solvents, and petroleum hydrocarbons.

13.9.4 Proposed RI Plan

13.9.4.1 Phase I

Two surface soil samples should be collected to a depth of 6 in. from the area south of the building where local surface runoff concentrates (see Fig. 13.12). In addition, four core soil samples should be collected to a depth of 0.6 m (2 ft) from the paved area where the the underlying soils were reportedly contaminated with waste oils. Additional soil samples should be also collected in any open drain, pipe outfall, or any area with signs of contamination. A field inspection should be conducted to determine sampling locations. In addition, soil samples should be taken from any area with obvious signs of contamination. These soil samples should be analyzed for all TCL parameters, uranium, explosives, propellants, and TCLP leachability (if necessary).

13.9.4.2 Phase II

If an area is found to be contaminated, soil borings should be drilled and additional surface and subsurface soil samples collected to delineate the extent of the contamination. Depending upon the soil sampling results, surface and groundwater monitoring may also be needed.

13.10 SITE 43 — BUILDING 3157, PESTICIDES STORAGE AREA

13.10.1 Site History

Site 43, the pesticides storage area at Bldg. 3157, is located at the intersection of Jenkins and Schrader Roads near a storage reservoir in the east central part of PTA. Figure 13.14 shows the building's general location. The Site consists of Bldg. 3157 and two concrete pads surrounded by fences with locked gates. A ditch located east of the pads carries water southeast (downslope) from the area of the pads and building.

Building 3157 was built in 1896 for use as a pump house. In 1962, it was transferred from the Navy to the Army. In 1976, the building was modified for use as a storage and mixing area for pesticides, which are stored in drums, metal cans, and glass bottles. Figure 13.15 gives details of the interior layout of the building. Other uses of the building include the repairing of pest control equipment, the storage of pesticide wastes awaiting off-post disposal, and as office space for pest control operators. Rooms in which pesticides are stored or mixed are bermed. Contaminated equipment is washed on the enclosed pads. Pesticide wastes and spills that are not collected during mixing operations are stored in a 55-gal tank in the building (Gaven 1986, Attachments N and O; Anderson 1988b; Foster Wheeler 1988b).

Closure plans have been prepared for both Bldg. 3157 and the pesticide waste storage tank because wastes were stored for more than 90 days in the past. An exemption from the RCRA permitting process is claimed because wastes will be stored in the building for less than 90 days. The closure for the building, which will continue to be used, is scheduled to be a clean closure (Foster Wheeler 1988b).

In 1980, banned pesticides such as chlordane and DDT (which was reported to have not been used since 1975) were stored in the building awaiting disposal. Other excess pesticides stored in the building in 1980 are listed in Table 13.6, along with an existing inventory (June 1988) of pesticides in the building (Ludemann et al. 1981).

There have been no major spills in the building since it was operated by the Division of Engineering and Housing. However, there are indications that minor floor spills have occurred. Also, before the berms were installed spills were contained by use of a commercial absorbent. As of 1980, hydrated lime and sodium hypochlorite were available in the storage and mixing rooms to neutralize any spilled materials (Ludemann et al. 1981; Martin undated; Anderson 1988b).

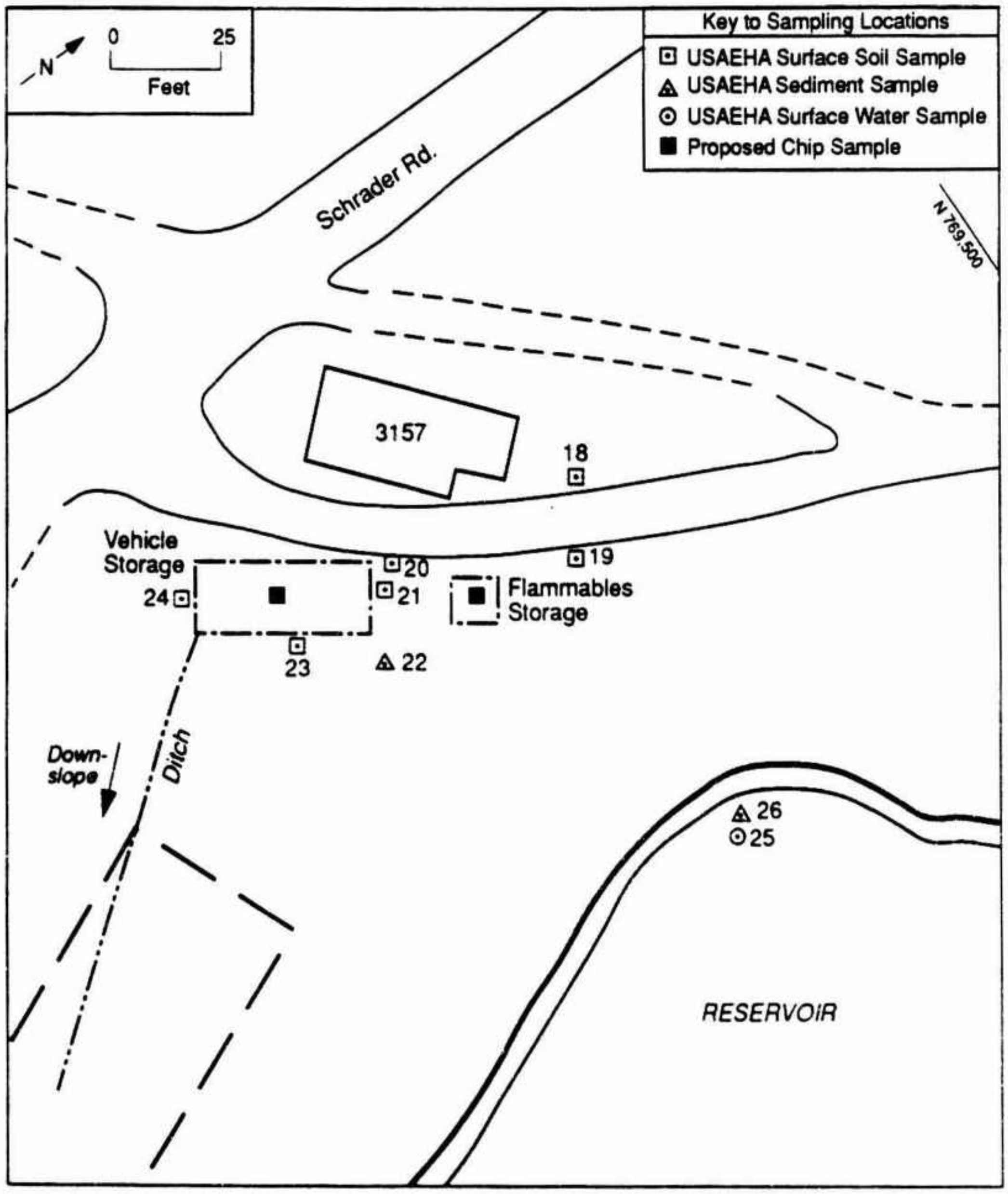

FIGURE 13.14 Details of Site 43, Pesticide Storage Area at Building 3157, Showing Sampling Locations (Sources: Map adapted from USACE 1984b; sampling locations from USAEHA 1989)

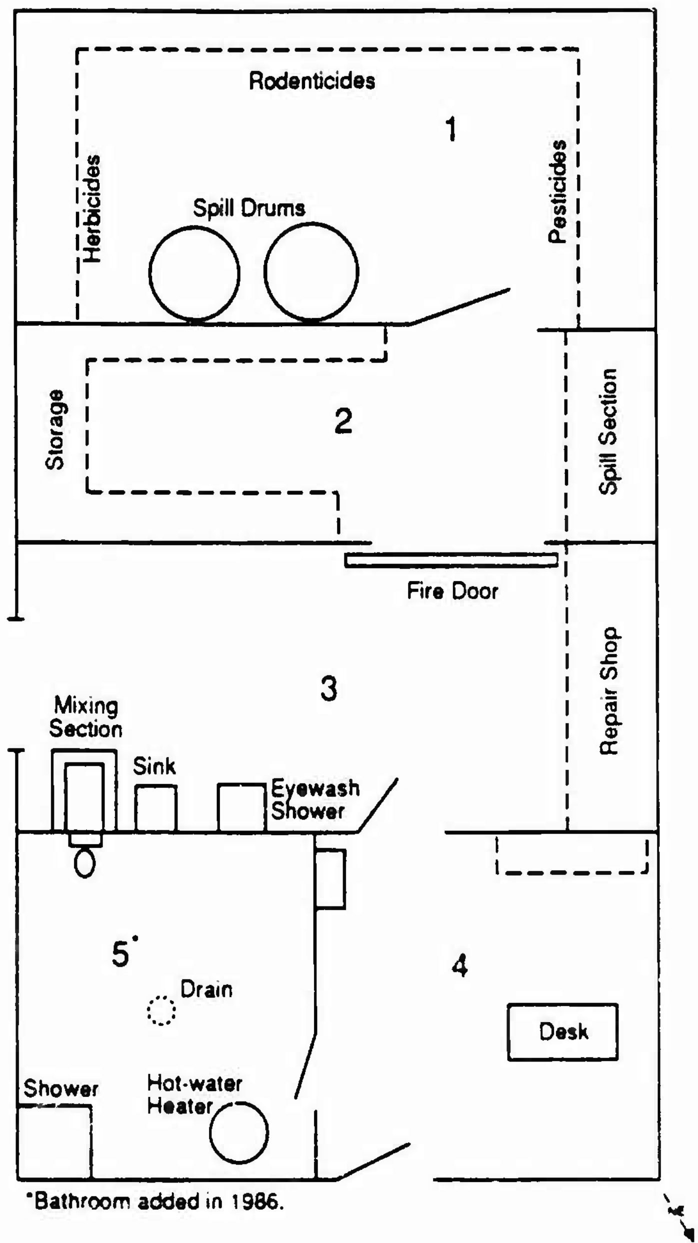

FIGURE 13.15 Floor Plan of Building 3157
(Source: Adapted from Martin undated)

TABLE 13.6 Inventory of Pesticides in Building 3157

Trade Name	Active Ingredient (and Concentration)	Quantity
1980 excess pesticides		
Drazinon	Diazinon (47.5%)	10 gal
Diazinon (powder)	Diazinon (2%)	55 lb
Malathion	Malathion (57%)	255 gal
Malathion	Malathion (95%)	35 gal
Abate 4E	Temephos (43%)	1 gal
DDT	DDT (5%)	2.5 gal
Calcium cyanide	Calcium cyanide (42%)	14.5 lb
Ortho additive	-- (80%)	40 gal
June 1988 inventory		
Baygon	Propoxur (2%)	13.5 lb
Sevin	Carbaryl (80%)	38 lb
Pyrethrins	Pyrethrins (1%)	33 lb
Killmaster	Chlorpyrifos (1%)	56 oz
Killmaster	Chlorpyrifos (2%)	24.5 gal
Contrac	Bromadialone (0.005%)	244 lb
Sparrow cracks	Strychnine alkaloid (0.6%)	18 lb
Combat	Hydramethylon (1.65%)	91 baits
Wasp spray	Resmethrin (0.15%)	11 cans
Gencor plus	Hydroprene (0.85%)	48 cans
Precor plus	Methoprene (0.15%)	25 cans
Smokem	Potassium nitrate (46.2%)	48 cartridges
Moth flakes	Naphthalene (100%)	30 lb
Cythion malathion	Malathion (91%)	72 gal
Pyrethrum fogging spray	Pyrethrins (0.1%)	10 gal
Precor	Methoprene (65.7%)	17 mL
Diazinon	Diazinon (47.5%)	1.5 gal
Trimec	2,4-D (42.54%)	11.0 gal
Amine salt MCPP-2,4D	2,4-D (46.35%)	1.5 gal
Round-up	Glyphosate (41%)	19 gal
Diquat	Dibromide (35.3%)	26 gal
Copper sulfate	Pentahydrate (99%)	124 lb
D-Phenothrin	D-Phenothrin (1.92%)	25 cans
Treflan	Trifluralin (a)	70 lb
Abate 4E	Temephos (43%)	1 gal
Baygon	Propoxur (14.6%)	8 gal
Combat ant baits	Hydramethylon (0.9%)	852 bait trays

[a]Concentration unknown.

Sources: Ludemann et al. 1981; Clune and Milio 1988.

13.10.2 Geology and Hydrology

Bedrock in the area consists of Precambrian gneiss. Surface soils in the area belong to the Rockaway Series. These are characterized as deep, moderately well drained, acidic, upland soils with a permeability ranging from 1.5 to 5.9 cm/h (0.6 to 2.0 in./h). Subsoils are gravelly loam or gravelly sandy loam underlain by a dense fragipan over which water tends to move laterally. A ditch located east of the building and pads carries surface water runoff downslope to the southeast (USATHAMA 1976). The depth of soil and the depth and direction of groundwater flow at the Site are not known.

13.10.3 Existing Contamination

Wipe samples were collected from 10 locations in Bldg. 3157 (3 locations in the administrative office, 3 in the bathroom, 1 in the mixing room, 1 on the workbench, and 2 in the storage room) and analyzed for pesticides. No pesticides were detected. Samples were also collected at eight locations outside Bldg. 3157. The locations are shown in Fig. 13.14. Samples 22 and 26 are sediment samples, sample 25 is a water sample, and the rest are surface soil samples. Each soil sample is a composite from five cores taken to a depth of up to 6-7 cm. the five core locations consist of a central location and four locations about 1.6 m (5 ft) away from the center (USAEHA 1989).

Analysis of the samples for pesticides showed the presence of Mirex at 0.65 mg/kg in sample 21, 0.39 mg/kg in sample 22, and 1.65 mg/kg in sample 23 (all concentrations are dry weight values). No other pesticides were detected in any of the samples. The presence of Mirex is difficult to explain since historical records do not show the use of Mirex. The concentrations of Mirex found in sediment sample 22 is above the USAEHA action-level threshold of 0.10 mg/kg (dry weight) for sediments. (The threshold for soils, 5.0 mg/kg, is above the concentration found in sample 23 [USAEHA 1989].)

13.10.4 Closure Plan

The revised RCRA closure plans for Bldg. 3157 provide for collecting two samples of the contents of the waste storage tank and steam cleaning the interior of the tank. If needed, the tank will be washed with a surfactant and then triple rinsed. The samples will be analyzed for pesticides, herbicides, and VOCs. After removal of the contents from Bldg. 3157, the shelves, walls, and floors will be steam cleaned. Two grab samples of the condensate will be analyzed for priority pollutant metals. Following cleaning, two chip samples will be collected, one from the floor of the storage area and one from the floor of the mixing room, and analyzed for priority pollutant metals. The chip samples will also be analyzed for priority pollutant metals (Foster Wheeler 1988b, 1989; Solecki 1989a).

13.10.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. If a clean closure is not possible, the proposed sampling plan will be modified as new data become available.

13.10.5.1 Phase I

One chip sample each should be collected from the center of the vehicle and flammables storage areas (Fig. 13.14). The two samples should be analyzed for pesticides, herbicides, and TCL metals.

Soil samples should also be taken from three locations at 15-m (50-ft) intervals along the drainage ditch that carries water from the Site. At least one of the ditch samples should be collected near the storage areas. Exact locations of the samples will be determined by field inspection. If possible, all samples should be collected to a depth of 0.15 m (6 in.). The samples should be analyzed for TCL metals, pesticides, herbicides, Mirex, and cyanide. These samples are needed in addition to those already collected and analyzed (USAEHA 1989) because the ditch has not been sampled.

During the spring and summer, when there is water in the ditch, two water samples should be taken from it during each season, one near the storage areas and the other 100 m (330 ft) downstream. The four samples should be analyzed for herbicides, TCL metals, pesticides, herbicides, Mirex, fluoride, and cyanide. These analyses should give information on the potential transport of contaminants off the Site by runoff.

13.10.5.2 Phase II

If the soil samples of the water samples taken from the ditch show significant contamination, then additional samples should be taken to determine how far down the ditch the contamination occurs. Soil borings may be necessary if the contamination is extensive.

If significant contamination is found in the chip samples, then the pads should probably be steam cleaned and possibly washed. Chip samples should be taken after cleaning and analyzed for the contaminants found prior to the cleaning.

13.11 SITE 51 — HAZARDOUS MATERIAL STORAGE TANKS NEAR BUILDING 1380

13.11.1 Site History

Site 51 consists of two aboveground tanks near Bldg. 1380 off South N.G. Road (Fig. 13.16). They were used for storage of a mixture of nitric and sulfuric acid, which was used for the production of nitroglycerin in Bldg. 1362. From there, spent acid from the NG manufacturing process would then flow via pipeline to Bldg. 1365 (Site 35) for storage prior to disposal (Foster Wheeler 1988b).

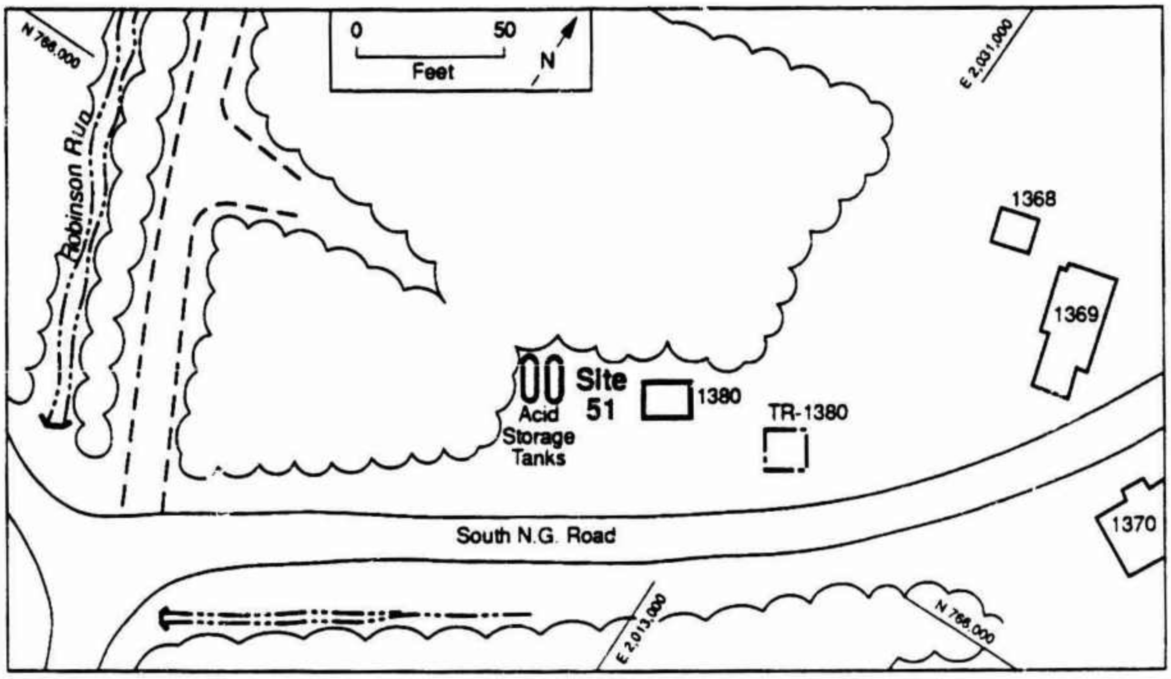

FIGURE 13.16 Layout of Site 51, the Hazardous Material Storage Tanks near Building 1380 (Source: Adapted from USACE 1984b)

Each of the stainless-steel acid tanks on the site has a capacity of about 11,000 L (3,000 gal). They are supported on concrete supports, located about 5 ft from the tank ends. Secondary containment is provided by a PVC liner, creating a berm underneath both tanks. The tanks are 5 ft in diameter and 20 ft long. Water accumulation in the bermed area under the tanks was observed during the Site visit in June 1988.

The erection date of the tanks is unknown, but Bldg. 1380 was constructed in 1949. Nitroglycerin has not been manufactured in this general area since 1983.

The acid tanks at Site 51 are to be closed in accordance with New Jersey hazardous waste regulations because they never had interim status.

13.11.2 Geology and Hydrology

The study area is on the upland of the foothills occupying the east portion of the PTA. The ground throughout this area is swampy, suggesting poor drainage and very shallow groundwater. The topography in the locality is moderately flat, sloping toward the left arm of an intermediate stream, Robinson Run. Based on topographic maps, this stream would receive runoff from the Site.

No subsurface geological data for Site 51 are available, but the subsurface geology of the site possibly resembles that of Site 17, which is about 2,000 ft from the Site. Based on the information from soil borings at Site 17, the thickness of the glacial till and soil mantel ranges from 20 to greater than 40 ft (Dames & Moore 1988).

The marshy area indicates that groundwater is shallow and the Site could be a groundwater discharge area. Shallow groundwater is likely to be topographically controlled. Based on the ground surface contour, the groundwater flow could be in the northwesterly direction. It is likely that some small component of vertical flow exists in the area.

13.11.3 Existing Contamination

One surface water sample and one sediment sample were collected in July 1988 from a location on the left arm of Robinson Run at Upper X.H.E. Road. The sample location is downgradient of Site 51 and identified as SW/SDA-4 (see Fig. 13.7) (York 1989a, 1989b). Analysis results for these samples showed concentrations of metals similar to regional background levels.

There has been no soil or groundwater monitoring at Site 51.

13.11.4 Closure Plan

One air bomb sample and one liquid sample from each of the two acid tanks will be collected for analysis of nitrate and VOCs (liquid samples only). Each tank then will be decontaminated by flushing it with water and steam cleaning to remove the remaining organics. Two condensate grab samples will be collected from each tank and tested for nitrates, pH, and priority pollutant metals. Following decontamination, each tank will be removed and transported to the burning ground, where it will be flashed off and scrapped.

Soil samples will be taken from any discolored area discovered underneath the foundation of each tank. If an area is found to be contaminated, vertical and horizontal samples will be collected to determine the extent of contamination. Contaminated soil will be excavated and disposed of at a permitted hazardous waste facility. If required, the excavated area will be filled with clean soil.

13.11.5 Proposed RI Plan

No additional sampling activities are proposed at this time. Should clean closure not be possible, the closure plan should be revised once new data become available.

13.12 SITE 77 — BUILDING 3150, MACHINE SHOP AND WASTE STORAGE AREA

13.12.1 Site History

Building 3150 is on the southeastern PTA boundary. A map of the Site is shown in Fig. 13.17. Building 3150 was built in 1942 as a storage building. Currently, it houses a precision machine shop (85,592 ft^2), a gymnasium (8,285 ft^2), and a bowling alley (4,060 ft^2). The metal fabrication machine shop, which also has a waste storage

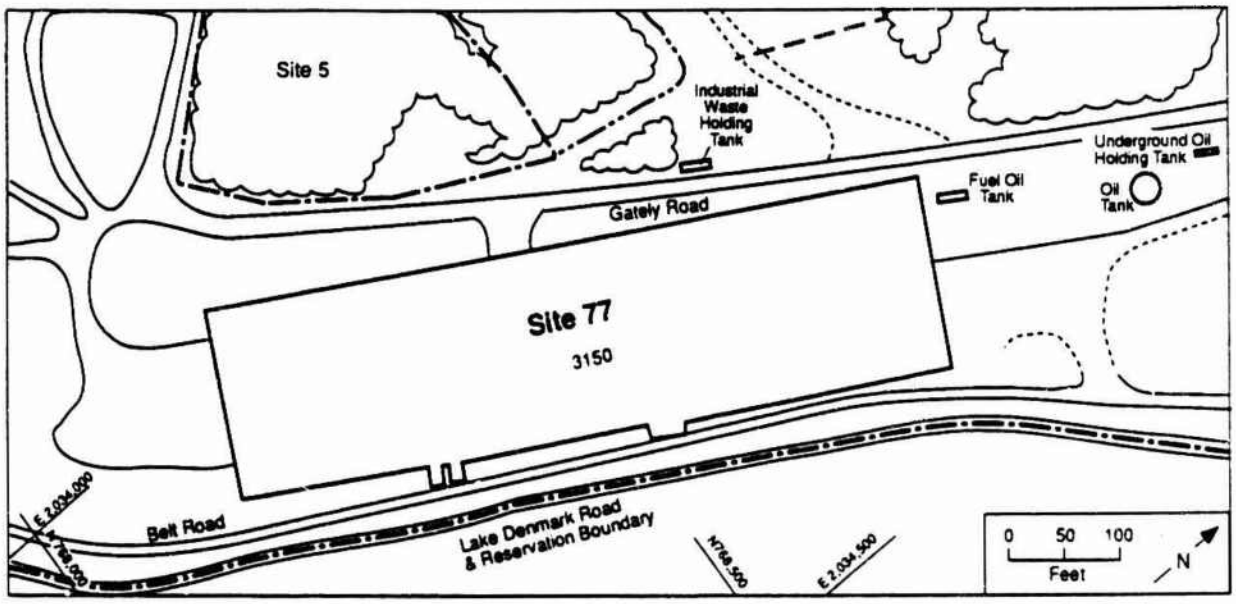

FIGURE 13.17 Layout of Site 77, the Machine Shop and Waste Storage Areas at Building 3150 (Source: Adapted from USACE 1984b)

area, is still expanding. The north corner of the basement contains a storage area for waste oil as well as a system of underground storage tanks. An industrial waste holding tank is located west of the building on the other side of Gately Road, and three tanks for oil and fuel oil are north of the building.

Closure plans have been prepared for the basement storage area, tanks, and machine shop. The basement storage area will be closed under interim status because hazardous wastes have been stored for more than 90 days (Foster Wheeler 1988a, 1988c). The basement storage area will be closed under New Jersey hazardous waste regulations because it never had interim status.

13.12.2 Geology and Hydrology

The Bldg. 3150 area is 960 ft above MSL. The land slopes to the northwest to the reservoir in the south basin. Soils at the Site belong to the Rockaway Series, and the bedrock is Precambrian gneiss. Three aquifers underly the Site: water table, confined, and bedrock aquifers. The hydraulic connection between the water table and confined aquifers is greater near Site 77 than in areas more centrally located at PTA. Surface water and runoff from the Site would flow toward the south basin reservoir and eventually into Picatinny Lake.

13.12.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that there are shells under the floor of the building. In addition, the machine shop generates waste lubricating oils, hydraulic oils, and water-soluble coolant from metal and plastic cutting (220 gal/mo water soluble coolant, 220 gal/mo hydraulic oil, 55 gal/mo oil-contaminated speedi-dry, and 55 gal/mo oil-contaminated rags), which are temporarily stored in 55-gal drums for less than 90 days (Solecki 1989c). The drums are stored in a waste storage area in the southwest corner of the building. According to the closure plan, the drums are checked daily for leaks and spills. The plan lists the maximum storage inventory as thirty 55-gal drums of waste oil and thirty-eight 55-gal drums of Coolex 40.

13.12.4 Closure Plan

The revised closure plan for the machine shop waste storage area includes sealing off the area and cleaning the walls and floor with high-pressure steam. Two condensate grab samples and three chip samples will be collected and analyzed for priority pollutant metals. The closure plan does not include any sampling outside of the building.

The revised closure plan for the underground storage tanks includes sampling the soil around the tanks, removing the tanks, cleaning them, sampling the removed soil and also soil in the area of the removed tanks, and backfilling the areas of the removed tanks with uncontaminated soil. A total of 15 soil samples and two wash water or condensate samples will be collected for each tank. The soil samples will be analyzed for VOCs, TPH, priority pollutant metals, and possibly EP toxicity for metals, and the water samples will be analyzed for priority pollutant metals (Foster Wheeler 1989; Solecki 1989a).

The revised closure plan for the basement waste oil storage room includes removing the waste and cleaning the floor and walls with high-pressure steam. Two rinsate grab samples and two chip samples will be collected and analyzed for priority pollutant metals. The closure plan does not include any sampling outside of the building (Foster Wheeler 1989; Solecki 1989a).

13.12.5 Proposed RI Plan

The proposed phased sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of Site 77 not be possible, the RI plan will be modified as new data become available.

13.12.5.1 Phase I

The interior and exterior perimeter of Bldg. 3150, especially near machine shop and basement waste storage entrances, should be visually inspected. (Inspection of the underground tank system is covered by the closure plan.) If no staining or signs of spills are evident, then no further investigation is necessary.

If the need for soil sampling is indicated by the inspection, then one surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each stained area. Samples should be analyzed for TCL volatiles, TCL semivolatiles, and TCL metals.

13.12.5.2 Phase II

If significant contamination is found in the surface soil samples, then soil borings should be drilled and soil samples collected from the borings. The soil borings should be drilled at or near the areas with contaminated surface soil identified during Phase I. The subsurface soil samples should be analyzed for TCL volatiles, TCL semivolatiles, and TCL metals.

13.12.5.3 Phase III

If significant contamination is found in the subsurface soils, it will be necessary to evaluate the movement of contaminants into groundwater by installing monitoring wells. The number and location of the wells would depend on the location of the contaminated soil boring samples.

13.13 SITE 91 — BUILDING 1301, ROCKET MOTOR ASSEMBLY FACILITY

13.13.1 Site History

Building 1301 is located about 1,000 ft from the southeastern PTA boundary and about 2,500 ft south of Green Pond Brook. A map of the Site is shown in Fig. 13.18. Building 1301 was built in 1945 during World War II as a mortar powder building. During the Korean and Vietnam wars, it was used to load mines. In 1988, it was being used to assemble rocket motors.

Closure plans have been prepared for Bldg. 1301 because hazardous wastes may have been stored there in the past for more than 90 days. PTA has claimed an exemption from RCRA permitting requirements because future hazardous waste storage at the building will be for less than 90 days (Foster Wheeler 1988a). The building will be closed under New Jersey hazardous waste regulations because it never had interim status.

13.13.2 Geology and Hydrology

The Bldg. 1301 area is 995 ft above MSL. The land slopes to the north to Green Pond Brook. Soils in the area belong to the Rockaway Series, and the bedrock is Precambrian gneiss. The hydraulic connection between the water table and confined aquifers in this area is greater than in areas more centrally located on the Arsenal. Surface water and runoff from the Bldg. 1301 area would flow toward the north and eventually into Green Pond Brook.

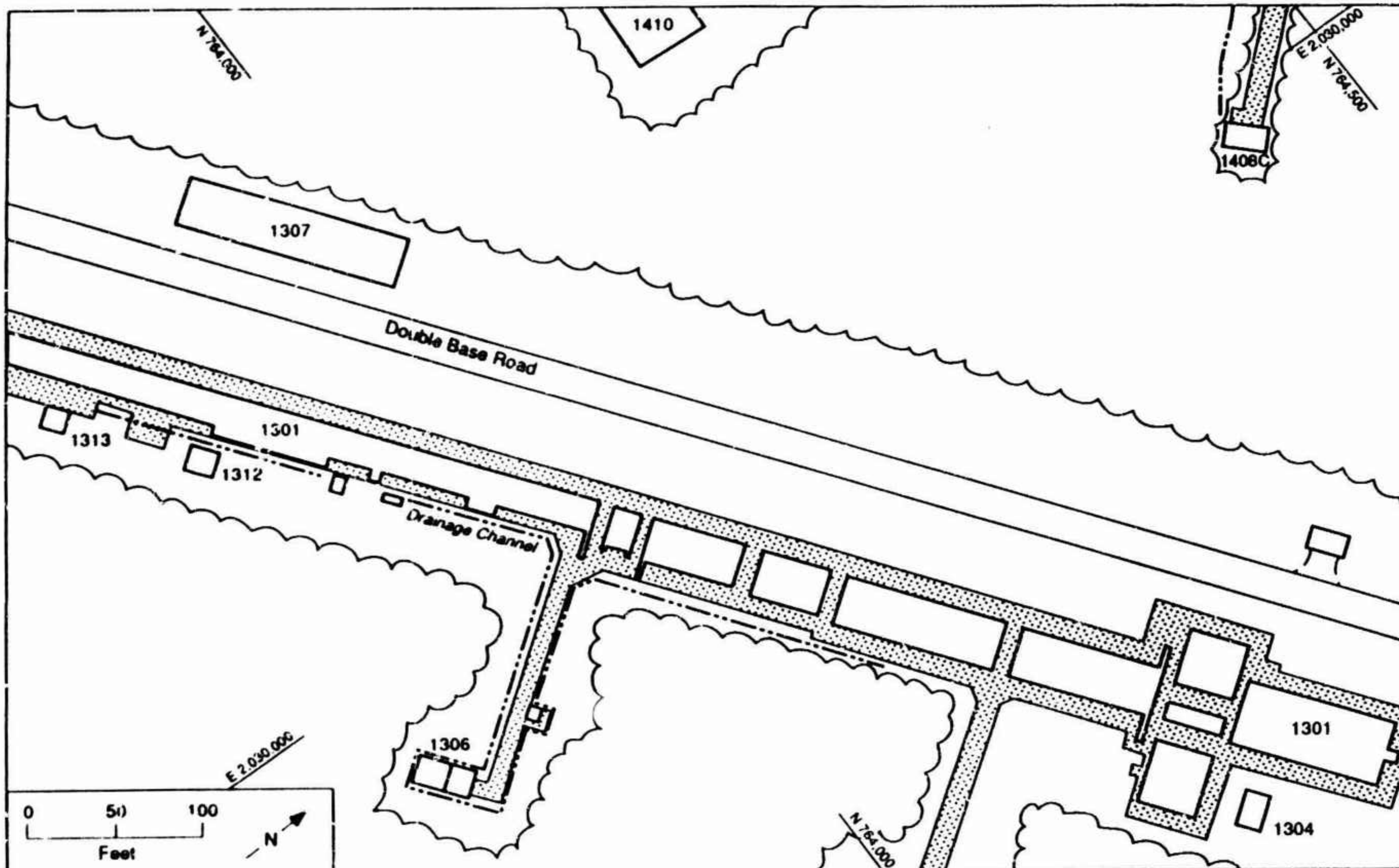

FIGURE 13.18 Layout of Site 91, the Rocket Motor Assembly Facility at Building 1301 (Source: Adapted from USACE 1984b)

13.13.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that Bldg. 1301 contained little waste and that barrels containing lead azide were washed out behind the building in the 1960s. Lead azide was washed down with a yellow liquid containing ferric ammonium nitrate to desensitize it, and the yellow liquid was then washed down the drain. The closure plan indicates that a walkway outside of Room E-7 is used as a waste storage area. The maximum waste inventory is listed as one 55-gal drum of waste solvents, one 55-gal drum of waste-solvent-contaminated solids, and 3 lb of energetic waste submerged in 15 gal of water.

Because Bldg. 1301 has a corrugated asbestos roof, any cleanup or decommissioning plans should consider the need to first remove any friable asbestos present and otherwise minimize worker exposure to asbestos.

13.13.4 Closure Plan

The revised RCRA closure plan for the building includes steam cleaning and washing the walkway outside and behind Room E-7. Two rinsate grab samples and two chip samples will be collected and analyzed for priority pollutant metals. Closure does not appear to involve any sampling outside of the building (Foster Wheeler 1988a, 1989; Solecki 1989a).

13.13.5 Proposed RI Plan

The proposed phased RI sampling plan will be carried out independently of implementation of the closure plan. Should clean closure of Bldg. 1301 not be possible, the RI plan will be modified as new data become available.

13.13.5.1 Phase I

The area behind Bldg. 1301 should be visually inspected to locate the lead azide washout site. If the washout site cannot be located visually, then geophysical methods should be employed to detect elevated concentrations of lead. If the washout site is located, then three surface soil samples should be collected from it; the sampling depth should be 0.3 m (1 ft).

In addition to sampling at the reported lead azide washout site, two surface soil samples should be collected to a depth of 0.3 m (1 ft) from the area beside the waste storage walkway. All surface soil samples should be analyzed for explosives, propellants, and lead.

13.13.5.2 Phase II

If significant contamination is found in the surface soil samples, then one soil boring should be drilled near each contaminated soil area identified during Phase I.

Subsurface soil samples should be collected from each boring and analyzed for explosives, propellants, and lead.

13.13.5.3 Phase III

If significant contamination is found in the subsurface soils, it will be necessary to evaluate the movement of contaminants into groundwater by installing monitoring wells. The number and location of the wells would depend on the location of the contaminated soil boring samples.

13.14 SITE 103 — RESERVOIR NEAR BUILDING 3159

13.14.1 Site History

Site 103, the reservoir near Bldg. 3159, is located in the southeastern basin area of PTA. A map of the Site is shown in Fig. 13.19. Overflow from the reservoir flows into the South Basin and then into the North Basin. The reservoir has no current use other than to serve as a backup water supply for PTA.

13.14.2 Geology and Hydrology

The surface elevation at the reservoir is about 950 ft above MSL. Soils in the area belong to the Rockaway and Hibernia Series, and the bedrock is Precambrian gneiss.

13.14.3 Existing Contamination

In June 1988, surface water and sediment samples were collected from three locations in the reservoir (Fig. 13.19) and analyzed for pesticides. No pesticides were detected (York 1989a, 1989b).

Reportedly, the reservoir contains UXO. It is rumored that a 16-in. shell was removed from the reservoir.

13.14.4 Proposed RI Plan

13.14.4.1 Phase I

The reservoir should be surveyed for UXO. Possible survey methods include the use of geophysical techniques or underwater television cameras. Additional methods may be available to EOD teams, including classified methods. Any UXO located should be removed or, at a minimum, marked with buoys.

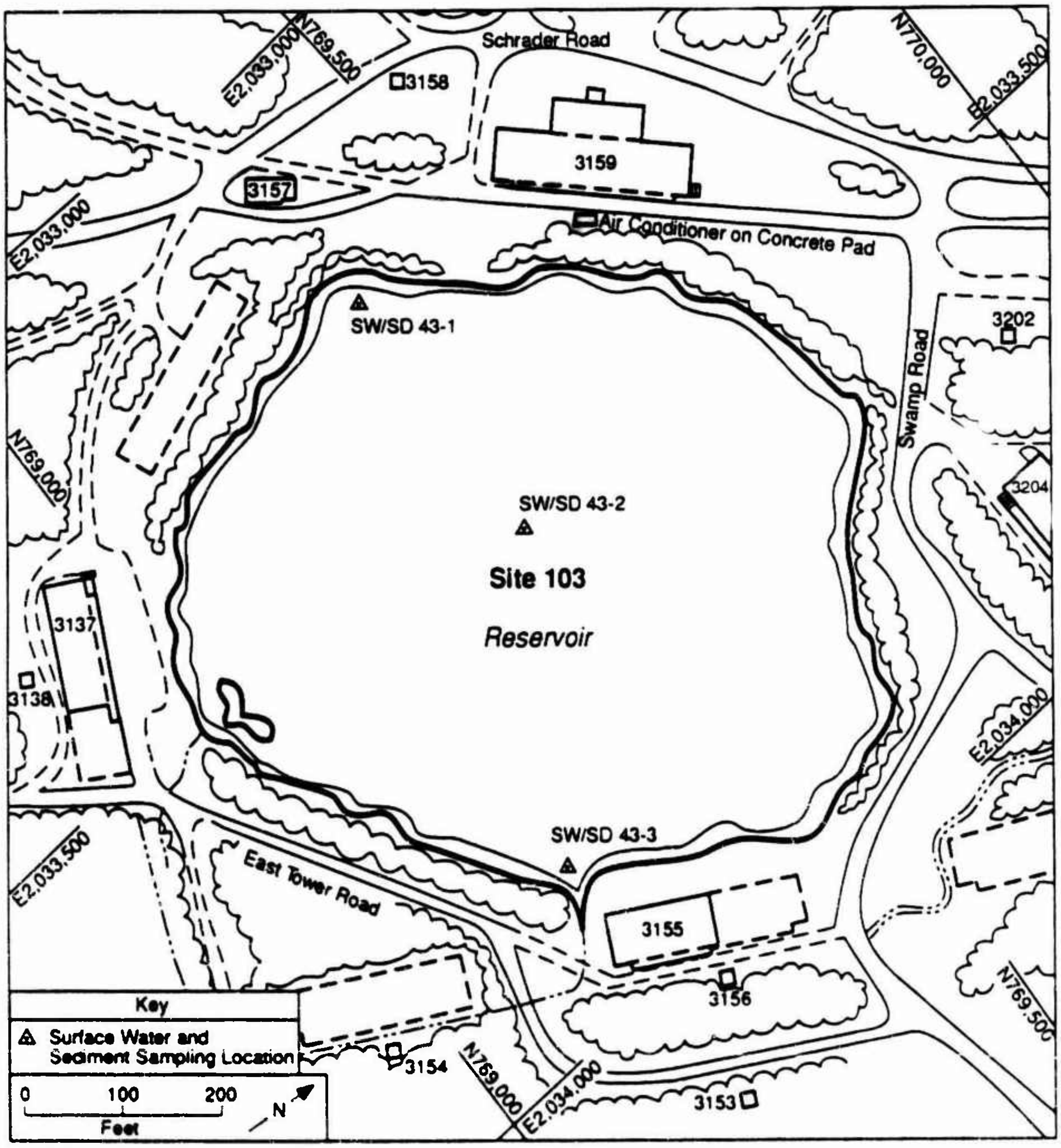

FIGURE ¯ .19 Layout of Site 103, the Reservoir near Building 3159 (Source: Adapted from USA⌣E 1984b; York 1989b)

13.14.4.2 Phase II

If UXO is found, then two sediment samples should be collected to a depth of 0.3 m (12 in.) from the reservoir near each UXO item and analyzed for explosives and lead. These samples will help determine whether any contaminants have been released from the UXO. Also, two surface and two bottom samples of water should be collected from the area and analyzed for the same parameters.

13.15 SITE 114 — BUILDING 1033

13.15.1 Site History

Building 1033 is located just east of Twelfth Street and north of Upper X.H.E. Road (Fig. 13.20). During interviews, PTA personnel reported that the building is used for loading explosives. The pinkwater effluent discharged from the tanks flowed through two filters then into Robinson Run, which flows to the east from Site 114. The floors of the building were reportedly cleaned with acetone and "visatol." Used cleaning rags were sent to the burning ground. Additional information on past activities at this Site is not available.

13.15.2 Geology and Hydrology

Building 1033 is located just to the northwest of Robinson Run, a tributary of Green Pond Brook. The site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 114 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 114 flows towards Robinson Run, which flows west and discharges into Green Pond Brook.

13.15.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. During interviews, PTA personnel reported that a wastewater treatment system in the building failed during the 1970s and untreated wastewater was discharged into Robinson Run. The discharge included water brought by tanker truck from Bldg. 1400. It was also reported that holding tanks for cleanup water often overflowed. Contaminants reportedly discharged into Robinson Run include TNT, composition B, octol, and RDX.

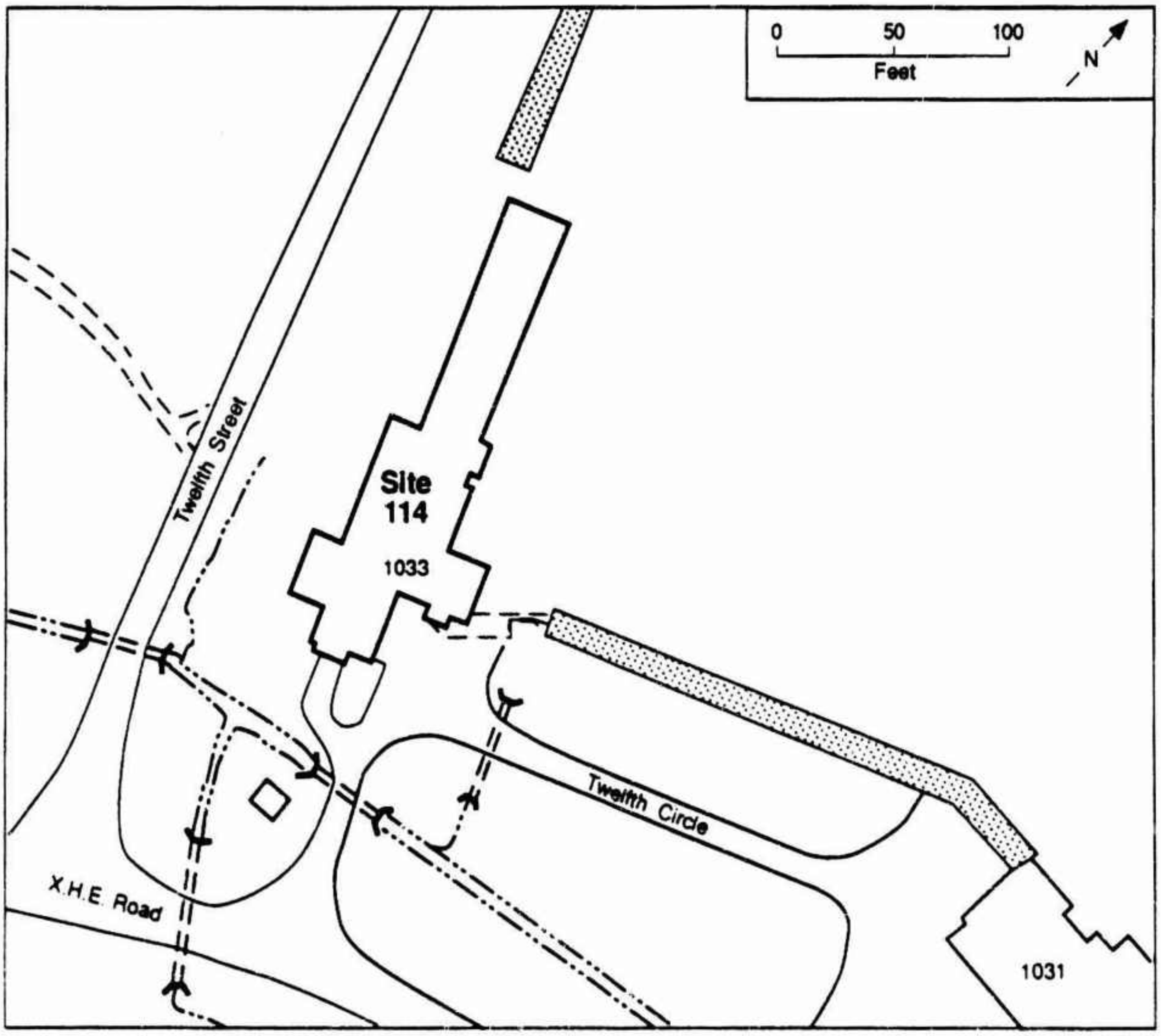

FIGURE 13.20 Layout of Site 114, the Filling Plant for Cast High Explosives at Building 1033 (Source: Adapted from USACE 1984b)

13.15.4 Proposed RI Plan

13.15.4.1 Phase I

The area around Bldg. 1033 should be visually inspected for signs of contamination. One surface sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the building. Sediment samples should be collected from four locations along Robinson Run, at intervals of 30 m (100 ft) along its shore and from any visibly contaminated areas. Sampling should begin at the discharge point from Bldg. 1033 and should continue 300 ft downstream of the building. All samples should be analyzed for explosives.

13.15.4.2 Phase II

If contamination is found, additional surface soil and sediment sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. At least two samples should be collected from each boring. The samples should be analyzed for contaminants identified during Phase I.

13.16 SITE 160 — BUILDING 1029, ORDNANCE FACILITY

13.16.1 Site History

Building 1029 is located northwest of N.G. Road and north of X.H.E. Road (Fig. 13.21). The building is a satellite waste accumulation area where waste material are temporarily stored until picked up for disposal. Wastes generated from analysis -- propellants and nitrocellulose (200 gal/yr) and tetrahydrofuran (8 gal/yr) -- are stored inside the building on a tile-covered concrete floor (Solecki 1989c). Additional information about past activities at this Site is not available.

13.16.2 Geology and Hydrology

Building 1029 is located approximately 100 ft from Robinson Run along the eastern side of PTA. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 160 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 160 flows towards Robinson Run, which flows west and discharges into Green Pond Brook.

13.16.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Propellants, nitrocellulose, and tetrahydrofuran, which were stored inside the building, are possible contaminants.

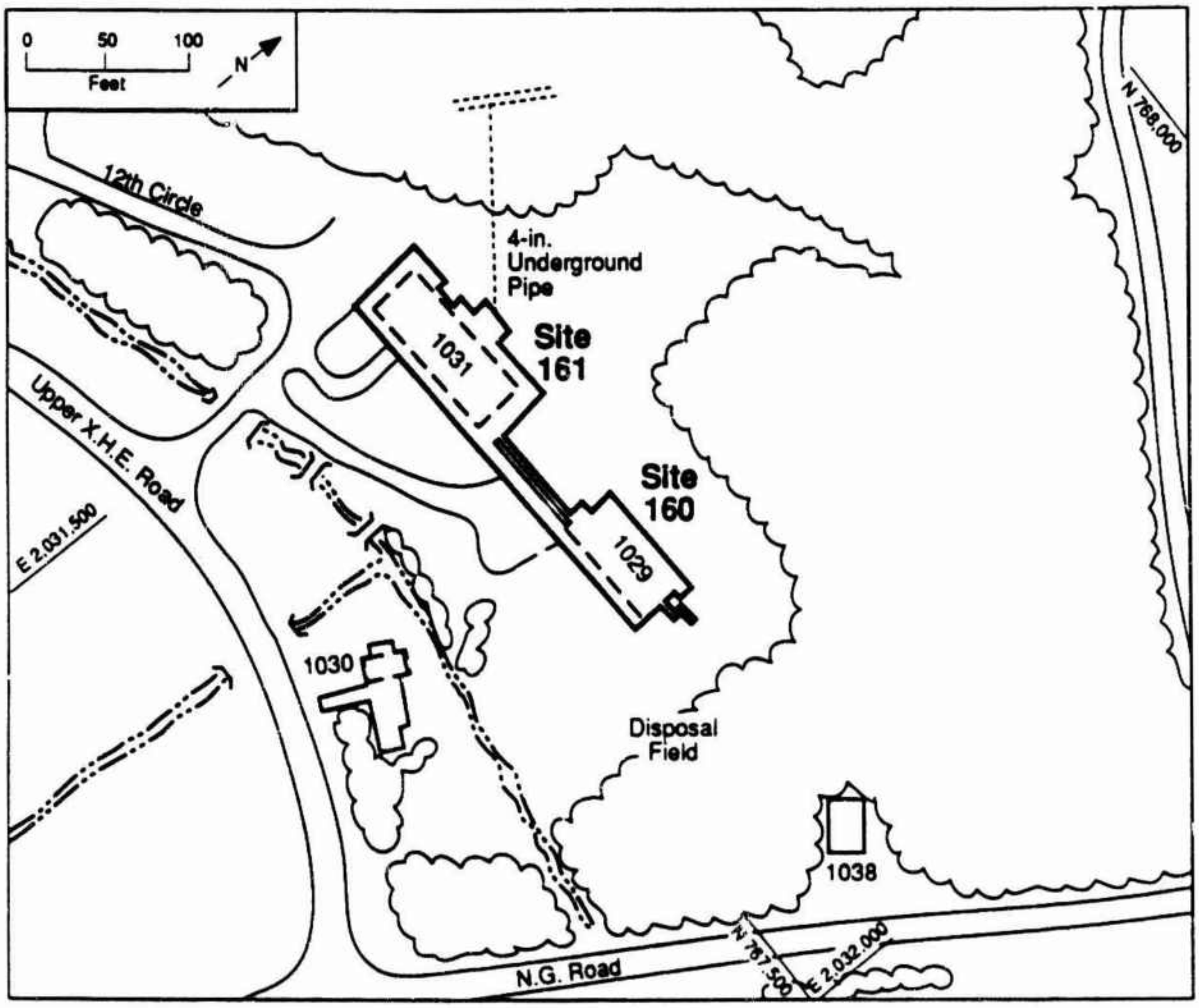

FIGURE 13.21 Layout of Site 160, Building 1029, and Site 161, Building 1031 (Source: Adapted from USACE 1984b)

13.16.4 Proposed RI Plan

13.16.4.1 Phase I

The area around Bldg. 1029 should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the building. All samples should be analyzed for propellants, expl‹ sives, and tetrahydrofurans.

13.16.4.2 Phase II

If contamination is foun‹l, add‹ ‹onal surface soil sampling may be required to determine its extent. One soil bor‹ should be drilled at each contaminated area identified during Phase I. Samples should be collected from each boring and analyzed for contaminants identified during Phase I.

13.17 SITE 161 — BUILDING 1031, NITRATION BUILDING

13.17.1 Site History

Building 1031 is located to the west of Bldg. 1029 (Site 160) just north of Upper X.H.E. Road (Fig. 13.21). The five-story building was constructed in 1956 to manufacture HMX and RDX and was later modified for the computer-controlled manufacture of TNT. Chemicals used at the building include caustics, glycerin, nitric acid, and sulfuric acid, which were used to manufacture nitroglycerin (Foster Wheeler 1988c). During interviews, PTA personnel reported that over the years, a wide range of chemicals have been discharged to the surrounding environment.

Closure plans for Bldg. 1031 have been prepared because hazardous wastes were stored in the building for more than 90 days. The estimated maximum inventory of hazardous waste includes three drums of acetic anhydride, one drum each of nitric acid and caustic soda, and eight drums of unknown waste. A clean closure is scheduled (Foster Wheeler 1988c). The building will be closed in accordance with New Jersey hazardous waste regulations because it never had interim status.

13.17.2 Geology and Hydrology

Building 1031 is located approximately 130 ft north of Robinson Run, along the eastern side of PTA. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 161 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 161 flows towards Robinson Run, which flows west and discharges into Green Pond Brook.

13.17.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the site and past activities have not been well documented. PTA personnel reported during interviews that nitric acid was spilled onto the ground. When the storage tanks were destroyed under TECUP, the contents were reportedly spilled onto the ground. It was also reported that chemicals such as toluene and benzene were dumped into the swamp behind the building. Mercury may also have been spilled onto the ground.

Building 1031 may be contaminated with nitric acid, sulfuric acid, RDX, HMX, and nitroglycerin, according to a report by Foster Wheeler (1988c). Acetic anhydride and other materials may have been spilled in the area.

13.17.4 Closure Plan

The revised RCRA closure plans for Bldg. 1031 include washing the equipment and the building interior with steam or hot water, collecting two grab samples of wash water or condensate, collecting 27 chip samples, and analyzing the samples for priority pollutant metals (Foster Wheeler 1988c, 1989; Solecki 1989a).

13.17.5 Proposed RI Plan

If clean closure is not possible, the proposed RI sampling plan may have to be modified as new data become available. It will be carried out independently of implementation of the closure plan.

13.17.5.1 Phase I

The area around Bldg. 1031 should be visually inspected for signs of contamination. One surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the building and from the center of each visibly contaminated area around the building. Surface water and sediment samples should be collected from two locations in the swamp behind the building.

If areas of contamination are identified during visual inspection, one soil boring should be drilled about 16 m (50 ft) downslope from the building, between the building and Robinson Run. Samples should be collected from the boring. All samples should be analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

13.17.5.2 Phase II

If contamination is found in the surface soil and sediment samples, additional sampling may be required to determine its extent. Depending on the results of the sediment samples, surface water samples from the swamp may be needed. Monitoring wells may also be needed. One soil boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from each boring and analyzed for contaminants identified during Phase I.

13.18 SITE 162 — BUILDINGS 1070, 1071, AND 1071C, EXPLOSIVES MANUFACTURING AND STORAGE FACILITY

13.18.1 Site History

Buildings 1071 and 1071C, shown in Figure 13.22, are located to the west of Nineteenth Avenue and Robinson Run. Building 1070 could not be located on detail maps of the PTA Master Plan. Building 1071C is presently empty but was previously used for the storage of HMX and solvents (acetone and alcohol), which were used in the manufacturing of explosives in Bldg. 1071. During interviews, PTA personnel reported that Bldgs. 1070 and 1071C were used for chemical storage prior to 1986. It has also been reported that an explosives wastewater leach field exists near a tank outside Bldg. 1071. Currently, Bldg. 1071C, although now empty, is classified as a flammable materials storehouse (Foster Wheeler 1988c).

13.18.2 Geology and Hydrology

Buildings 1070, 1071, and 1071C are located along the eastern side of PTA approximately 650 ft north of Robinson Run, a tributary of Green Pond Brook. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 162 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 162 flows toward Robinson Run, which flows west and discharges into Green Pond Brook.

13.18.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Flammable materials, stored inside Bldg. 1071C, may have been spilled although this has not been documented. Explosives, discharged in wastewater to the leach field near Bldg. 1071, are also contaminants of concern.

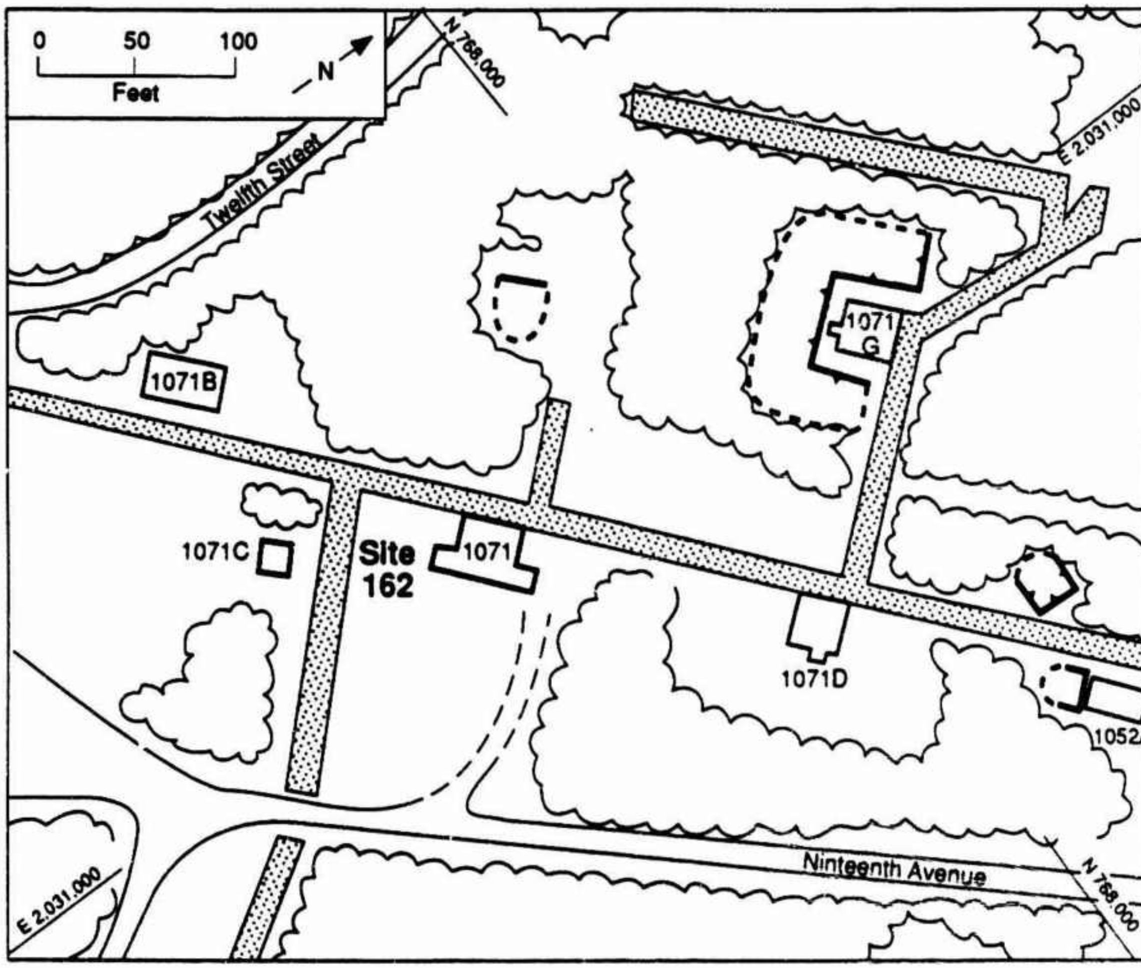

FIGURE 13.22 Layout of Site 162, Buildings 1070, 1071, and 1071C (Source: Adapted from USACE 1984b)

13.18.4 Proposed RI Plan

13.18.4.1 Phase I

Before sampling activities begin, the exact location of Bldg. 1070 must be determined. A geophysical survey should be conducted near Bldg. 1071 to locate the reported wastewater leach field. If the leach field lines are located, two soil borings should be drilled next to each line to depth intervals of 0.9-1.5 m (3-5 ft) below the lines and sampled. All soil samples should be analyzed for explosives.

The area around Bldgs. 1071 and 1071C should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. In addition, one surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from each side of Bldg. 1071. All soil samples should be analyzed for explosives, TCL volatiles, and TCL semivolatiles.

13.18.4.2 Phase II

If contamination is found, additional surface soil sampling may be required to determine its extent. One boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from each boring and analyzed for contaminants of concern identified during Phase I.

13.19 SITE 166 — BUILDINGS 1354, 1357, AND 1359, PROPELLANT PLANTS

13.19.1 Site History

The three buildings, Bldgs. 1354, 1357, and 1359, are located along a road just south of Upper X.H.E. Road (Fig. 13.23) and are to the northwest and downslope of Site 51. The buildings were constructed in 1948 and were made of concrete. During interviews, PTA personnel reported that explosive materials (e.g., nitroglycerin) were spilled inside the three buildings. Material was reportedly placed in bags that may have leaked. Additional information on past activities at this Site is not available.

13.19.2 Geology and Hydrology

Buildings 1354, 1357, and 1359 are located along the eastern side of PTA. The ground surface slopes to the west toward Robinson Run, a tributary of Green Pond Brook. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 166 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 166 flows toward Robinson Run, which flows west and discharges into Green Pond Brook.

13.19.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Explosives, which were reportedly spilled inside the buildings, are possible contaminants at the Site.

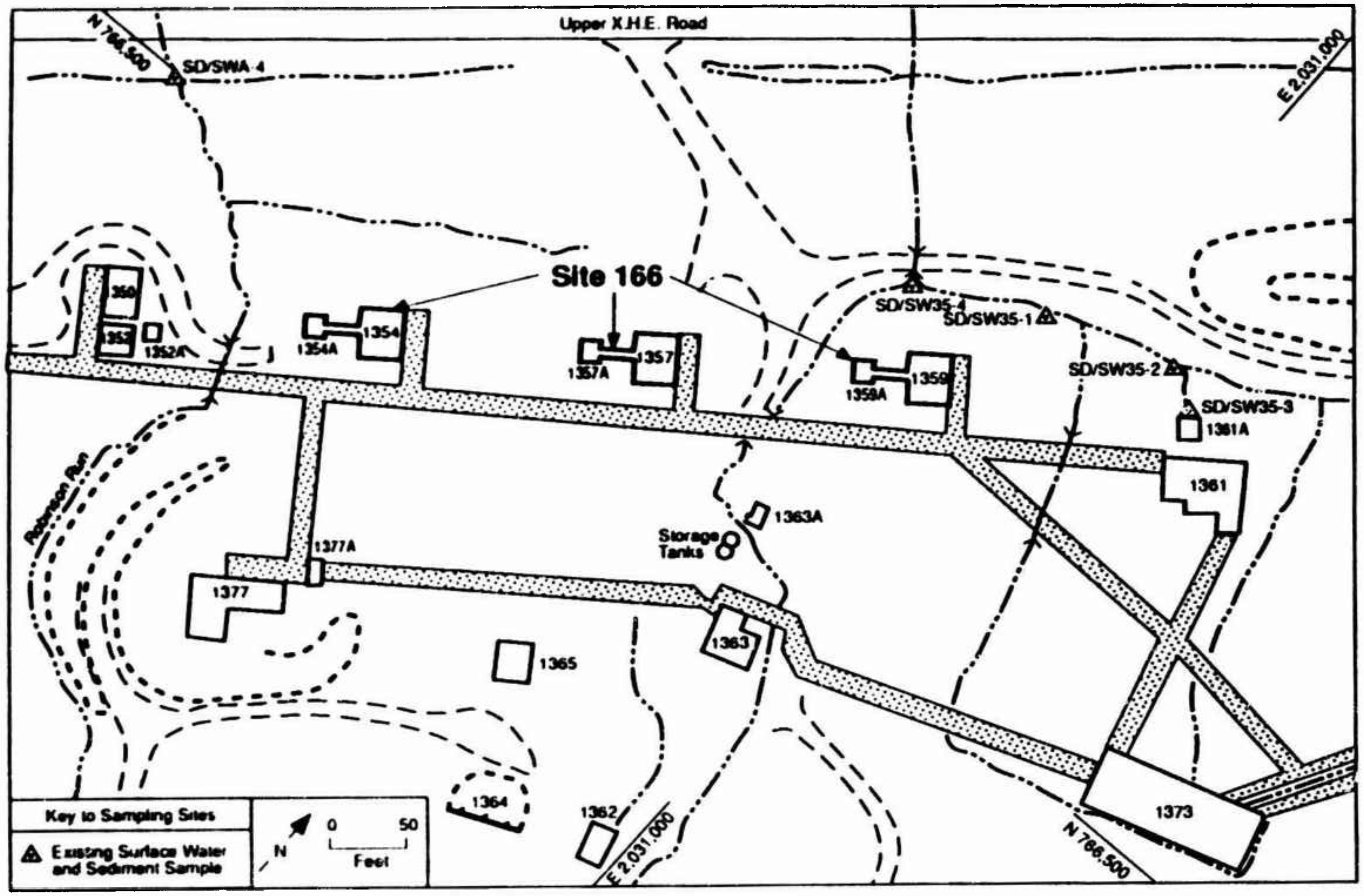

FIGURE 13.23 Layout of Site 166, the Propellant Plants at Buildings 1354, 1357, and 1359 (Source: Adapted from USACE 1984b)

13.19.4 Proposed RI Plan

13.19.4.1 Phase I

The areas around Bldgs. 1354, 1357, and 1359 should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. All samples should be analyzed for explosives.

13.19.4.2 Phase II

If contamination is found, additional surface soil sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from the borings and analyzed for contaminants identified during Phase I.

13.20 SITE 167 — BUILDINGS 1373 AND 1374, PROPELLANT PLANT AND ORDNANCE FACILITY

13.20.1 Site History

Buildings 1373 and 1374 are located just west of N.G. Road along the southeast boundary of PTA (Fig. 13.24). PTA personnel reported that Bldg. 1373, a propellant plant, has two sumps that have not been used since 1981 (Solecki 1989e).

Building 1374 was used until the early to mid 1970s for the blending of nitroglycerin/nitrocellulose slurries into homogeneous mixtures and for block breaking to shape nitrocellulose blocks for further processing (Foster Wheeler 1988c).

13.20.2 Geology and Hydrology

Buildings 1373 and 1374 are located along the eastern side of PTA. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 167 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 167 flows toward Robinson Run, which flows west and discharges into Green Pond Brook.

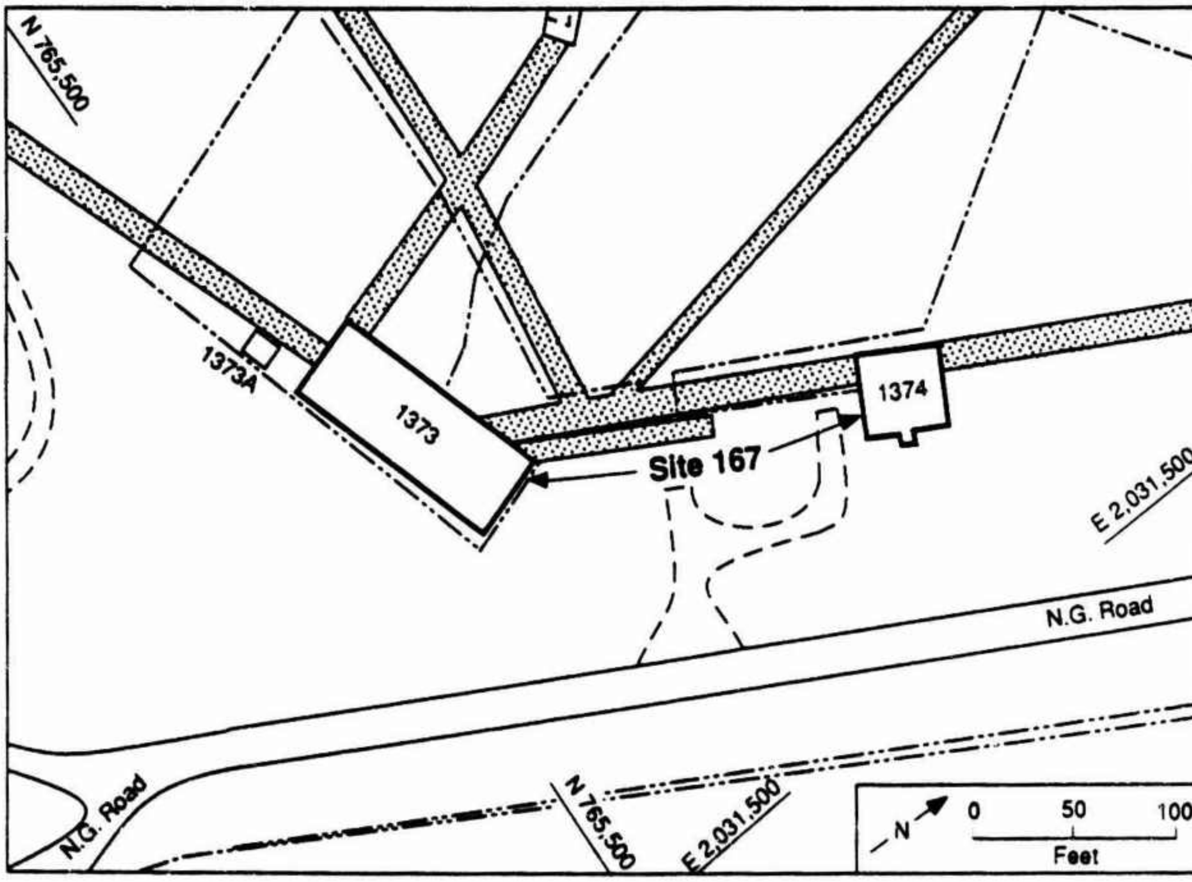

FIGURE 13.24 Layout of Site 167, the Propellant Plant and Ordnance Facility at Buildings 1373 and 1374 (Source: Adapted from USACE 1984b)

13.20.3 Existing Contamination

Both sumps at Bldg. 1373 contain water. Water from one sump was analyzed and was found to be contaminated with HMX (0.7 ppm), RDX (7.5 ppm), and other unknown explosives (Solecki 1989e).

Potential contaminants at Bldg. 1374 are the explosive compounds associated with nitrocellulose and nitroglycerin, and propellants.

13.20.4 Proposed RI Plan

13.20.4.1 Phase I

The areas around Bldgs. 1373 and 1374 should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. One water and one sediment sample should be collected from each sump in Bldg. 1373.

A field inspection should be conducted to locate drain lines leading from the sumps and any other drain line outfalls. Detailed maps and geophysical surveys should be used if necessary. If drain line outfalls are located, one surface soil sample should be collected from each outfall area and one sediment sample should be collected from the end of each drain line. All samples should be analyzed for explosives and propellants.

13.20.4.2 Phase II

If contamination is found, additional surface soil sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from the borings and analyzed for contaminants identified during Phase I.

13.21 SITE 168 - BUILDINGS 1400, 1402, AND 1403, PROPELLANT PLANTS AND PRESS HOUSE

13.21.1 Site History

Buildings 1400, 1402, and 1403 are located just south of Rocket Production Road (Fig. 13.25). All three buildings were designated as satellite waste accumulation areas and are still being used. Scrap propellant (12-120 lb/yr) is stored on the floor in each building.

Building 1403 is a press house, constructed of concrete with an earth-covered concrete roof. Materials generated from the mixing and extruding of propellants are stored at Bldg. 1403, including contaminated solvents (60 gal/yr), contaminated rags (18 lb/yr), and inert nonhazardous propellant (10 lb/wk for 3 mo of the year) (Solecki 1989c). Building 1400 has one sump and Bldg. 1403 has two sumps. The sumps in both buildings are still in use (Solecki 1989e).

13.21.2 Geology and Hydrology

Buildings 1400, 1402, and 1403 are located along the eastern side of PTA. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 168 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Because detailed hydrogeological information is not available, it is not certain whether the groundwater and surface water in the vicinity of Site 168 flow towards the unnamed creek to the south, or Robinson Run, to the north; both discharge into Green Pond Brook.

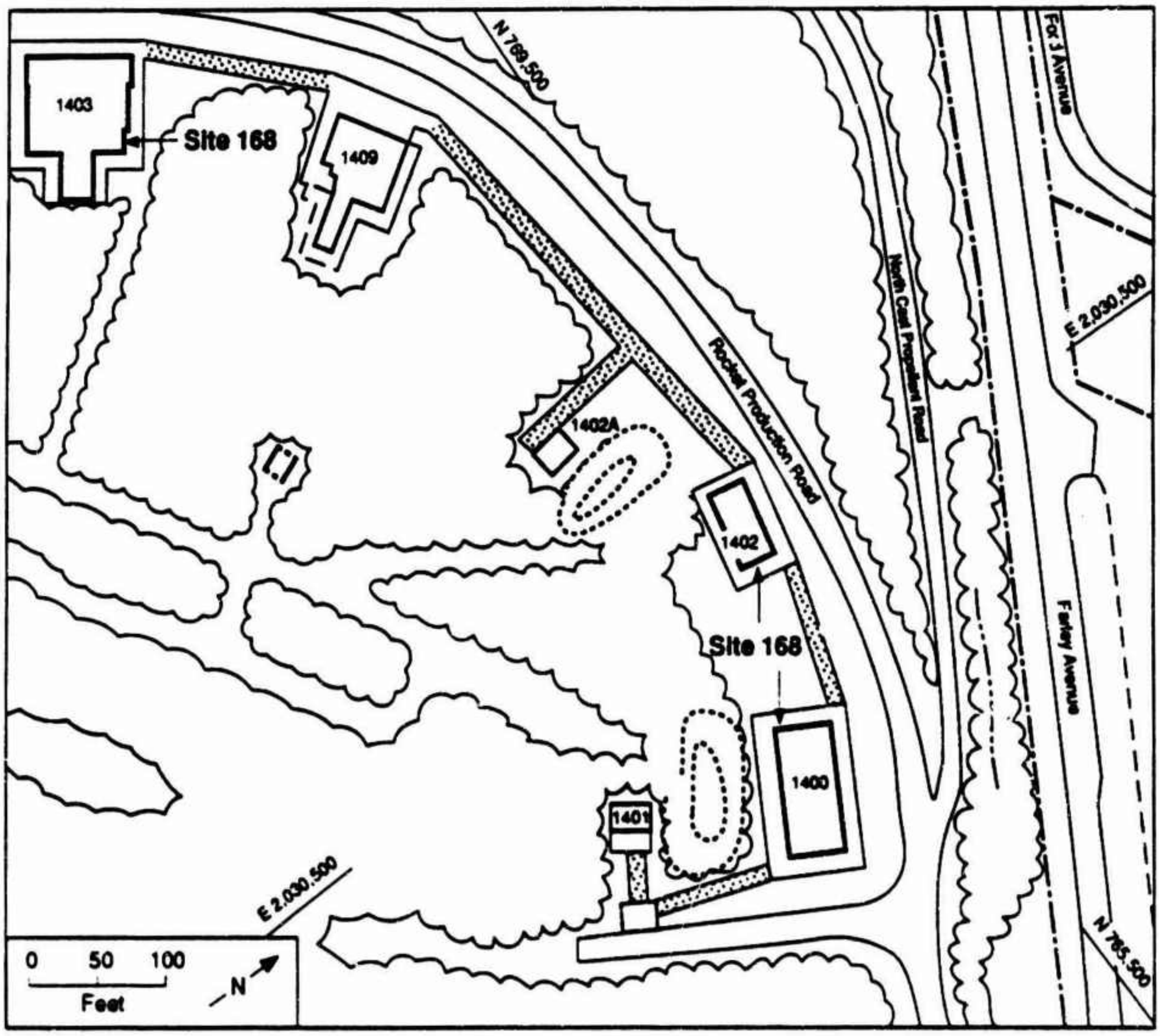

FIGURE 13.25 Layout of Site 168, the Propellant Plants at Buildings 1400, 1402, and 1403 (Source: Adapted from USACE 1984b)

13.21.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Potential contaminants are compounds related to propellant processing and stored materials. The sumps in both Bldgs. 1400 and 1403 have not been sampled (Solecki 1989e). PTA personnel reported during interviews that red water from receiving tanks in Bldg. 1400 was taken by truck to Bldg. 810. During transfers, small quantities of liquid may have been spilled.

13.21.4 Proposed RI Plan

13.21.4.1 Phase I

The areas around Bldgs. 1400, 1402, and 1403 should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. One water and one sediment sample should be collected from each sump in Bldgs. 1400 and 1403 (a total of three sumps sampled).

A field inspection should be conducted to locate drain lines leading from the sumps and any other drain line outfalls. Detailed maps and geophysical surveys should be used if necessary. If drain line outfalls are located, one surface soil sample should be collected from each outfall area and one sediment sample should be collected from the end of each drain line. All soil and water samples should be analyzed for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

13.21.4.2 Phase II

If contamination is found in the surface soil samples, additional sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. Split-spoon samples should be collected from the borings and analyzed for contaminants identified during Phase I.

13.22 SITE 169 — BUILDINGS 1408, 1408A-C, 1409, AND 1411, PROPELLANT PLANTS

13.22.1 Site History

Buildings 1408, 1408A-C, 1409, and 1411 are located just south of Rocket Production Road along the southeast boundary of PTA (Fig. 13.26). Buildings 1408, 1408A-C, and 1411 were built in the late 1940s. Building 1409 was built in 1956. All the buildings are propellant plants. Buildings 1408 and 1411 are also satellite waste accumulation areas.

13.22.2 Geology and Hydrology

Buildings 1408, 1408A-C, 1409, and 1411 are located near the headwaters of an unnamed creek, a tributary of Green Pond Brook. The ground surface at the Site slopes to the west, towards the creek. The site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 169 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep,

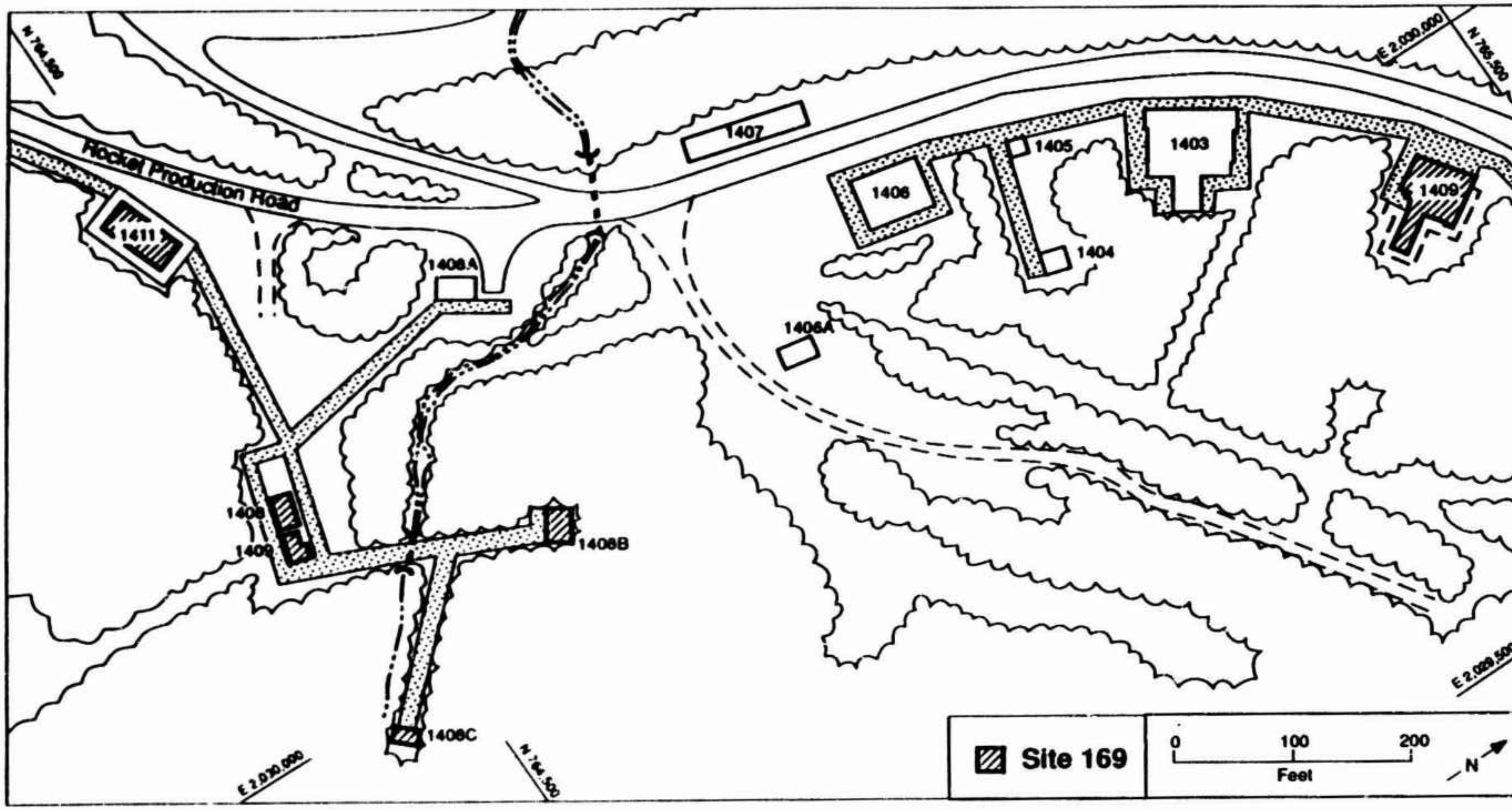

FIGURE 13.26 Layout of Site 169, Buildings 1408, 1408A-C, 1409, and 1411 (Source: Adapted from USACE 1984b)

well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 169 flows towards the unnamed, which flows west and discharges into Green Pond Brook.

13.22.3 Existing Contamination

PTA personnel reported during interviews that in the past, wastewater containing explosives was discharged into a swampy area between Bldgs. 1408A and 1408B. The wastewater is now discharged into holding tanks. It is possible that spills, as a result of overflow, may have occurred near the tanks and the troughs through which the wastewater flows.

Waste generated from propellant mixing operations — cleaning solvents, ethyl acetate, and cleaning rags — are stored on the concrete floors in Bldgs. 1408 and 1408C. There are two catch basins in Bldg. 1408. One of the catch basins is empty and has not been used since 1981. The other, which contains about 2 ft of water, has been used since 1981 (Solecki 1989e).

Scrap energetic material (up to 36 lb/yr) are stored on the concrete floor in Bldg. 1409. The building also has two empty sumps that have not been used since 1981.

Waste materials stored on the concrete floor in Bldg. 1411 include scrap propellant, contaminated solvents (acetone, ethyl acetate, or alcohol), and contaminated rags. Two catch basins, containing up to 2 ft of water contaminated with HMX (0.7 ppm) and RDX (5.3 ppm), have been in use since 1981 (Solecki 1989e).

13.22.4 Proposed RI Plan

13.22.4.1 Phase I

The areas around Bldgs. 1408, 1408A-C, 1409, and 1411 should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. One sediment sample should be collected to a depth of 0.3 m (12 in.) from each of two locations in the swamp between Bldgs. 1408A and 1408B. One water and one sediment sample should be collected from each sump, catch basin, or holding tank in each building.

A field inspection should be conducted to locate drain lines leading from the sumps and any other drain line outfalls. Detailed maps and geophysical surveys should be used if necessary. If drain line outfalls are located, one surface soil sample should be collected from each outfall area and one sediment sample should be collected from the end of each drain line. All samples should be analyzed for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

13.22.4.2 Phase II

If contamination is found, additional surface soil and sediment sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from each boring. Depending on the results of the sediment samples, surface water samples from the swamp may be needed. The samples should be analyzed for contaminants identified during Phase I.

13.23 SITE 170 — BUILDINGS 1462-1464, EXPLOSIVES PLANTS

13.23.1 Site History

Buildings 1462-1464 are located north and south of Lower Cast Propellant Road, along the southeast boundary of PTA (Fig. 13.27). PTA personnel reported during interviews that these buildings were used for pilot-plant research and development, which was stopped in 1981. Building 1463, designated as a special storage area, contains about 800 gal of potassium perchlorate and other chemicals awaiting analysis (Solecki 1989c). Additional information about past activities at this Site is not available.

13.23.2 Geology and Hydrology

Buildings 1462-1464 are located along the eastern side of PTA. The ground surface near the Site slopes to the west and southwest. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Precambrian gneiss, which is not exposed at PTA.

The soils at Site 170 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 170 flows towards an unnamed creek, which flows southwest and discharges into Green Pond Brook.

13.23.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. During

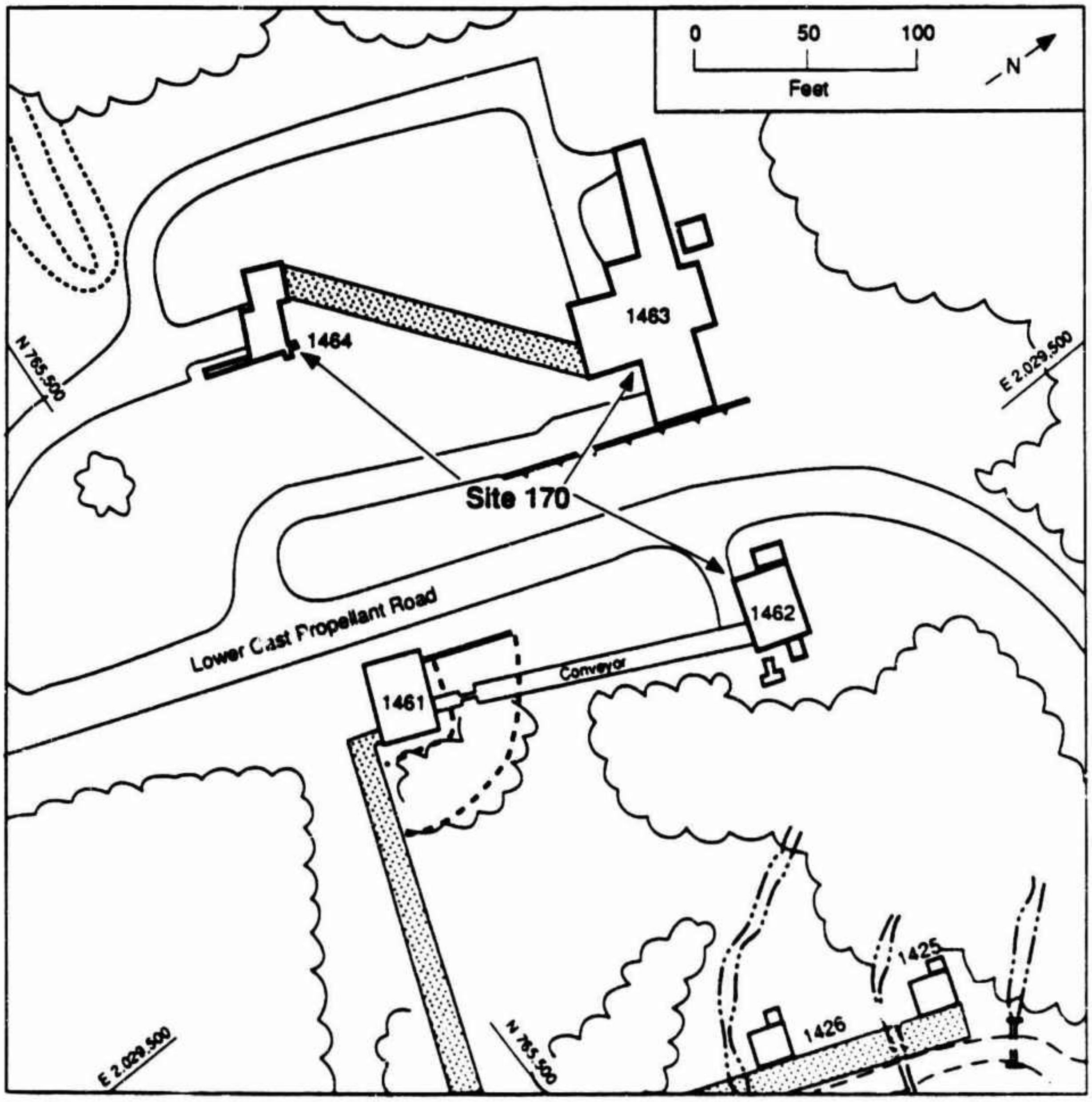

FIGURE 13.27 Layout of Site 170, Buildings 1462-1464 (Source: Adapted from USACE 1984b)

interviews, PTA personnel reported that wastewater from washdown operations was discharged outside and not into the troughs. Chemicals reportedly used in these buildings include TNT, composition B, phosphate esters, and glycol-based hydraulic fluid. There are two sump tanks near Bldg. 1462 that were installed between 1971 and 1973. Another sump tank, near Bldg. 1463, was installed in 1977. It is not known when the sump tank near Bldg. 1464 was installed (Solecki 1989a).

13.23.4 Proposed RI Plan

13.23.4.1 Phase I

The areas around Bldgs. 1462-1465 should be visually inspected for signs of contamination. A records search and additional PTA personnel interviews should be conducted to determine the locations of wastewater discharge.

Two surface soil samples should be collected to a depth of 0.3 m (12 in.) near each of the four sump tanks. Sampling locations should include areas under valves and pipe inlets and outlets. One surface soil sample should also be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. All soil samples should be analyzed for explosives, TCL volatiles, and TCL semivolatiles.

13.23.4.2 Phase II

If contamination is found, additional surface soil sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from each boring and analyzed for contaminants identified during Phase I.

13.24 SITE 171 — BUILDINGS 3106, 3109, AND 3111, ORDNANCE FACILITIES

13.24.1 Site History

Buildings 3106, 3109, and 3111 are southeast of Picatinny Lake about two-thirds of the distance between the southern tip of Picatinny Lake and the eastern PTA boundary. A map of Site 171 is shown in Fig. 13.28.

Building 3106 was built as a magazine in 1934; it also has been used as an ordnance facility. Its estimated life as of 1971 was until 2005. Building 3109 was built in 1943 as a magazine and modified in 1965. It has been used as an ordnance facility for munitions testing. Building 3111 was also built as a magazine in 1943, modified in 1965, and used as an ordnance facility.

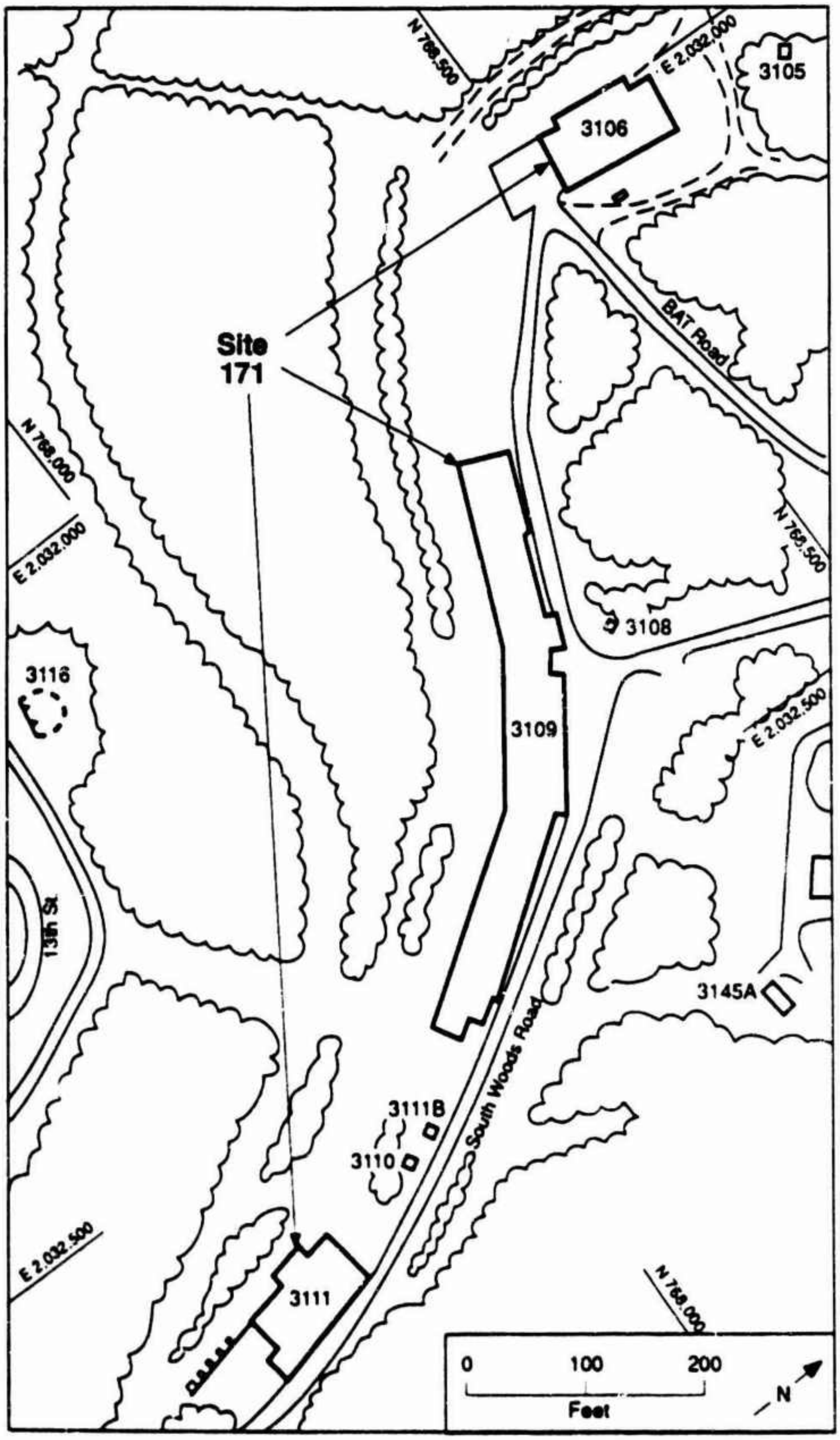

FIGURE 13.28 Layout of Site 171, the Ordnance Facilities at Buildings 3106, 3109, and 3111 (Source: Adapted from USACE 1984b)

13.24.2 Geology and Hydrology

The Site 171 area has an elevation of 950 ft above sea level. Soils in the area belong to the Rockaway Series, and the underlying bedrock is Precambrian gneiss. Surface water and runoff from the Site would flow northwest and eventually enter Green Pond Brook.

13.24.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that Bldg. 3109 was used for munitions testing. A list of PTA satellite waste accumulation areas (Solecki 1989c) shows that oily waste is generated (by machine leaks and repairs) at a rate of 5 gal/yr each of lubricating oil, hydraulic oil, and speedi-dry; in addition, oily rags are generated at a rate of 1 lb/mo. The wastes are stored inside the building on the concrete floor. No spills or other incidents that could lead to contamination were reported.

Because Bldg. 3106 has a cement asbestos roof and Bldg. 3109 has a corrugated asbestos roof, a health hazard from asbestos exposure may exist in these buildings.

13.24.4 Proposed RI Plan

13.24.4.1 Phase I

The exterior perimeters of the buildings should be visually inspected. If the buildings appear to be clean, then no further work is necessary.

If stained soils or signs of spills are found, then one surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each stained area and analyzed for TCL volatiles, TCL semivolatiles, and lead.

13.24.4.2 Phase II

If significant contamination is found in the surface soil samples, then one soil boring should be drilled beside each area of contaminated soil. Samples should be collected from the borings and analyzed for TCL volatiles, TCL semivolatiles, and TCL metals.

13.24.4.3 Phase III

If significant contamination is found in the subsurface soils, it will be necessary to evaluate the movement of contaminants into groundwater by installing monitoring wells. The number and location of the wells would depend on the location of the contaminated soil boring samples.

13.25 SITE 176 — LITTLE LEAGUE BASEBALL FIELD

13.25.1 Site History

The little league baseball field is located near the intersection of Swamp and Schrader roads (Fig. 13.29). During interviews, PTA personnel reported that, in April 1983, two truckloads of dredge material from Green Pond Brook (near a plating facility) were dumped in the field. Also, for three years unknown material was reportedly put in pits under the field. It is not known if these activities took place here, at the other baseball fields (Site 163), or at both.

13.25.2 Geology and Hydrology

The Site is situated in a basin in the middle of the unnamed mountain southeast of Picatinny Lake. A few water bodies are within 90 m (300 ft) of the field. The surficial deposits on the Site may include clay, silt, and sand beds near the surface and underlain by a glacial till. The bedrock under the Site probably is Precambrian gneiss.

Soil on the Site was classified as Rockaway Series (Wingfield 1976). A water-table aquifer may be present under the Site. The water table probably is shallow, judging from the nearby water bodies. Flow direction of the groundwater is not known.

13.25.3 Existing Contamination

The dredge material from the brook may contain metals and VOCs from the plating facility. PTA personnel reported that munitions were found in the dredge material (see Site 26).

13.25.4 Proposed RI Plan

13.25.4.1 Phase I

Geophysical methods should be used to locate the pits and areas reportedly covered with the dredge material. If the areas can be located, a soil boring should be drilled at the center of each anomaly. Soil samples should be collected from the top, depth of the bottom of each anomaly, and bottom of each boring and analyzed for cyanide, TCL volatiles, TCL semivolatiles, TCL metals, PCBs, propellants, explosives, pesticides, and herbicides. If contamination is not found, no further action is needed.

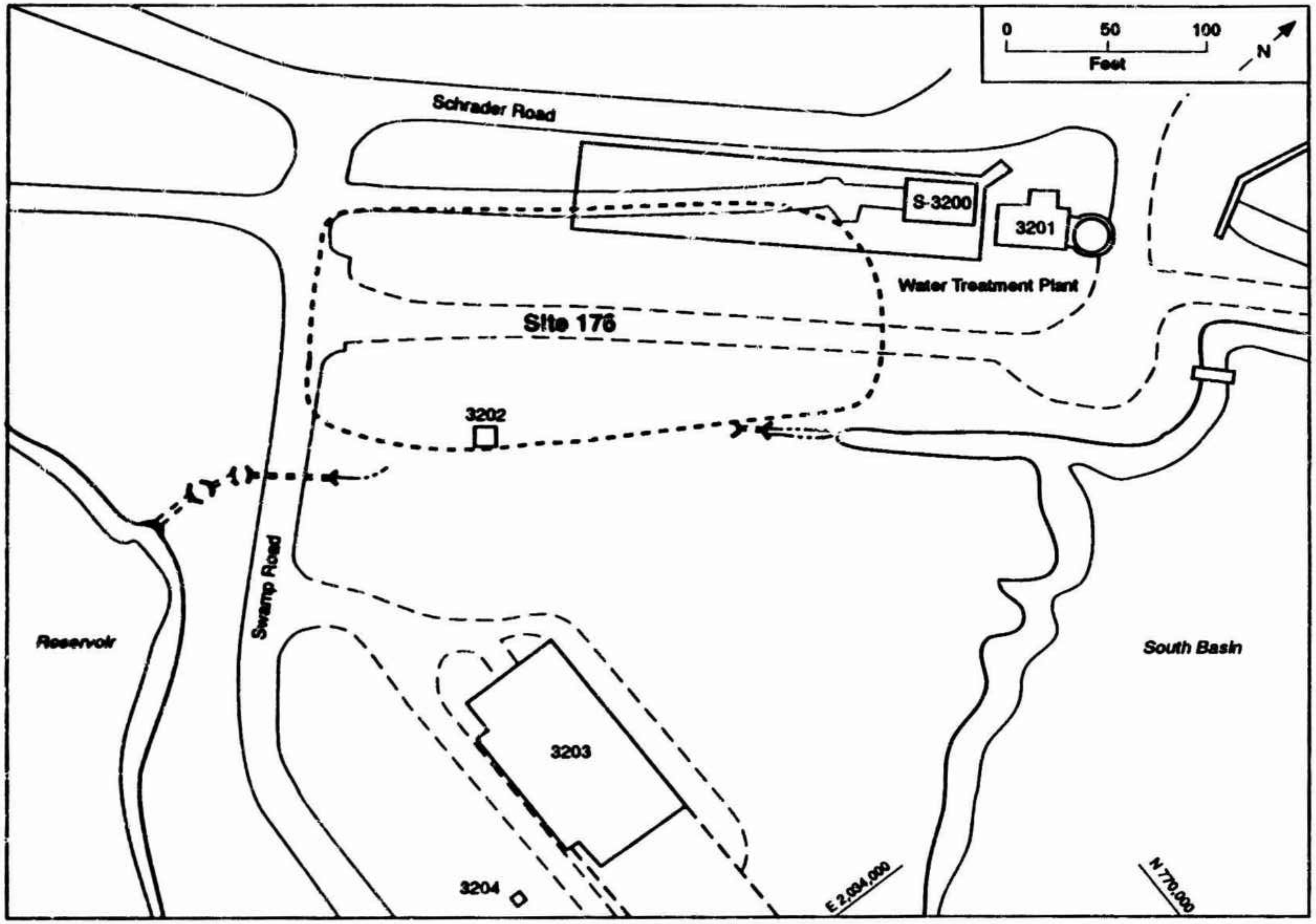

FIGURE 13.29 Layout of Site 176, Little League Baseball Field (Source: Adapted from USACE 1984b)

13.25.4.2 Phase II

If the Phase I results show significant concentration of contaminants, additional soil samples should be collected and tested for the parameters found in the Phase I soil samples.

Monitoring wells may be required to delineate the extent of contamination, depending on the Phase I results.

13.26 SITE 177 — PTA SANITARY SEWER SYSTEM BREAKS/LEAKS

13.26.1 Site History

The sanitary sewer lines at PTA are made mainly of vitrified clay, with some sections made of cast iron, asbestos cement, or galvanized pipe. In 1979, Haven and Emerson Inc. provided PTA with an analysis of infiltration and inflow for the entire PTA sewer system. In 1981, Visu-Sewer issued a report on the cleaning and inspection of the existing sanitary sewer system, with recommendations for upgrading the entire system. Neither the Haven and Emerson nor the Visu-Sewer reports were available to ANL.

In 1984, raw sewage was discharged from ejector station 162A because of an excessive inflow and infiltration of storm water into the system in subbasins 6 and 7. Damage to the system in Subbasins 6 and 7 due to crushed and cracked pipes, root penetration, etc. was identified by Tectonic architectural engineers (Tectonic 1984). Eleven repair projects were devised to eliminate excessive inflow and infiltration.

A map of Subbasins 6 and 7 is provided in Plate 2.1.

13.26.2 Existing Contamination

During interviews with ANL staff, PTA personnel reported that industrial sources, such as chemical laboratories and photo shops, and other operations at PTA probably disposed of chemicals into the sewers. As a result, the soils and groundwater along the sewer lines may have become contaminated, especially where sewer pipe is crushed, cracked, or misaligned.

13.26.3 Proposed RI Plan

13.26.3.1 Phase I

First, the reports of Havens and Emerson, Inc., and Visu-Sewer should be located and used to identify breaks in the sanitary sewer system, other than those at Subbasins 6 and 7 identified by Tectonic (1984).

If the reports cannot be used, the sewer system (except Subbasins 6 and 7) should be surveyed to identify breaks (e.g., a television survey). Identification of these break locations is critical to evaluating present and past releases of toxic wastes into the sanitary sewer system.

For Subbasins 6 and 7, where the condition of the sewer system has been mapped, four locations were chosen from Tectonic (1984) to take soil borings because of the clear identification of crushed and cracked pipes. These locations are:

1. Between manholes (MHs) 350 and 352, where Tectonic located crushed pipe, downstream from the shell burial ground (Site 6) and Bldg. 3100 (an ordnance facility and flammables storehouse).

2. At MH 324, where Tectonic located crushed and cracked pipe, downstream from Bldgs. 3022 and 3028 (energetics laboratories where chemicals reportedly have been disposed of down the sinks).

3. At MH 455, which is between MHs 451 and 467, where Tectonic identified a stretch of crushed and cracked pipes about 1,700 ft long.

4. At MH 465, which is also between MHs 451 and 467.

For the rest of the PTA sewer system, where the conditions of the line could not be evaluated for this assessment, two additional locations should be evaluated by drilling soil borings: (1) near MH 4A, downstream from Bldg. 95 (a physics laboratory), and (2) near MH 25, downstream from Bldg. 24 (a machine shop). These additional locations were chosen because they are downstream from two buildings currently associated with the highest levels of contamination at PTA.

At each of the six locations, two borings should be drilled, one on each side of the pipe, to a depth 2 ft below the bottom of the pipe. Two samples should be collected from each boring, one from the depth of the break or fault and the other from the bottom of the boring. The samples should be analyzed for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

In the above approach, four locations of known breaks in Subbasins 6 and 7 and two locations from other subbasins (and downstream from buildings with high levels of contamination) will be analyzed for the release of contaminants into the soil surrounding the sanitary sewer pipes. The results will provide an initial indication of the seriousness of problems associated with the sewer system.

13.26.3.2 Phase II

After sewer system breaks and faults outside Subbasins 6 and 7 have been located, they should be categorized as major or minor. The subsurface soils at all major break locations should be sampled and analyzed as described for Subbasins 6 and 7 in Phase I.

13.26.3.3 Phase III

Additional soil boring locations should be determined based on the results of Phases I and II.

14 AREA M: 600 BUILDINGS AREA

14.1 INTRODUCTION

Area M contains six Sites in the western part of the Arsenal. It includes the headwaters of Bear Swamp Brook. Munitions testing was carried out in the Area. Potential contaminants include explosives and solvents.

14.2 SITE 15 — BUILDINGS 616 AND 654, MUNITIONS TEST AREA

14.2.1 Site History

The munitions test area is northwest of Picatinny Lake in the central portion of PTA. Figure 14.1 provides details of the Site. The Site consists of two areas, each consisting of about 4 acres. At the Bldg. 616 area, static detonation testing is conducted on a metal stand over a gravel pad. The Bldg. 654 area is a demonstration area where small projectiles are fired into sand piles (Dames & Moore 1989).

14.2.2 Geology and Hydrology

Information regarding Site-specific geology and hydrology is limited. From the overall Arsenal characterization, it is known that the bedrock formation directly underlying the Site is Green Pond Conglomerate. Although a soil classification was not available for this Site, the soils in this area are generally quite permeable and well drained.

14.2.3 Existing Contamination

14.2.3.1 Soil

Dames & Moore sampled the surface soil during 1988. Results show elevated values for arsenic, chromium, lead, zinc, and HMX. Table 14.1 contains selected data from the sampling points shown in Fig. 14.1 (Dames & Moore 1989). Many of the shells manufactured at PTA contained depleted uranium.

14.2.3.2 Water

No groundwater monitoring wells are located in this area, and the available information does not include any Site-specific studies.

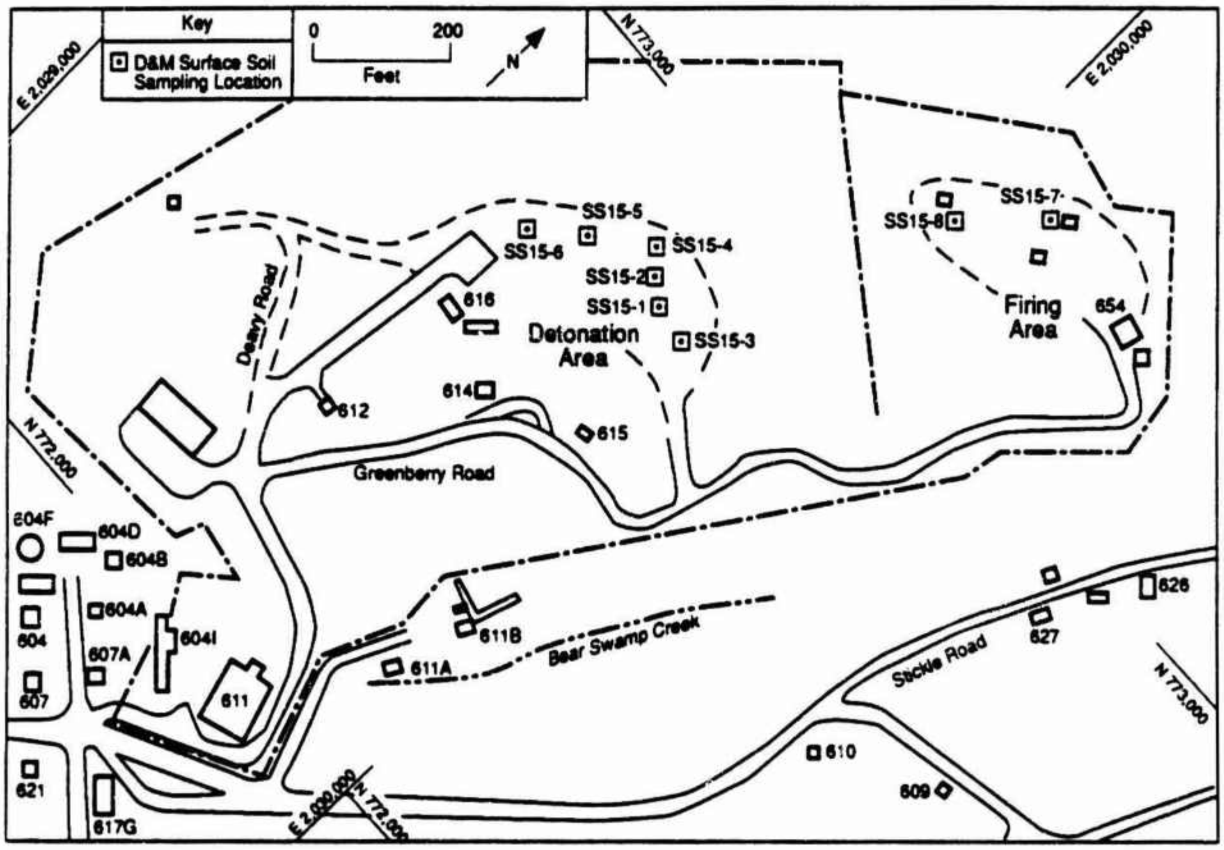

FIGURE 14.1 Layout of Site 15, the Munitions Test Area near Buildings 616 and 654 (Sources: Map adapted from USACE 1984a; sampling locations from Dames & Moore 1989)

14.2.4 Proposed RI Plan

14.2.4.1 Static Detonation Area (Building 616)

Phase I

Soil samples should be obtained from the pad beneath the test stand. Eight samples should be collected from a depth of 0-6 in. across a 4- by 4-ft grid at 2-ft intervals. They should be analyzed for TCL metals, explosives, propellants, and uranium.

Soil samples should be obtained at the base of all drums on the Site, aboveground tanks, and a cylinder reported to be partially buried. Samples should be collected from a depth of 0-6 in. and analyzed for TCL metals, TCL volatiles, and TCL semivolatiles.

TABLE 14.1 Selected Analytical Results for Surface Soil Samples 1-8 from Site 15[a]

Contaminant	Sample Depth (ft)[b]	Concentration in Sample (ppm)							
		1	2	3	4	5	6	7	8
Arsenic	4.9	6.59[c]	7.97	6.27	8.42	6.17	7.79	5.82	5.5
Barium	4.9	42.1	25.6	52.0	62.5	32.0	83.8	26.5	43.2
Beryllium	4.9	-	-	0.704	0.474	0.393	-	-	0.453
Chromium	4.9	11.0[c]	21	10	6.9	9	35	9.5	200
Copper	4.9	>50.0	190	-	-	-	240	-	750
Lead	4.9	8.3[c]	51.0	16.0	42.0	6.40	84.0	25.0	62.0
Mercury	4.9	-[c]	-	-	-	-	-	2.21	-
Nickel	4.9	-	16.5	-	-	14.3	14.2	21.7	140
Zinc	4.9	52.1	71.6	66.6	130	53.7	116	65.0	54.1
HMX	0.5	-	-	4.76	-	-	-	-	>24.4

[a]A hyphen indicates that the contaminant was not detected or detected in trace amounts.

[b]Except as noted for sample 1.

[c]These samples were taken from a depth of 0.5 ft.

Source: Dames & Moore 1989.

Phase II

Based on the results of these samples, soil borings should be drilled in the contaminated areas. Samples should be taken from the borings and analyzed for contaminants determined to be significant from previous results.

If borings show significant contamination, groundwater monitoring wells should be installed and sampled.

14.2.4.2 Projectile Firing Area (Building 654)

Phase I

Soil samples (the number depending upon the circumference of the sand pile) should be obtained in a ring around each sand pile, no more than 3 ft apart, at a depth of 0-6 in.

The sand piles should be sampled according to the methods in EPA Report SW-846: Method II-7, Sampling Bulk Material with a Scoop or Trier, or Method II-8, Sampling Bulk Materials with a Grain Thief (EPA 1987d). Depending on the size of the sand pile, a representative number of samples have been obtained when the triers have been angled properly to intersect all quadrants of the volume. All samples should be analyzed for TCL metals, explosives, propellants, and uranium.

Phase II

Based on the results of these samples, soil borings should be drilled in the contaminated areas. Samples from the borings should be analyzed for contaminants determined to be significant from previous results.

If borings indicate the presence of significant contamination, groundwater monitoring wells should be installed and sampled.

14.3 SITE 115 — BUILDING 611, ORDNANCE FACILITY

14.3.1 Site History

Building 611 is located west of James Road and north of Twentieth Avenue to the West of Picatinny Lake (Fig. 14.2). The Site is a designated satellite accumulation area where limited quantities of waste material are temporarily stored until picked up for disposal elsewhere. During interviews, PTA personnel reported that the soil surrounding

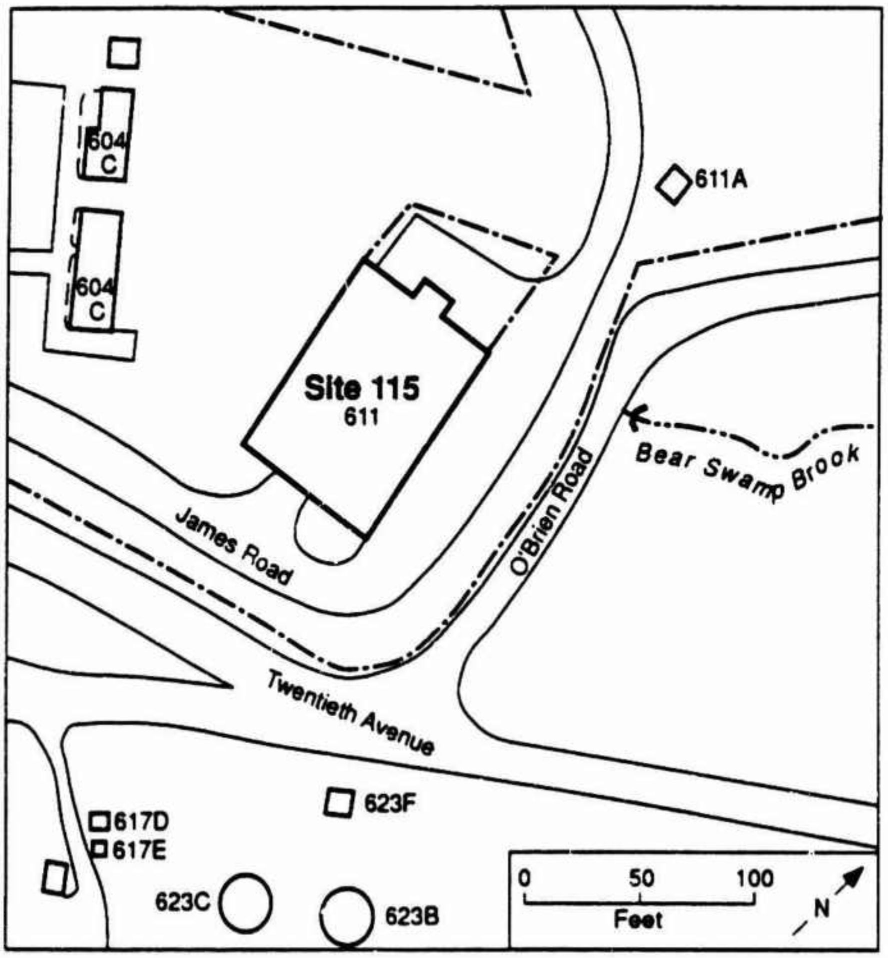

FIGURE 14.2 Layout of Site 115, the Ordnance Facility at Building 611 (Source: Adapted from USACE 1984b)

the building was stained red by seepage coming from the Bldg. 528 area. Since the 528 area is on the other side of Picatinny Lake, it is unlikely that it is the source of the staining. Additional information on past activities at this Site is not available.

14.3.2 Geology and Hydrology

Building 611 is located approximately 1,200 ft west of the northwest shoreline of Picatinny Lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly Green Pond Conglomerate of Silurian age. The Green Pond Conglomerate is composed of very coarse quartzite conglomerate interbedded with and grading upward into quartzite and sandstone (Vowinkel et al. 1985).

The soils at Site 115 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 115 flows into Bear Swamp Brook, which discharges into Green Pond Brook.

14.3.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Reported contamination includes red-stained soil (probably caused by pinkwater). Waste, generated from the manufacturing of test stands and targets, is stored inside the building. The waste generation rate is four aerosol cans per month (Solecki 1989c).

14.3.4 Proposed RI Plan

14.3.4.1 Phase I

The area around Bldg. 611 should be inspected for signs of contamination and to located red-stained soil. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the building. All samples should be analyzed for explosives.

14.3.4.2 Phase II

if contamination is found in the surface soil samples, additional sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase i. At least two samples should be collected from each boring. The samples should be analyzed for contaminants identified during Phase I.

14.4 SITE 152 — BUILDINGS 604 AND 604C, ORDNANCE FACILITY

14.4.1 Site History

Building 604, located north of Twentieth Avenue and northwest of Picatinny Lake (Fig. 14.3), is a designated satellite accumulation area where limited amounts of waste are temporarily stored until they are picked up for disposal elsewhere. The Site includes two nearby underground storage tanks (T1 and T2) at Bldg. 604C.

The underground catch basin and storage tanks (T1 and T2), located on the southeast side of Bldg. 604C, are used to store explosive-contaminated water generated

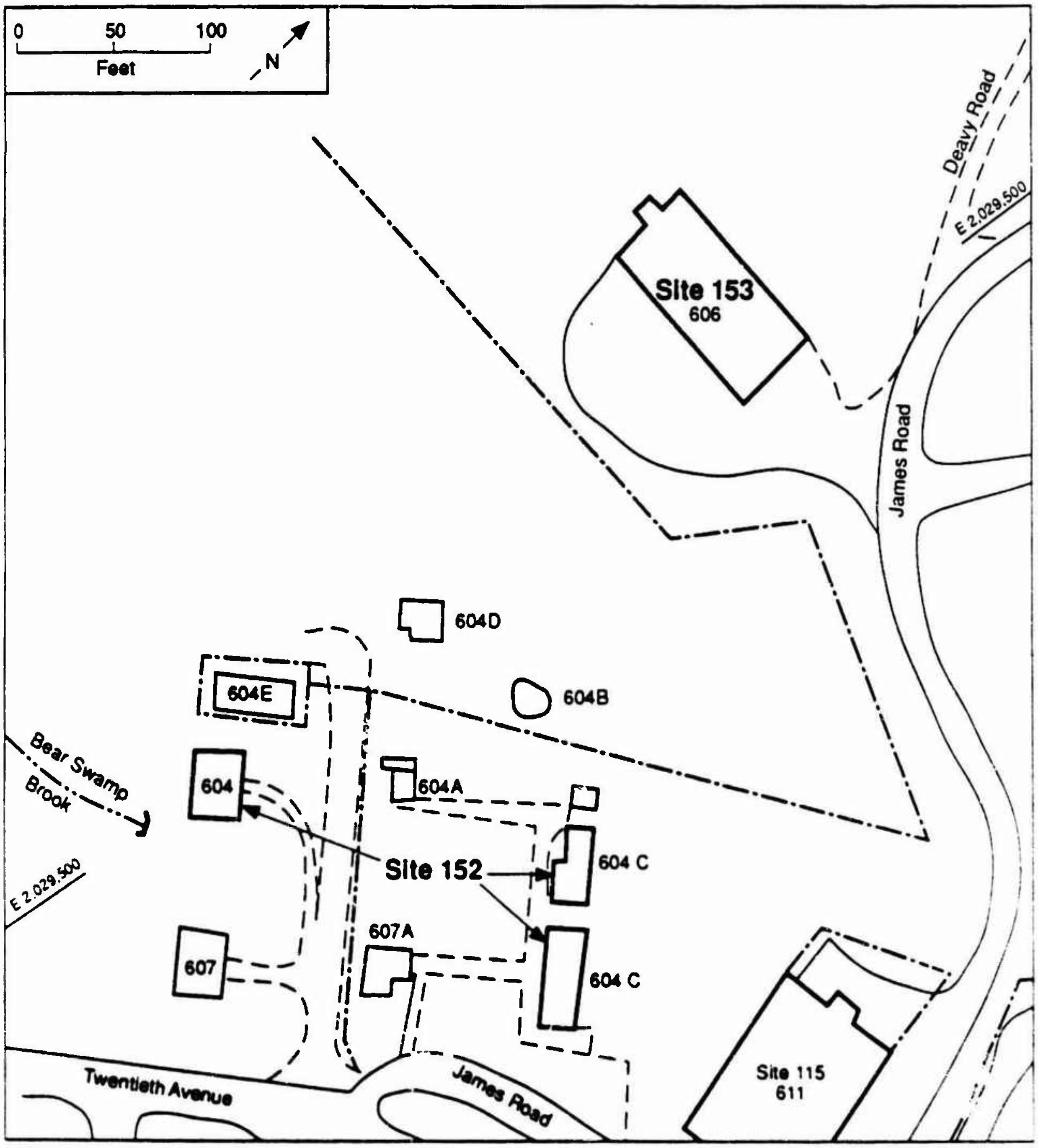

FIGURE 14.3 Layout of Site 152, Buildings 604 and 604C, and Site 153, Building 606 (Two buildings are numbered 604C according to the Master Plan Detail Plats, Plates 67 and 68) (Source: Adapted from USACE 1984b)

from the "wet saw" (Foster Wheeler 1988c). Tank T1 has a capacity of 500 gal and is 1.2-1.8 m (4-6 ft) in diameter and 1.2 m (4 ft) deep. Tank T2 has a capacity of 2,500 gal and is 2.1 m (7 ft) in diameter and 2.7 (9 ft) deep. Both tanks were installed below grade. Neither of the tanks has corrosion or overflow protection (Foster Wheeler 1988c).

Because hazardous wastes have been placed in the Bldg. 604C tanks for periods exceeding 90 days, RCRA closure plans have been prepared for them (Foster Wheeler 1988c). The tanks will be closed in accordance with New Jersey hazardous waste regulations because they never had interim status.

14.4.2 Geology and Hydrology

Buildings 604 and 604C are located approximately 1,200 ft to the northwest of the south end of Picatinny Lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overly the Green Pond Conglomerate of Silurian age. The Green Pond Conglomerate is composed of very coarse quartzite conglomerate interbedded with and grading upward into quartzite and sandstone (Vowinkel et al. 1985).

The soils at Site 152 have been classified by the Soil Conservation Service, USDA, into the Rockaway Series. Soils belonging to this category are generally deep, well drained soils of the uplands. The subsoil is commonly gravelly loam or gravelly sandy loam, with a fragipan at depth.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 152 flows to the southwest into Bear Swamp Brook which discharges into Green Pond Brook.

14.4.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Water contaminated with explosives is stored in tank T2 near Bldg. 604C. Waste material stored outside on the ground and on a paved surface consists of solvents, explosive-contaminated parts, ammo packing materials, and empty paint cans. PTA personnel reported that barrels were washed outside behind Bldg. 604.

14.4.4 Closure Plan

Revised RCRA closure plans for the underground tanks include transferring their contents to Bldg. 809, excavating, and cleaning them. Two grab samples of wash water or condensate will be collected and analyzed for nitrates and priority pollutant metals; four soil samples (three from the surface and one from beneath tank T2) will be collected and analyzed for VOCs, priority pollutant metals, nitrates, and if necessary, EP toxicity for metals. After the tanks are cleaned, tank T1 will be reburied for reuse and tank T2 will be flashed and scrapped (Foster Wheeler 1988c, 1989; Solecki 1989a).

14.4.5 Proposed RI Plan

If clean closure is not possible, the proposed RI sampling plan may have to be modified as new data become available. It will be carried out independently of implementation of the closure plan.

14.4.5.1 Phase I

The area around Bldgs. 604 and 604C should be visually inspected to locate stained soil and other signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. In addition, one surface soil sample should be collected from each side of the storage area and each side of the catch basin (a total of eight samples).

After the storage tanks have been removed, one soil boring should be drilled in the area between the tank locations. One soil boring should also be drilled next to the catch basin. The borings should be drilled to a depth of 1-1.5 m (3-5 ft) below the bottom of the tanks and catch basin, respectively. Samples should be collected at the top, depths of tanks, catch basin bottoms, and bottoms of the borings. All samples should be analyzed for TCL volatiles, TCL semivolatiles, TCL metals, and explosives.

14.4.5.2 Phase II

If contamination is found, additional surface soil and soil boring sampling may be required to determine its extent. If contamination is found at depth, it may also be necessary to install monitoring wells to collect groundwater samples. The samples should be analyzed for contaminants identified during Phase I.

14.5 SITE 153 — BUILDING 606, ORDNANCE FACILITY

14.5.1 Site History

Building 606 is located south of Deavy Road and west of Picatinny Lake (Fig. 14.3). Waste generated during the development of X-ray film (5 gal/mo of both fixer and developer) is stored outside of the building (Solecki 1989c). Additional information on past activities at this Site is not available.

14.5.2 Geology and Hydrology

Building 606 is located approximately 1,500 ft west of the northwest shoreline of Picatinny Lake. The ground surface near the Site slopes to the southeast, toward the lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). These deposits overlie the Green Pond Conglomerate of Silurian age. The Green Pond Conglomerate is composed of very coarse quartzite conglomerate interbedded with and grading upward into quartzite and sandstone (Vowinkel et al. 1985).

The soils at Site 153 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 153 flows east toward Bear Swamp Brook.

14.5.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. X-ray fixer and developer are stored outside the building.

14.5.4 Proposed RI Plan

14.5.4.1 Phase I

The area around Bldg. 606 should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the building. All samples should be analyzed for silver; and because little information is available for this Site, samples should also be analyzed for TCL volatiles, TCL semivolatiles, and TCL metals. If no signs of contamination are discernable, no further action is required.

14.5.4.2 Phase II

If contamination is found, additional surface soil sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase I. Samples should be collected from the borings and analyzed for contaminants identified during Phase I.

14.6 SITE 154 — BUILDINGS 617 AND 617G, FIELD OFFICE AND DISASSEMBLY FACILITY

14.6.1 Site History

Buildings 617 and 617G are located south of Twentieth Avenue just east of Twentieth Circle (Fig. 14.4). PTA personnel reported that munitions and explosives

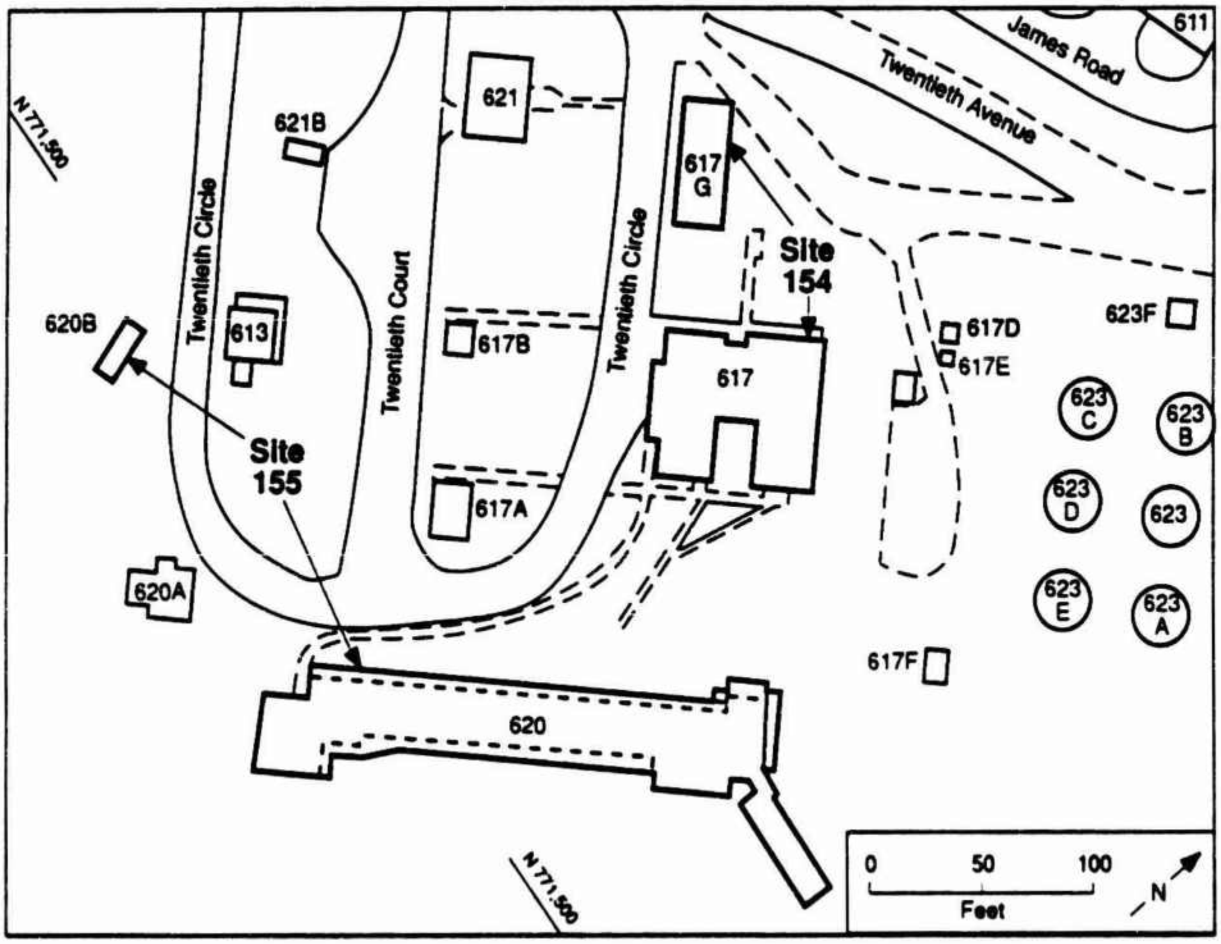

FIGURE 14.4 Layout of Site 154, Buildings 617 and 617G, and Site 155, Buildings 620 and 620B (Source: Adapted from USACE 1984b)

were tested at Bldg. 617. Over 25 years ago, before Bldg. 636 was built, Bldg. 617 was used for test firing and cleaning guns with solvents.

Building 617G is an ordnance machine shop located west of Bldg. 617. The building is a designated satellite accumulation area where waste material — small amounts of waste aerosol cans, oily rags, and oil — are temporarily stored until picked up for disposal elsewhere (Solecki 1989c).

14.6.2 Geology and Hydrology

Buildings 617 and 617G are located approximately 930 ft to the northwest of the south end of Picatinny Lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay (Vowinkel et al. 1985). The deposits overly the Green Pond Conglomerate of Silurian age. The Green Pond Conglomerate is composed of very coarse quartzite conglomerate interbedded with and grading upward into quartzite and sandstone (Vowinkel et al. 1985).

The soils at Site 154 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profiled is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 154 flows south into Green Pond Brook.

14.6.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. Contamination, if present, would most likely be related to explosives and munitions processing and solvents used for gun cleaning at Bldg. 617. Waste oil is a possible contaminant at Bldg. 617G.

14.6.4 Proposed RI Plan

14.6.4.1 Phase I

The areas around Bldgs. 617 and 617a should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. In addition, one surface soil sample should be collected over a depth interval of 0.15-0.3 m (6-12 in.) from each side of Bldg. 617. The soil samples should be analyzed for TCL volatiles, TCL semivolatiles, and explosives.

14.6.4.2 Phase II

If contamination is found, additional surface soil sampling may be required to determine its extent. One soil boring should be drilled at each contaminated area identified during Phase 1. Samples should be collected from the borings and analyzed for contaminants identified during Phase I.

14.7 SITE 155 — BUILDINGS 620 AND 620B, ORDNANCE FACILITY

14.7.1 Site History

Buildings 620 and 620B are located just south of Twentieth Circle, west of Picatinny Lake (Fig. 14.4). According to Solecki (1989c), the test facility generates 111TCE (60 gal/yr), floor sweepings contaminated with propellant (750 lb/yr), propellant (100 lb/yr), and scrap explosives (1 lb/yr). The waste is presently stored inside the test facility. Additional information on past activities at this Site is not available.

14.7.2 Geology and Hydrology

Buildings 620 and 620B are located approximately 660 ft northwest of the south end of Picatinny Lake. The ground surface near the Site slopes toward the lake. The Site is underlain by unconsolidated glacial deposits consisting of interbedded layers of sand, silt, and clay. These deposits overly the Green Pond Conglomerate of Silurian age. The Green Pond Conglomerate is composed of very coarse quartzite conglomerate interbedded with and grading upward into quartzite and sandstone (Vowinkel et al. 1985).

The soils at Site 155 have been classified by the Soil Conservation Service, USDA, as Urban Land (Eby 1976). Soils belonging to this category have been reworked by urban activity to the extent that the original profile is not discernible. In general, most of the soils at PTA are well drained.

Although detailed hydrogeological information is not available, it is estimated that groundwater as well as surface water in the vicinity of Site 155 flows to the southeast towards Picatinny lake and Green Pond Brook.

14.7.3 Existing Contamination

No previous investigations have been conducted to determine the presence of contamination at the Site and past activities have not been well documented. 111-trichloroethane, propellant, and explosives, which are reportedly stored in the buildings, are possible contaminants.

14.7.4 Proposed RI Plan

14.7.4.1 Phase I

The areas around Bldgs. 620 and 620B should be visually inspected for signs of contamination. One surface soil sample should be collected to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the buildings. All soil samples should be analyzed for propellants, explosives, TCL volatiles, and TCL semivolatiles.

14.7.4.2 Phase II

If contamination is found, additional sampling may be required to determine its extent. One soil boring should be drilled at each contaminated site identified during Phase I. Samples should be collected from the borings and analyzed for contaminants identified during Phase I.

15 AREA N: FIRING AND TEST RANGES

15.1 INTRODUCTION

Area N contains eight Sites, several of which are large areas used to test fire munitions. The Area is located in the hilly western part of the Arsenal. Potential contaminants include explosives and metals.

15.2 SITE 7 — BUILDING 1242, MUNITIONS AND PROPELLANTS TEST AREA

15.2.1 Site History

This Site, which currently is not being used, is located west of Lake Denmark on Green Pond and the Copperas Mountains. The site, about 14 ha (37 acres), consists of two ranges of 820 m (900 yd) and 500 m (550 yd) and contains a total of five structures (Fig. 15.1). Both ranges share a common firing area located on Copperas Mountain. This Site previously was used as part of an ongoing program for testing munitions under development (Gaven 1986). No manufacturing or hazardous waste treatment, storage, or disposal is reported to have occurred at this Site (Dames & Moore 1989). Access to the site is along Gorge Road through Site 8.

15.2.2 Geology and Hydrology

Bedrock underlying the Site is Green Pond Conglomerate. The impact area for the 500-m (550-yd) range is on Copperas Mountain, while the impact area for the 820-m (900-yd) range is just above Green Pond Brook and associated wetlands at the base of Green Pond Mountain. At the 900-yd range impact area, Green Pond Conglomerate bedrock is overlain by alluvial material. The thickness and lithologic composition of the alluvial material along Green Pond Brook is unknown. Hydrogeological conditions of the wetlands have not been determined, but any groundwater would be tributary to Green Pond Brook. Bedrock is at the surface in places and is more than 3 m (10 ft), below the surface at other places; its depth varies greatly within short horizontal distances.

Soils in the area have been mapped as the Rockaway Rock Outcrop Association (Eby 1976). According to Eby (1976), these soils are deep, well to moderately well drained, strongly sloping to very steep, and very to extremely stony sandy loams; they overlie granitic gneiss, quartzite, and conglomerate, and have strongly sloping to very steep rock outcrops on uplands. Soils in this association have low permeability (Eby 1976).

Green Pond Brook enters PTA about 1,100 m (3,600 ft) northeast of the 900-yd range impact area and flows southwest across the Site. In 1976, samples of water were collected at the northern boundary of PTA and analyzed for dissolved mineral matter (Wingfield 1976). The analysis determined that all concentrations of most analyzed parameters (Table 15.1) were well below MCLs (see Sec. 3 in Volume 1). The single

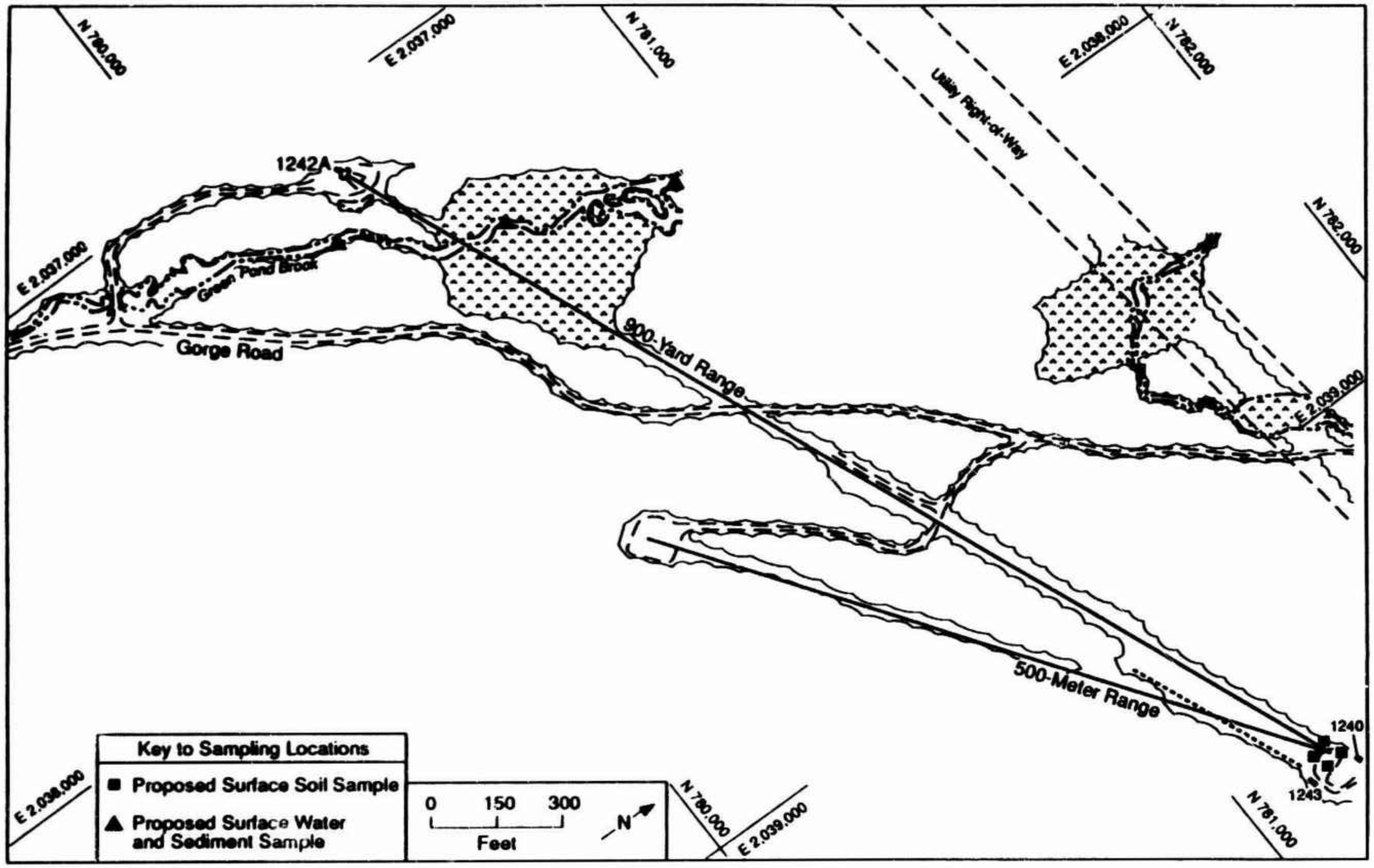

FIGURE 15.1 Layout of Site 7, the Munitions and Propellants Test Area near Building 1242 (Source: Adapted from USACE 1984b)

TABLE 15.1 Results of Inorganics Analysis for Water Samples from Green Pond Brook at North Entrance to PTA (mg/L)[a]

Parameter	7/12-15/76	5/23/79	5/18/81	7/30/81
Calcium	-	16.0	12.0	-
Sodium	-	6.5	ND	-
Potassium	-	-	1.03	-
Magnesium	-	7.1	5.5	-
Iron	0.11	-	-	-
Cadmium	0.0021	-	-	-
Chromium	Trace	-	-	-
Copper	Trace	-	-	-
Nitrate	2.3	ND	ND	-
Ammonia	0.11	-	-	-
Chloride	15.0	13.0	4.5	-
Fluoride	-	0.07	0.09	-
Sulfate	18.2	20.0	19.0	-
pH (units)	9.9	5.7	7.3	7.1
Specific conductance (μmho/cm)	-	173	144	172
Total dissolved solids	-	123	85	-
Total alkalinity	-	44	40	-
Hardness, as $CaCO_3$	-	69	60	-
Lab. oxygen demand	10.4	-	-	-
COD	24	-	-	-

[a]Except as noted for pH and conductance.

Source: Wingfield 1976.

exception is the pH values measured in 1976 and 1979, which are outside the secondary water standard range of 6.5 to 8.5 (40 CFR 143).

15.2.3 Existing Contamination

Even though numerous types of munitions have been tested at this range for a number of years, the extent of any contamination is unknown. However, UXO may be present at the Site.

Based on the lack of contaminants in surface water and sediment samples collected from a point 360 m (1,200 ft) downstream at the upper end of Site 8 (see

Sec. 15.3), Dames & Moore (1989) concluded that Site 7 does not appear to be contributing significant contamination to Green Pond Brook.

15.2.4 Proposed RI Plan

15.2.4.1 Phase I

A surface reconnaissance of the common firing area and the two impact areas should first be conducted to locate any obvious signs of contamination. This survey should be followed by a geophysical survey to locate any buried objects, including UXO and drums. All UXO detected should be removed, and any located buried drums should be sampled and removed.

Because of the remote location of Site 7, the exact size of the common firing area is unknown. To determine if contamination is present at this area, a maximum of four surface soil samples should be collected from it. The samples should be collected to a depth of 0.15-0.3 m (6-12 in.) at 15-m (50-ft) grid intervals in the area. Tentative locations are shown in Fig. 15.1. One sample should also be taken from each area of obvious soil discoloration, disturbance, or other indicators of possible contamination.

The 820-m (900-yd) impact area is located in a very remote area along the northwest corner PTA. Any significant contamination from this site would migrate via Green Pond Brook. Therefore, three surface water and sediment samples should be collected from the brook in the 820-m (900-yd) range area; one sample should be collected at the northern boundary of PTA, another at the middle of the Site, and the third at the lower edge of the Site. Tentative locations are shown in Fig. 15.1.

All soil, sediment, and water samples should be analyzed for TCL metals, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta. Water samples should be collected quarterly at each location and analyzed for the same parameters and macroparameters.

Air sampling is not needed in Phase I because the Site is inactive.

15.2.4.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate its source and extent. To accomplish this, it may be necessary to resample all sites indicating contamination, collect additional surface soil samples, and drill soil borings. It is not possible, at this time, to accurately define the number of surface soil samples or soil borings that would be needed. However, the number should be sufficient to fully define the contaminated areas. Air sampling may also be needed.

All samples collected during Phase II should be analyzed for significant parameters identified during the Phase I investigation.

15.3 SITE 8 — BUILDING 1222, MUNITIONS AND PROPELLANTS TEST AREA

15.3.1 Site History

This test area, about 1 ha (4 acres) in extent, is located west of Lake Denmark along Gorge Road at an elevation of about 260 m (850 ft) above MSL. The Site consists of a large pile of sand along the east side and a sand-filled bunker at the north end (Fig. 15.2). In the past, demolition of nonspecification items has occurred at the Site using demolition explosives in 1.2 m (4 ft) pits that were excavated into sandy soil near the eastern boundary of the Site. Currently, the Site is a ballistics demonstration area where projectiles are fired into the sand-filled bunker (Dames & Moore 1989; Gaven 1986). The Arsenal has submitted a RCRA Subpart X permit application for this area (York 1990).

During 1989 interviews with ANL staff, PTA personnel reported that the disposal and testing of these items occurred in the open demolition area. It was also reported that primer rejects from Bldg. 204 were sent to the Site for destruction. The rejects were destroyed with dynamite in an area about the size of two football fields.

15.3.2 Geology and Hydrology

The Site, an open area along Green Pond Brook, consists of alluvial material and artificial fill overlying the Green Pond Conglomerate bedrock. High hills border the Site on two sides. Along the west side of the Site, an unnamed fault separates Precambrian gneiss and Green Pond Conglomerate. Although detailed hydrogeological information is not available, groundwater flow in the unconsolidated deposits is probably toward Green Pond Brook.

Eby (1976) mapped the soils in the area as belonging to the Rockaway and rock outcrop associations. These soils are deep, well to moderately well drained, and strongly sloping to very steep stony sandy loams. The bedrock in the area consists of granitic gneiss, quartzite, and conglomerate on uplands. Bedrock is at the surface, in places, with strongly sloping to very steep rock outcrops. In other places, the bedrock is more than 3 m (10 ft) below the surface, and depth varies greatly within short, horizontal distances. Soils in this association have low permeability (Eby 1976).

15.3.3 Existing Contamination

The extent of any contamination is unknown. Records were not maintained that documented types of munitions tested or destroyed at this Site.

During the course of its investigation of this Site, Dames & Moore (1989) collected 10 soil, two sediment, and two surface water samples at the locations shown in Fig. 15.2. At the ballistics testing facility, two soil samples were collected: SS8-1 from the area where projectiles are fired, and SS8-2 from in front of the bunker. The remaining eight soil samples (SS8-3 through SS8-10) were collected from the shallow pits

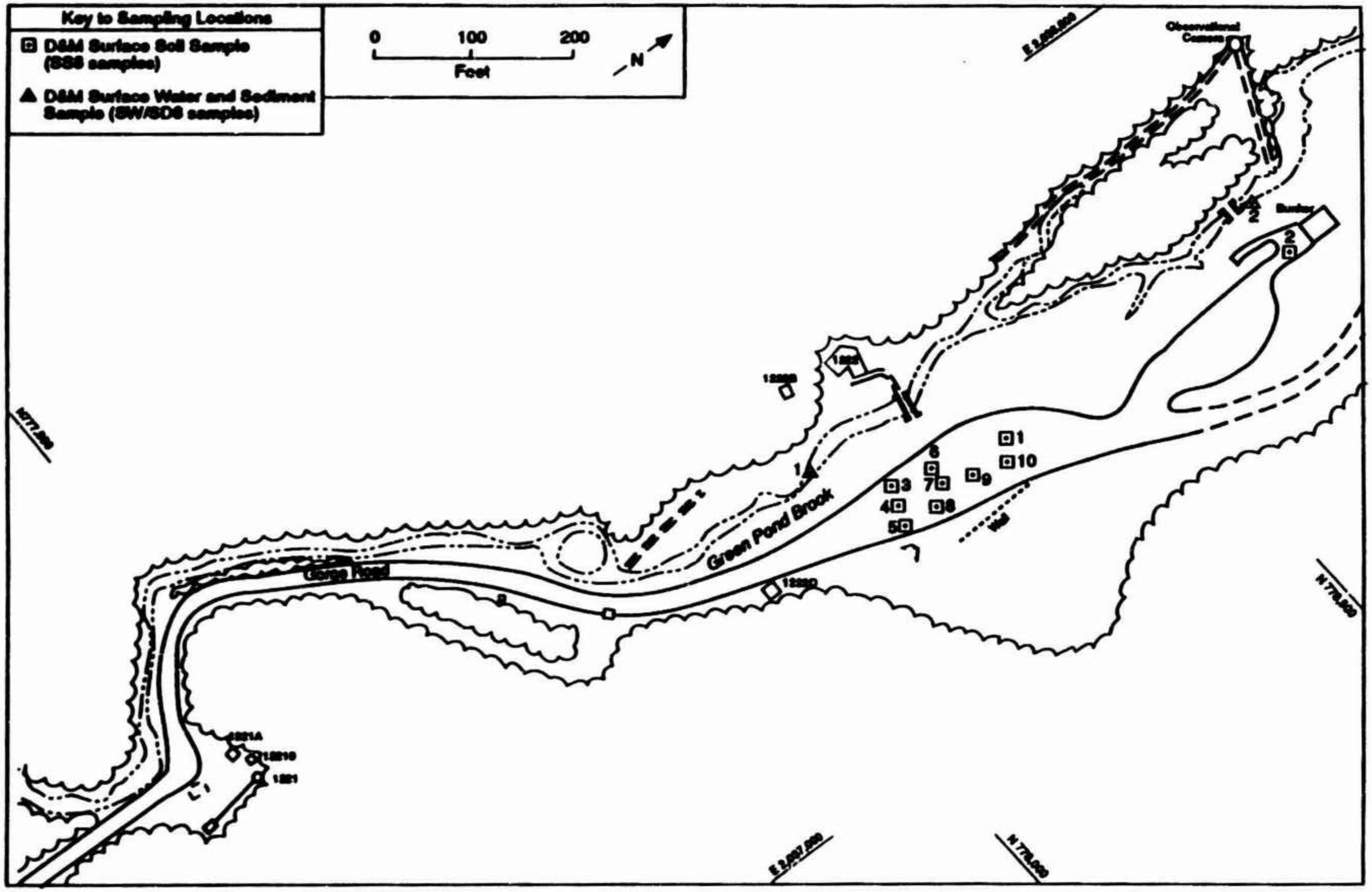

FIGURE 15.2 Layout of Site 8, the Munitions and Propellants Test Area near Building 1222 (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

where nonspecification items were destroyed. Surface water samples and sediment samples (SW8-1 and SD8-1) were collected from Green Pond Brook, 15 m (50 ft) downgradient from the area where nonspecification items were destroyed. Sediment sample SD8-2 and surface water sample SW8-2 were collected upgradient from the Site.

The soil sediment and surface water samples were analyzed for sulfate, nitrate, nitrite, chromium, barium, and explosives. The results for the soil samples are summarized in Table 15.2.

The results given in the table show the presence of explosives (up to 1300 ppm nitroglycerin) and nitrites (up to 60 ppm as NO_2) contamination in the shallow pits. Except for a small amount of nitroglycerin (2 ppm) in one sample, explosives were not detected in the testing facility area.

Analytical results for measurements on surface water sediment samples are summarized in Table 15.3. The data show that the surface water quality is good. The sediments may be slightly contaminated with barium and sulfate.

15.3.4 Proposed RI Plan

15.3.4.1 Phase I

A surface reconnaissance of the Site should be conducted first to locate any obvious signs of contamination. This survey should be followed by a geophysical survey to locate UXO, drums, and other buried objects. All UXO located by the survey should be removed, and any located buried drums should be sampled and removed.

Dames & Moore (1989) determined that the soil in the southeastern part of the Site is contaminated with explosive residue to a depth of 1.5 m (5 ft). To determine extent of this contamination, surface and subsurface soil samples should be collected from a sampling grid, and from areas of obvious soil discoloration, disturbance, or other indicators of possible contamination. The grid should consist of a series of traverse lines extending outward from the limit of the Dames & Moore sampling locations toward Green Pond Brook and to the north. The distance between individual grid lines should be no less than 23 m (75 ft). At each of ten grid intersections, one surface soil sample should be collected to a depth of 0.15-0.3 m (6-12 in.). One soil boring should be drilled at each of four grid intersections. Three 0.6-m (2-ft interval) soil samples should be collected from each boring, giving a total of 12 subsurface soil samples to be collected.

Samples should be collected from the spent sand piles near the bunker. The sand pile near the southeast corner of the site should be throughly evaluated for possible contamination. To accomplish this, a minimum of four soil samples should be collected from each of these piles. It is estimated that a total of 12 sand-pile samples will be collected.

TABLE 15.2 Selected Analytical Results for Soil Samples from Site 8 (ppm)[a]

	Ballistics Testing Facility Samples		Shallow Pit Samples							
Parameter[b]	SS8-1	SS8-2	SS8-3	SS8-4	SS8-5	SS8-6	SS8-7	SS8-8	SS8-9	SS8-10
Chromium	20.0	7.2	10.0	15.0	7.5	46.0	8.4	12.0	6.9	9.6
Barium	120.0	48.7	130.0	140.0	120.0	60.2	75.0	83.6	63.1	86.2
Sulfate	101.0	85.7	128.0	114.0	BDL	84.3	BDL	BDL	BDL	BDL
Nitrite, as NO_2	BDL	BDL	5.7	BDL	BDL	BDL	4.19	26.9	53.8	59.8
HMX	BDL	BDL	23.1	32.3	6.5	7.1	BDL	11.1	BDL	BDL
RDX	BDL	BDL	9.8	19.3	BDL	11.4	BDL	13.7	BDL	BDL
Tetryl	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3.7	BDL	BDL
2,4-DNT	BDL	BDL	BDL	BDL	BDL	BDL	13.0	7.3	BDL	12.3
2,4,6-TNT	BDL	BDL	BDL	86.0	3.8	30.7	BDL	10.2	BDL	BDL
Nitroglycerin	BDL	2.0	BDL	1300	0.68	BDL	0.79	BDL	BDL	BDL

[a]BDL means below detection limit.

[b]Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

TABLE 15.3 Selected Analytical Results for Surface Water and Sediment Samples from Green Pond Brook near Site 8[a]

	Concentration in Water Samples (mg/L)		Concentration in Sediment Samples (μg/g)	
Parameter[b]	SW8-1	SW8-2	SD8-1	SD8-2
Barium	BDL	BDL	43.1	590
Chromium	BDL	BDL	4.3	11.0
Nitrate, as NO_3	0.635	0.667	BDL	BDL
Sulfate	10.2	9.94	173	BDL

[a]BDL means below detection limit.

[b]Table lists only the parameters that were detected in one or more sample.

Source: Dames & Moore 1989.

All samples should be analyzed for TCL metals, TCL volatiles, TCL semivolatiles, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta.

Because no water quality problems were indicated by the Dames & Moore surface water and sediment samples from Green Pond Brook, above and below the Site, no additional surface water or sediment samples are recommended in Phase I.

Air samples should be collected at two downwind locations, one near the sand bunker and another near the sand piles during dry periods in the summer and fall. The samples should be analyzed for explosives, TCL metals, and TCL volatiles.

15.3.4.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate the source and extent of the contamination. To accomplish this, it may be necessary to resample all locations indicating contamination, collect additional surface soil samples, and drill additional soil borings. It is not possible, at this time, to accurately define the number of surface soil samples or soil borings that would be needed. However, the number should be sufficient to fully define the contaminated areas.

The presence and extent of groundwater contamination should be determined during Phase II by drilling and installing groundwater monitoring wells. The number of wells required will depend on the extent of contamination. At a minimum, one well should be located upgradient of any contaminated area and two downgradient of the area.

All samples collected during Phase II should be analyzed for significant contaminants identified during Phase I investigation.

15.4 SITE 9 — BUILDINGS 670, 673, and 674, MUNITIONS AND PROPELLANTS TEST AREA

15.4.1 Site History

This test area is located in the general vicinity of SWMUs 7 and 8 near the western boundary of PTA at an elevation of 340 m (1,125 ft) above MSL. The Site is about 5 ha (20 acres) in extent and contains five structures and portions of Bear Swamp Road. This Site is currently utilized for munitions testing. As far as it is known, only munitions testing has been done in this area, and there has been no reported treatment, storage, or disposal of hazardous waste at the Site in the past (Dames & Moore 1989). Access to the Site is from Bear Swamp Road (Fig. 15.3).

Relatively small metal projectiles, which are launched and propelled by explosive charges, are tested at the Site. For the most part, projectiles travel no farther than 30 m (100 ft), although, in the past, they may have traveled up to 150 m (500 ft). Standard operating procedures include retrieval of the projectile after launching (Dames & Moore 1989).

During 1989 interviews with the ANL staff, PTA personnel described some of the past activities that occurred at this Site. At one time, 500-lb bombs were manufactured at the Site. A wide range of material was destroyed at the Site, although reportedly none was buried there. Lead azide was destroyed at the Site, in addition to 15-lb blocks of explosives, which were placed on the ground just beyond the building and detonated. Testing of explosives and munitions occurred at the upper end of the Site where the material was placed on a stand and fired.

15.4.2 Geology and Hydrology

Geological conditions of the Site, located high on Green Pond Mountain, consists of a thin soil cover or artificial fill overlying Green Pond Conglomerate bedrock. Detailed geohydrological information is not available, as no wells have been drilled in the area. A small, unnamed stream flows southwest along the west side of Site, crosses under the Site in a buried culvert, and exits along the southeast corner. During 1989 interviews with the ANL staff, PTA personnel reported that the stream collects runoff from an adjacent area and has no natural flow.

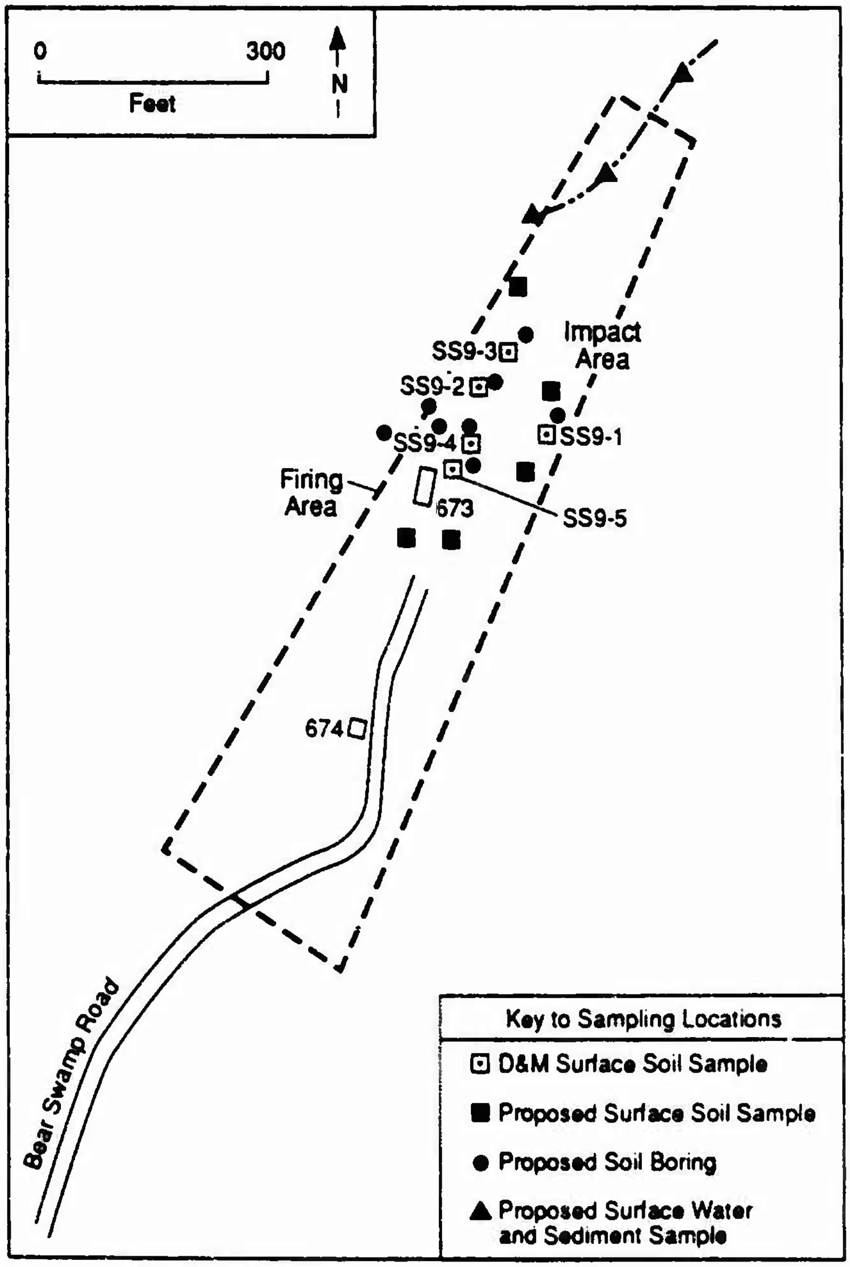

FIGURE 15.3 Layout of Site 9, the Munitions and Propellants Test Area near Building 674 (Source: Adapted from Dames & Moore 1989)

Soils in the area have been mapped as part of the Rockaway Rock Outcrop Association (Eby 1976). Eby (1976) described these soils as being deep, well to moderately well drained, and strongly sloping to very steep, stony sandy loams. The soils overlie granitic gneiss, quartzite, and conglomerate. Bedrock is at the surface, in places, in the form of strongly sloping to very steep rock outcrops. In other places, the depth to bedrock is more than 3 m (10 ft), and depth varies greatly within short horizontal distances. Soils in this association have low permeability (Eby 1976).

15.4.3 Existing Contamination

While all types of munitions have been tested at the Site, the extent of any contamination is unknown.

Dames & Moore (1989) collected five soil samples and analyzed them for priority pollutant metals, barium, sulfate, and explosives. Sampling locations are shown in Fig. 15.3. Soil samples SS9-1 and SS9-2 were collected at about 30 m (100 ft) down range of the firing location, SS9-3 was collected from a location greater than 30 m (100 ft) downrange from the firing area, and SS9-4 and SS9-5 were collected in the vicinity of the firing area. Analysis showed that 10 of the 27 parameters in the soil samples tested for were present above detection limits (Table 15.4). Concentration levels varied between sampling locations, with highest concentrations consistently not being found at any one location. Explosives were not detected except at one location near the firing area where 21 ppm were found. The presence of beryllium (up to 10 ppm), mercury (up to 4.9 ppm), and lead (up to 91 ppm) suggests that the soils are contaminated with metals. Beryllium, which is quite toxic, is a component of some shells and has been found at least one other Site (Site 3).

15.4.4 Proposed RI Plan

15.4.4.1 Phase I

A surface reconnaissance of the Site should first be conducted to locate any obvious signs of contamination. This survey should be followed by a geophysical survey to locate UXO, drums, and other buried objects. All UXO located during the survey should be removed, and any located buried drums should be sampled and removed.

Analysis of the five samples collected north of Bldg. 673 indicated that the soil possibly was contaminated. The extent of this contamination should be determined by collecting five more surface soil samples to a depth of 0.15-0.3 m (6-12 in.) at the following locations shown in Fig. 15.3: two samples south of Bldg. 673, one about 30 m (100 ft) east of sampling locations SS9-4 and -5, one about 30 m (100 ft) north of location SS9-1, and one about 30 m (100 ft) north of location SS9-3. In addition, one sample should be collected from each previously unsampled area of obvious soil discoloration, disturbance, or any other indicator of possible contamination.

TABLE 15.4 Selected Analytical Results for Soil Samples from Site 9 (ppm)[a]

Parameter[b]	SS9-1	SS9-2	SS9-3	SS9-4	SS9-5
Mercury	BDL	0.664	BDL	BDL	BDL
Arsenic	6.19	10.0	10.0	7.45	2.26
Cadmium	0.116	4.0	2.2	0.0477	0.79
Chromium	6.5	9.9	14.0	11.0	9.7
Lead	>5.0	55.0	73.0	36.0	91.0
Barium	26.4	86.1	59.9	70.4	47.7
Beryllium	10.0	1.09	0.465	1.42	0.512
Copper	BDL	BDL	BDL	24.9	180
Nickel	BDL	20.7	20.7	BDL	BDL
Zinc	49.9	194	86.8	49.7	98.8
HMX	BDL	BDL	BDL	BDL	21.2

[a]BDL means below detection limit.

[b]Table lists parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

To determine if the subsurface soil beneath the Site has also been contaminated, soil borings should be drilled at the five Dames & Moore surface soil sampling locations where contamination was detected. Each sample should be collected over a 0.6-m (2-ft) interval for a total of 15 samples.

Three additional soil borings should be drilled at locations near the edge and just off the Site area. These are needed because of reported munitions impacts in the area. Locations are shown in Fig. 15.3 (York 1990; Gabel 1990). Each sample should be collected over a 0.6-m (2-ft) interval for a total of four samples.

At least three surface water and sediment samples should be collected along the unnamed stream that crosses the Site. One sample should be collected where the stream enters the Site, another in the middle of the Site, and the third below where it exits the Site. See Fig. 15.3 for all proposed sampling locations.

All samples should be analyzed for TCL metals, explosives, propellants, nitrate, nitrite, sulfate, gross alpha, and gross beta. Water samples should be collected quarterly at each location and analyzed for the same parameters and macroparameters.

15.4.4.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate the source and extent of the contamination. To accomplish this, it may be necessary to resample all Phase I sampling locations indicating contamination, collect additional surface soil samples, and drill additional soil borings. It is not possible, at this time, to accurately define the number of surface soil samples or soil borings that would be needed. However, the number should be sufficient to fully define the contaminated areas. Soil and water samples should be collected from these borings.

The presence and extent of groundwater contamination should be determined during Phase II by drilling and installing groundwater monitoring wells. The number of wells required would depend upon the extent of the contamination. At a minimum, one well should be located upgradient of any contaminated area, and two downgradient of the area.

All samples collected during Phase II should be analyzed for the significant parameters identified during the Phase I investigation.

15.5 SITE 10 — CHEMICAL BURIAL PIT

15.5.1 Site History

An abandoned chemical waste pit is located in the central portion of PTA near the western boundary (Fig. 15.4). The Site, next to Berkshire Trail, at an elevation of 1,225 ft above MSL, consists of a small unlined pit 7.6 m (25 ft) by 7.6 m (25 ft) square and 1.5 m (5 ft) deep into which toxic chemicals, including cyanide and fluoroacetate, were pumped (Dames & Moore 1989). The pit, now covered with rocks and overgrown with vegetation, is very difficult to recognize.

No records are available on the exact type and quantity of liquid chemical waste disposed of in the pit. Cyanides and fluoroacetates were known to have been disposed of in the pit (Gaven 1986). Ludemann et al. (1981) reported that the types of hazards present at this Site could include acids, pickling liquors, cyanide, phenols, metals, propellants, and fluoroacetates.

15.5.2 Geology and Hydrology

Bedrock, which is exposed in the immediate vicinity of the pit, is fractured Green Pond Conglomerate overlain by a thin soil cover. Except for some very small isolated ponds, no surface water bodies or streams are present in the area. Because this Site is located on the top of a hill, groundwater flows towards the northwest and southeast away from the Site. Depth to groundwater at the Site is between 4.6 and 10.7 m (15 and 35 ft) (Dames & Moore 1989).

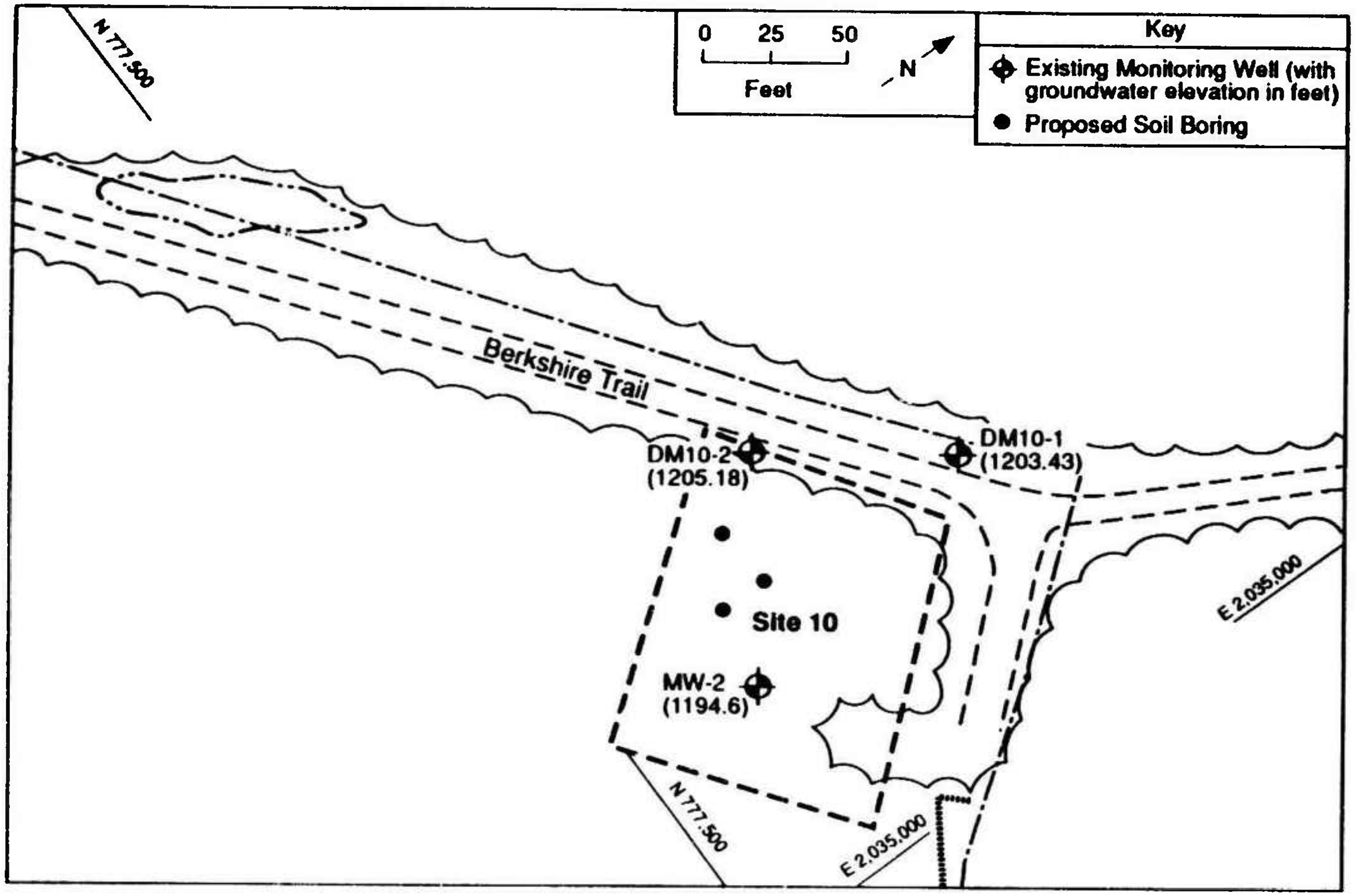

FIGURE 15.4 Layout of Site 10, the Chemical Burial Pit (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

Like all areas on Green Pond Mountain, the soils at this Site are part of the Rockaway and rock outcrop associations (Eby 1976). These soils are deep, well to moderately well drained, and strongly sloping to very steep, stony sandy loams. The soils overlie granitic gneiss, quartzite, and conglomerate, on uplands. Bedrock is at the surface in places in the form of strongly sloping to very steep rock outcrops. In other places, the depth to bedrock is more than 3 m (10 ft), and depth varies greatly within short horizontal distances. Soils in this association have low permeability (Eby 1976).

15.5.3 Existing Contamination

In 1981, a 14.8-m (48.5-ft) deep groundwater monitoring well (MW-2) was drilled southeast of the pit. In 1981 and 1987, water samples from this well were collected and analyzed for 90 extractable organics and 17 inorganic chemical parameters. The detected parameters and the measured concentrations are summarized in Table 15.5. The 1981 samples showed the presence of several metals, with chromium at 136 μg/L, lead at 86 μg/L, nickel at 91 μg/L, and arsenic at 33 μg/L. The chromium and lead values are above the federal MCL values for drinking water. Also, small amounts of organics (benzene, chloroform, and toluene, up to 17 μg/L) were found.

To help evaluate the pollution potential of this Site, Dames & Moore (1988) drilled two additional groundwater monitoring wells. Well DM10-1, located north-northeast of the pit across Berkshire Trail, was drilled to a depth of 14.6 m (48 ft). Well DM10-2 is located on the south side of Berkshire Trail, about 61 m (200 ft) north of the pit (Fig. 15.4). This well was drilled to a depth of 10.4 m (34 ft). Samples of the waters in these wells and the existing monitoring wells were collected and analyzed for fluoroacetate, cyanide, total phenols, VOCs, base-neutral and acid extractable organic compounds, barium, iron, manganese and the priority pollutant metals. Analysis determined that, of the 136 chemical parameters analyzed, 28 were present in concentrations above detection limits. Phthalates (up to 3 μg/L) and methylene chloride (up to 9 μg/L) were found (Table 15.6).

No data are available on soil contamination at the Site.

15.5.4 Proposed RI Plan

15.5.4.1 Phase I

A geophysical survey should be conducted to locate the chemical burial pit, UXO, drums, and other buried objects. All UXO located during the survey should be removed, and any located buried drums should be sampled and removed.

If the pit can be located, one soil boring should be drilled through the pit bottom and two other soil borings should be drilled near the pit. One boring should be located about 2.4 m (8 ft) from the northwest of the pit and the other the same distance southeast of the pit. If the pit cannot be located three soil borings should be drilled in

TABLE 15.5 Selected Analytical Results for Groundwater Samples from Well MW-2 at Site 10 (μg/L)[a]

	1981 Sampling[b]		
Parameter	6/19/81	8/07/81	1988 Sampling[c]
Mercury	<0.5	-	
Zinc	378	-	215
Cadmium	6.0	-	1.2
Chromium	136	-	-
Copper	56.0	-	36.3
Lead	86.0	-	
Nickel	91.0	-	11.0
Arsenic	33.0	-	
Barium	-	-	24.1
Manganese	-	-	179
Chloroform	ND	1	-
Benzene	ND	1	ND
Ethylbenzene	ND	12	ND
Toluene	ND	17	-
Diethyl phthalate	-	-	10.0
Di-N-butyl phthalate	-	-	3.0
Unknown 047	-	-	5.0
Unknown 528	-	-	20.0
Unknown 530	-	-	80.0
Unknown 548[d]	-	-	2.0
Unknown 558	-	-	1.0
Unknown 567	-	-	9.0
Unknown 569	-	-	10.0

[a] A hyphen means not analyzed, and ND means not detected. Table lists only parameters that were detected in one or more samples.

[b] Source: USAEHA 1981a. Other detections included a series of approximately 20 dimethyl benzene to tetramethyl benzene isomers ranging in concentration from 20 to 17 μg/L.

[c] Source: Dames & Moore 1989.

[d] Identified as "undecane" in the source.

TABLE 15.6 Selected Analytical Results for Groundwater Samples from Wells DM10-1 and DM10-2 at Site 10 (μg/L)[a]

Parameter	DM10-1	DM10-2
Barium	32.8	33.3
Cadmium	0.579	0.379
Copper	11.5	13.1
Iron	BDL	49.0
Manganese	128	109
Nickel	5.13	4.46
Zinc	104	123
Methylene chloride	9.0	5.0
Acetone	4.0	ND
Unknown 528	30.0[b]	10.0
Unknown 529	ND	4.0
Unknown 530	1.0	100
Unknown 540	ND	1.0
Unknown 548	2.0[c]	3.0[c]
Unknown 551	1.0	ND
Unknown 554	1.0	2.0
Unknown 558	35.0	2.0
Unknown 560	35.0	1.0
Unknown 567	35.0	10.0
Unknown 568	35.0	ND
Unknown 569	ND	10.0
Unknown 574	35.0	1.0

[a]ND means not detected, and BDL means below detection limit. Table lists only the parameters that were detected in one or more samples.

[b]Identified as "alkane" in the source.

[c]Identified as "undecane" in the source.

Source: Dames & Moore 1989.

the pit area. Suggested boring locations are shown in Fig. 15.4. The number and locations of the borings are chosen to determine the extent of soil contamination in the area soils and the source of contamination in the groundwater. Split-spoon soil samples should be collected from each boring at 0.6-m (2-ft) intervals down to 0.3 m (12 in.) below the bottom of the pit.

The three groundwater monitoring wells installed by Dames & Moore should be resampled for two successive quarters to determine whether the groundwater in the area has been affected by any leachate escaping from the pit.

All soil and water samples collected should be analyzed for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, herbicides, PCBs, explosives, propellants, nitrate, nitrite, fluoride, cyanide, fluoroacetate, gross alpha, and gross beta. If significant contamination is found in any of the well samples, the wells should be monitored for the significant contaminants.

15.5.4.2 Phase II

If significant soil contamination is found, additional soil borings and monitoring wells may be needed to determine the extent of contamination.

15.6 SITE 11 — BUILDINGS 647, 649, AND 650, MUNITIONS TEST RANGE

15.6.1 Site History

This Site, about 27 acres in extent, contains nine structures as well as portions of Bear Swamp Road and Seavy Road (Gaven 1986). The Site is located about 610 m (2,000 ft) northwest of the inlet of Picatinny Lake along the western boundary of PTA. Access to the Site is from Bear Swamp Road.

Dames & Moore (1989) described the Site as consisting of three separate areas (Fig. 15.5). The westernmost area near Bldg. 647 is the largest (about 1 ha [4 acres]) and most active area. It consists of a short firing range (plate range) where inert projectiles are fired into a large armor-plated box filled with sand. The Bldg. 649 area is about 152 m (500 ft) northeast of the first, and occupies an area of less than 0.25 ha (1 acre). All that remains at this location is the foundation of a building where fuzes for detonating explosive devices were stored. The building was demolished and its contents reportedly totally destroyed by fire. The Bldg. 650 area, located 244 m (800 ft) northeast of the Bldg. 649 area, is about 0.75 ha (3 acres) in extent. Static testing is conducted at this area.

15.6.2 Geology and Hydrology

The Site is located on the top of Green Pond Mountain. Elevation of the Site ranges from 330 to over 340 m (1,075 to over 1,125 ft) above MSL. Geological conditions of the area consist of fractured Green Pond Conglomerate overlain in places by a thin

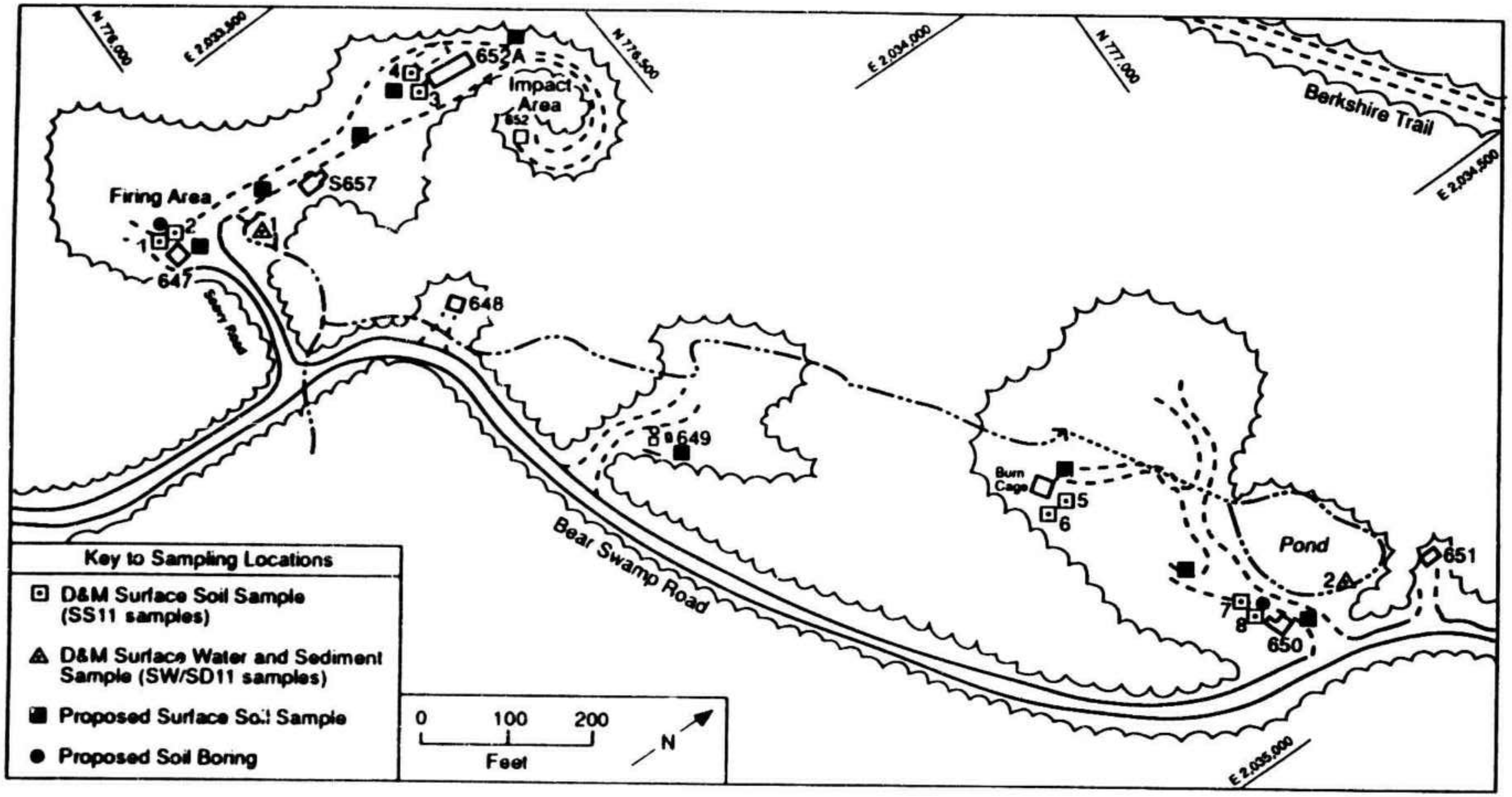

FIGURE 15.5 Layout of Site 11, the Munitions Test Range near Buildings 647, 649, and 650 (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

cover of soil and artificial fill. From examination of the Site, it appears that during construction of the Bldg. 649 and Bldg. 650 sites, artificial fill was placed over a wetlands area. A pond with associated wetlands is adjacent to the Bldg. 650 area. A small unnamed stream flows along the north side the Bldg. 650 area. This stream, like so many in the area, has a red color. Groundwater is probably restricted to Green Pond Conglomerate bedrock. Dames & Moore (1989) stated that groundwater probably is found at a shallow to moderate depth beneath the site, between 1.5 and 6.1 m (5 and 20 ft), and that the most probable direction of groundwater flow would be generally downslope toward the southeast. Dames & Moore (1989) concluded that the two small ponds at the Site are ponded surface water rather than groundwater discharge.

Eby (1976) mapped the soils in the area as belonging to the Rockaway and rock outcrop associations. These soils are deep, well to moderately well drained, and strongly sloping to very steep, stony sandy loams. The soils overlie granitic gneiss, quartzite, and conglomerate on uplands. Bedrock is at the surface, in places, in the form of strongly sloping to very steep rock outcrops. In other places the depth to bedrock is more than 3 m (10 ft), and depth varies greatly within short horizontal distances. Soils in this association have low permeability (Eby 1976).

15.6.3 Existing Contamination

No reports or evidence exist that dumping of wastes occurred either at the Site or within the pond adjacent to the Bldg. 650 area (Dames & Moore 1989).

During the course of their investigation, Dames & Moore (1989) collected eight soil, two surface water, and two sediment samples at the locations shown in Fig. 15.5.

In the Bldg. 647 firing range area, four soil samples, one sediment sample, and one surface water sample were collected. Two soil samples, SS11-1 and -2, were collected in the area where the munitions are fired. Two other soil samples, SS11-3 and -4, were collected from the impact area. Surface water and sediment samples, SW11-1 and SD11-1, were collected from across the access road from Bldg. 647.

No samples were collected from the Bldg. 649 area.

At the Bldg. 650 static testing area, soil samples SS11-5 and -6 were collected from around the perimeter of a burn cage, located at southern end of the area. Soil samples SS11-7 and -8 were collected around the base of the metal stand in front of the building where static testing was conducted. Surface water and sediment samples SD11-2 and SW11-2 were collected from the pond west of Bldg. 650.

The soil and sediment samples were analyzed for sulfate, metals, and explosives. Surface water samples were analyzed for sulfate, nitrate, nitrite, metals, and explosives. The results are summarized in Tables 15.7, 15.8, and 15.9.

The data in the table indicate that the levels of metal concentrations probably do not show the presence of contamination. Explosives contamination at the 647 and 650 areas is indicated by the presence of nitroglycerin (up to 280 ppm).

TABLE 15.7 Selected Analytical Results for Soil Samples from Site 11 (μg/g)[a]

Parameter	Bldg. 647 Samples				Bldg. 650 Samples			
	SS11-1	SS11-2	SS11-3	SS11-4	SS11-5	SS11-6	SS11-7	SS811-8
Arsenic	4.55	3.31	BDL	4.02	7.16	8.22	4.19	2.62
Cadmium	1.0	1.7	0.26	0.34	0.6	1.0	0.50	BDL
Chromium, total	5.8	5.7	4.0	4.7	7.7	19.0	BDL	BDL
Lead	13.0	14.0	49.0	15.0	17.0	32.0	15.0	0.67
Barium	32.3	24.2	26.7	28.3	23.9	23.4	54.1	71.3
Beryllium	0.39	0.40	0.43	BDL	0.37	BDL	0.88	1.28
Copper	14.0	BDL	30.7	32.8	BDL	33.5	BDL	16.6
Nickel	BDL	BDL	BDL	BDL	15.5	20.0	19.9	BDL
Zinc	42.1	BDL	BDL	BDL	BDL	91.8	49.0	43.6
Sulfate	BDL	BDL	149	131	BDL	BDL	BDL	130.
Nitroglycerin	14.0	5.39	BDL	BDL	BDL	BDL	280.	BDL

[a]BDL means below detection limit.

[b]Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

TABLE 15.8 Selected Analytical Results for Surface Water Samples from Site 11 (μg/L)[a]

Parameter	SW11-1	SW11-2
Cadmium	1.21	1.88
Chromium	BDL	10.7
Lead	BDL	20.9
Barium	35.3	86.7
Beryllium	1.07	BDL
Copper	BDL	42.8
Iron	2,200	12,000.0
Manganese	285	510
Nickel	BDL	11.5
Zinc	31.5	107
Sulfate	8,170	910,000
Nitrate, as NO_3	152	BDL

[a]BDL means below detection limit. Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

The surface water data (Table 15.8) indicate concentrations of iron up to 12 mg/L and sulfate up to 910 mg/L in the pond water; all other species concentrations were less than 1 mg/L. The existing data are insufficient to determine if the observed iron and sulfate concentrations are due to natural conditions or Site activities. However, it is likely that natural conditions are the cause of these concentrations.

Concentrations of metals and sulfate in the sediment samples are also probably representative of background levels in the area.

15.6.4 Proposed RI Plan

15.6.4.1 Phase I

A surface reconnaissance of the Site should first be conducted to locate any obvious signs of contamination. This survey should be followed by a geophysical survey to locate UXO, drums, and other buried objects. All UXO located by the survey should be removed, and any located buried drums should be sampled and removed.

TABLE 15.9 Selected Analytical Results for Sediment Samples from Site 11 (ppm)[a]

Parameter[b]	SD11-1	SD11-2
Arsenic	4.5	2.94
Cadmium	1.9	0.33
Chromium	3.9	4.2
Lead	45	13
Antimony	6.77	BDL
Barium	36.9	23.2
Beryllium	0.559	BDL
Copper	54.4	22
Zinc	184	BDL
Sulfate	394	BDL

[a]BDL means below detection limit. Table lists only the parameters that were detected in one or more samples.

[b]Nitrate was measured as BDL.

Source: Dames & Moore 1989.

To determine the extent of contamination, nine surface soil samples should be collected to a depth of 0.15-0.3 m (6-12 in.) from three areas: Four samples should be collected in the area between Bldg. 647 and soil sampling locations SS11-3 and -4, and one should be collected north of locations SS11-3 and -4 in the impact area. One soil sample should be collected halfway between Bldgs. 649 and 650. Three samples should be collected, one sample near Bldg. 649 and two between Bldg. 650 and the burn cage. Samples should also be collected from areas of obvious soil discoloration, disturbance, or other indicators of possible contamination not previously sampled.

To determine if the subsurface soil at the Site is contaminated, two soil borings should be drilled. One boring should be located adjacent to the soil sampling locations SS11-1, and -2, and the other next to SS11-7. Locations are shown in Fig. 15.5.

All samples should be analyzed for TCL metals, propellants, explosives, nitrate, nitrite, gross alpha, and gross beta.

Air samples should be collected at two locations one downwind from the Bldg. 64 firing area and the other downwind from Bldg. 650 during dry periods in the summer and fall. The samples should be analyzed for explosives, propellants, TCL metals, and TCL volatiles.

15.6.4.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate its source and extent. To accomplish this, it may be necessary to resample all locations indicating contamination, collect additional surface soil samples, drill soil borings, and install groundwater monitoring wells. It is not possible, at this time, to accurately define the number of surface soil samples or soil borings that would be needed. However, the number should be sufficient to fully define the contaminated areas. Additional air sampling may also be needed.

The presence and extent of groundwater contamination should be determined during Phase II by drilling and installing groundwater monitoring wells. The number of wells required will depend upon the extent of contamination. At a minimum, one well should be located upgradient of any contaminated area, and two downgradient of the area.

All samples collected during Phase II should be analyzed for significant parameters found at significant concentration levels during the Phase I investigation.

15.7 SITE 12 — BUILDING 656, MUNITIONS WASTE PIT

15.7.1 Site History

This small 0.75-ha (3-acre) Site is located adjacent to 20th Ave. on Green Pond Mountain at an elevation of 360 m (1,175 ft) above MSL. The Site is adjacent to the western boundary of PTA, about 853 m (2,800 ft) northwest of the inlet to Picatinny Lake (Fig. 15.6). Based on physical evidence of partially buried metallic objects, it may have been used as a dump. Dames & Moore (1989) report that steel armor plate and metal parts were being disposed of at the Site. However, personnel familiar with past operations of the Site do not recall waste pits ever being present. Previously, the Site had been used as a borrow pit (Dames & Moore 1989).

During interviews with ANL staff, PTA personnel reported that testing has gone on for a number of years at this Site, and it is possible that UXO could be present. They also reported that the Site used to be a warehouse for explosives and that other buildings were used to store black powder.

Gaven (1986, Attachment B) reports that an unlined waste pit, about 0.18 ha (0.7 acres) in area, existed at this Site. The pit, which is not fenced, is posted and covered.

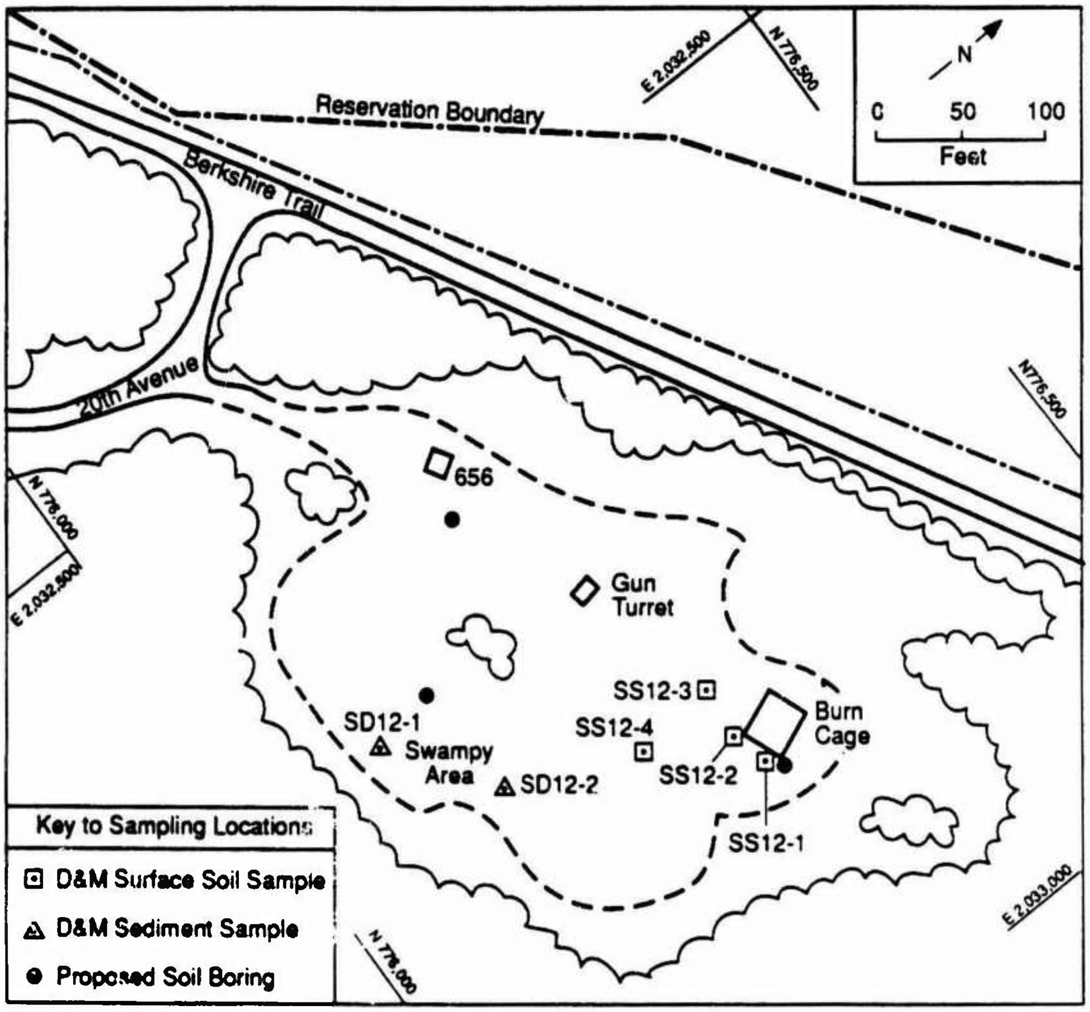

FIGURE 15.6 Layout of Site 12, the Munitions Waste Pit near Building 656 (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

15.7.2 Geology and Hydrology

Site 12 is located on top of the Green Pond Mountain. The underlying bedrock is Green Pond Conglomerate. No surface water bodies or streams are found in the area; however, a swampy area is located along the southern boundary of the Site. Detailed hydrogeological information is not available, as no monitoring wells have been drilled at the Site.

Soils at the Site have been mapped as the Rockaway and Rock Outcrop Associations (Eby 1976). These soils are deep, well to moderately well drained, and strongly sloping to very steep, stony sandy loams. The soils overlie granitic gneiss, quartzite, and conglomerate. Bedrock is at the surface, in places, in the form of strongly sloping to very steep rock outcrops. In other places the depth to bedrock is more than 3 m (10 ft), and depth varies greatly within short horizontal distances. Soils in this association have slow permeability (Eby 1976).

15.7.3 Existing Contamination

The amounts and kinds of materials disposed of at this Site and their composition remain unknown. Ludemann et al. (1981) report that the types of hazards present at this Site could include acids, pickling liquors, cyanide, phenols, metals, live ammunition, and propellants (rocket).

To evaluate the pollution potential of this area, Dames & Moore (1989) collected f[illegible] soil samples and two sediment samples at the locations shown in Fig. 15.6. Analytical results are presented in Tables 15.10 and 15.11. Soil samples SS12-1 and -2 were collected from the perimeter of the metal cage, which may have been used for burning of explosives. Samples SS12-3 and -4 were collected from areas where there is evidence of testing activities. Results of the soil sample analyses for sulfate, barium, priority pollutant metals, and explosives are summarized in Table 15.10.

Sediment samples SD12-1 and -2 were collected from the small, swampy area at the base of an embankment. Results of the sediment sample analyses for sulfate, nitrate, nitrite, barium, priority pollutant metals, and explosives are summarized in Table 15.11.

The soil data in Table 15.10 show the presence of explosives contamination (up to 97 ppm nitroglycerin and some RDX, and DNTs, and TNT) and metal contamination (up to 1,400 ppm copper and possibly lead and mercury) in both the metal cage and testing area. The sediment data in Table 15.11 suggest the presence of lead (up to 120 ppm) and possibly cadmium (up to 12 ppm) and arsenic contamination.

15.7.4 Proposed RI Plan

15.7.4.1 Phase I

A surface reconnaissance of the Site should first be conducted to locate any obvious signs of contamination. This survey should be followed by a geophysical survey to locate UXO, drums, and other buried objects. All UXO located by the survey should be removed, and any located buried drums should be sampled and removed.

To characterize the contamination potential of the subsurface soils at this Site, a maximum of six soil borings should be drilled. If the pit is located, at least three soil borings should be drilled near the pit to a depth 0.3 m (12 in.) below its bottom. Three additional soil borings should be drilled, one near sediment sampling location SD12-1, another near Bldg. 656, and the third just east of surface soil sampling location SS12-1. Soil samples should be collected from each boring over a 0.6-m (2-ft) interval from the top, middle, and bottom of each boring for a total of 18 samples. Suggested boring locations are shown in Fig. 15.6.

Samples should be analyzed for TCL metals, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta.

TABLE 15.10 Selected Analytical Results for Soil Samples from Site 12 (ppm)

Parameter	Metal Cage Samples SS12-1	Metal Cage Samples SS12-2	Testing Area Samples SS12-3	Testing Area Samples SS12-4
Mercury	1.47	1.38	2.36	0.23
Arsenic	>10	8.58	2.97	3.45
Cadmium	6.3	11	5.5	2.2
Chromium	51	37	5.9	8.5
Lead	>5	64	6.7	BDL
Barium	41.9	46.3	83.9	27.6
Beryllium	BDL	0.44	0.55	0.39
Copper	>50	320	BDL	1,400
Zinc	153	151	244	427
Sulfate	91.1	105	BDL	BDL
RDX	BDL	BDL	11	BDL
1,3-Dinitrobenzene	BDL	BDL	12.1	BDL
2,4-Dinitrotoluene	BDL	11.7	BDL	BDL
2,4,6-Trinitrotoluene	BDL	BDL	BDL	8.84
Nitroglycerin	BDL	97	39	13

[a]BDL means below detection limit. Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

Since the Site is inactive and the pit area is reportedly covered, air samples are not needed in Phase I.

15.7.4.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate its source and extent. To accomplish this, it may be necessary to resample all locations indicating contamination, collect additional surface soil samples, drill soil borings, and install groundwater monitoring wells. It is not possible, at this time, to accurately define the number of surface soil samples or soil borings that would be needed. However, the number should be sufficient to fully define the contaminated areas. Air samples may also be needed.

The presence and extent of groundwater contamination should be determined during Phase II by drilling and installing groundwater monitoring wells. The number of

TABLE 15.11 Selected Analytical Results for Sediment Samples from Site 12 (ppm)[a]

Parameter	SD12-1	SD12-2
Mercury	0.266	BDL
Arsenic	12.3	16
Cadmium	12	0.27
Chromium, total	7	11
Lead	120	16
Barium	116	39.5
Beryllium	BDL	0.46
Copper	21.3	18.5
Nickel	BDL	16
Zinc	116	99.4

[a]BDL means below detection limit. Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

wells required will depend upon the extent of contamination. At a minimum, one well should be located upgradient of any contaminated area and two downgradient of the area.

All samples collected during Phase II should be analyzed for significant parameters identified during the Phase I investigation.

15.8 SITE 13 — BUILDING 640, MUNITIONS/PYROTECHNICS TEST AREA

15.8.1 Site History

This inactive Site is located on the top of Green Pond Mountain at an elevation of about 340 m (1,125 ft) above MSL. Access to the Site is via Bear Swamp Road to Bell Road then to Nicholls Road, which runs along the northwest side of the Site (Fig. 15.7). The Site is about 2.2 ha (5.5 acres) in extent and contains eight structures and portions of Nicholls Road.

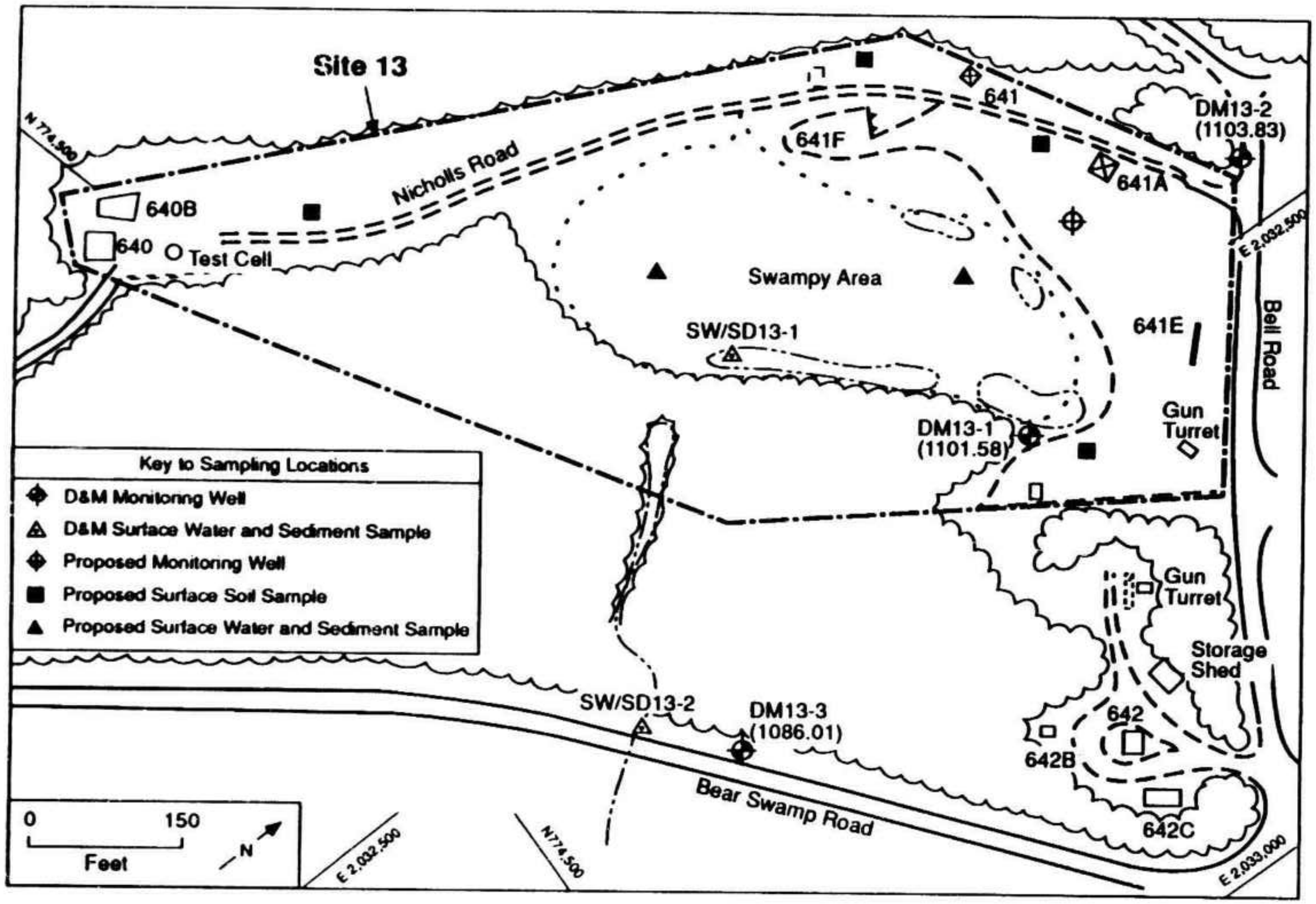

FIGURE 15.7 Layout of Site 13, the Munitions/Pyrotechnics Test Area near Building 640 (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

Past testing activities were confined to the northwestern portion of the Site. Reportedly, inert materials such as projectiles, shells, and metal were disposed of in the swamp. Currently, large steel armor plates are stored on the surface. Munitions under development were tested at the Site.

15.8.2 Geology and Hydrology

A large part of the Site consists of unusable wetlands and a swamp. Drainage from the swamp is well defined where it exits the southeastern boundary of the Site. Groundwater is found at depths of 0.5-1.7 m (1.5-5.5 ft) and it flows toward the swamp and discharges to the southeast (Dames & Moore 1989).

The Site is underlain by fractured Green Pond Conglomerate bedrock, which is obscured by lacustrine deposits and artificial fill.

Eby (1976) mapped the soils in the area as belong to the Rockaway and Rock Outcrop Associations. These soils are deep, well to moderately well drained, and strongly sloping to very steep, stony sandy loams. In places, bedrock is at the surface in the form of strongly sloping to very steep rock outcrops. In other places, the depth to bedrock is more than 3 m (10 ft), and the depth varies greatly within short horizontal distances. Soils in this association have low permeability (Eby 1976).

15.8.3 Existing Contamination

No records are available on the various types of munitions tested at the Site; therefore, the nature and extent of any contamination are unknown.

At the Site, Dames & Moore (1989) drilled three groundwater monitoring wells. Well DM13-1 is located along the northeast side of the swamp. Upgradient well DM13-2 is located at the extreme northwest corner of the Site. Both of these wells are 6.1 m (20 ft) deep. Well DM13-3, which is 7.9 m (26 ft) deep, is located along Bear Swamp Road adjacent to a small stream fed by overflow from the swamp.

Water from the monitoring wells was analyzed for sulfate, nitrate, nitrite, barium, iron, manganese, priority pollutant metals, and explosives.

The groundwater data, summarized in Table 15.12, show detectable concentrations of some metals. These include beryllium (at 1.5 μg/L in well DM13-1), copper (up to 70 μg/L), and cadmium (up to 3.4 μg/L). These values are probably in the range of background concentrations. Explosives were not detected.

Surface water and sediment samples were collected at two locations. SW13-1 and SD13-1 were collected at the outlet of the swamp. Samples SW13-2 and SD13-2 were collected from the small stream adjacent to well DM13-3 to compare groundwater and surface water quality. The surface water samples were analyzed for the same parameters (except mercury) as the groundwater. Sediment samples were analyzed for sulfate, priority pollutant metals, and explosives.

TABLE 15.12 Selected Analytical Results for Groundwater Samples from Site 13 (μg/L)[a]

Parameter	DM13-1	DM13-2	DM13-3
Cadmium	3.4	0.66	0.443
Barium	340	53.5	BDL
Beryllium	1.52	BDL	BDL
Copper	70.6	7.71	8.58
Iron	BDL	93.3	4,500.00[b]
Manganese	180[b]	167[b]	92.8
Nickel	5.39	5.07	BDL
Zinc	73	67	41.1
Sulfate	14,200	11,100	11,300
Nitrate, as NO_3	377	481	364

[a]BDL means below detection limit. Table lists only the parameters that were detected in one or more samples.

[b]Exceeds state secondary drinking water standards.

Source: Dames & Moore 1989.

The surface water data summarized in Table 15.13, show concentrations of sulfate from 300 to 320 mg/L. These values are larger than the groundwater concentrations (Table 15.12) by factors of 20 to 30. The concentration of beryllium (8.8 μg/L), found in one sample may represent contamination. Explosives were not detected.

The results of the sediment analyses, summarized in Table 15.14, show parameter concentrations that are probably representative of background conditions. This includes zinc and sulfate, which are present in concentrations up to 109 ppm and 183 ppm, respectively.

No soil samples were collected because no obvious areas of testing could be located (Dames & Moore 1989).

15.8.4 Proposed RI Plan

15.8.4.1 Phase I

A surface reconnaissance of the Site should first be conducted to locate any obvious signs of contamination. This survey should be followed by a geophysical

TABLE 15.13 Selected Analytical Results for Surface Water Samples from Site 13 (μg/L)[a]

Parameter	SW13-1	SW13-2
Cadmium	BDL	0.362
Barium	22.5	24.50
Beryllium	BDL	8.81
Iron	294	205
Manganese	89.1	56.3
Zinc	BDL	49.6
Sulfate	300,000[b]	320,000[b]
Nitrite, as NO_2	73.20	BDL

[a]BDL means below detection limit. Table lists only the parameters that were detected in one or more samples.

[b]Exceeds the federal and state secondary drinking water standards.

Source: Dames & Moore 1989.

TABLE 15.14 Selected Analytical Results for Sediment Samples from Site 13 (ppm)[a]

Parameter	SD13-1	SD13-2
Cadmium	2.80	0.22
Chromium	BDL	10.0
Lead	6.50	4.50
Barium	47.0	30.1
Zinc	109	BDL
Sulfate	183	BDL

[a]BDL means below detection limits. Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

survey to locate UXO, drums, and other buried objects. All UXO located by the survey should be removed, and any located buried drums should be sampled and removed.

Four surface soil samples should then be collected to a depth of 0.15-0.3 m (6-12 in.). Two soil samples should be collected from the northwest side of the Site, one from the northeast side of the Site, and one between Bldg. 640 and the swamp. Locations are shown in Fig. 15.17. In addition, one surface soil sample should be collected from each area of obvious soil discoloration, disturbance, or other indicators of possible contamination.

The three wells that Dames & Moore (1989) installed were not located in a position to fully determine whether groundwater quality had been affected by surface activities. Therefore, one monitoring well should be installed in the area northwest of the swamp area where the testing occurred. A monitoring program should be established for sampling and measuring this well on a continuing basis. Soil samples should be collected during the drilling of this well. Each sample should be collected over a 0.6-m (2-ft) interval. The boring should be sampled at a depth of 0.6 m (2 ft) below the surface, the middle, and the bottom for a total of three samples.

One surface water and sediment sample should be collected from each of two locations in the swamp (shown in Fig. 15.7).

All Phase I samples should be analyzed for explosives, TCL metals, TCL semivolatiles, propellants, nitrate, and nitrite. All water samples should be analyzed for macroparameters.

Since the Site is inactive, air samples are not needed to test for airborne contamination in Phase I.

15.8.4.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate its source and extent. To accomplish this, it may be necessary to collect additional surface soil samples, drill soil borings, and install additional groundwater monitoring wells. It is not possible, at this time, to accurately define sampling locations and media. However, the number and locations of the sampling should be sufficient to fully define the contaminated areas. Air samples may also be needed.

All samples collected during Phase II should be analyzed for significant parameters that are identified during the Phase I investigation.

15.9 SITE 14 — BUILDING 636, MUNITIONS TEST AREA

15.9.1 Site History

At this Site, projectiles are fired from large-caliber guns to test propellants, metal integrity, and weapon systems (Dames & Moore 1989). The projectiles are fired into sand-filled bunkers and recovered after firing. The test area, which is about 5 ha (20 acres) in extent, contains 10 structures and parts of Stickle, Hance, and Roth Roads (Gaven 1986) and is located adjacent to Bear Swamp Road (Fig. 15.8).

15.9.2 Geology and Hydrology

The Site is located on the top of Green Pond Mountain at an approximate elevation of 320 m (1,075 ft) above MSL. Bedrock underlying site is the Green Pond Conglomerate. Along the east side of the test area is a large, shallow lake that contains spent sand piles. The sand-filled bunkers, into which projectiles are fired, are excavated into the Green Pond Conglomerate. Detailed geohydrological information is not available.

Eby (1976) mapped the soils in the area as belonging to the Rockaway and Rock Outcrop Associations. These soils are deep, well to moderately well drained, and strongly sloping to very steep, stony sandy loams. The soils overlie granitic gneiss, quartzite, and conglomerate. In some places, bedrock is at the surface in the form of strongly sloping to very steep rock outcrops on uplands. In other places, soil depths are more than 3 m (10 ft), and depth varies greatly within short horizontal distances. Soils in this association have low permeability (Eby 1976).

15.9.3 Existing Contamination

Although many types of munitions have been tested at this range, the extent of any contamination, if it exists, is unknown. It is possible that hazardous UXO may remain at the Site, especially in the adjacent shallow lake.

To aid in their evaluation of this Site, Dames & Moore (1989) collected four soil samples and analyzed them for barium, priority pollutant metals (excluding mercury), explosives, sulfate, nitrate, and nitrite. Two of the samples, SS14-1 and -2, were collected from the west side of Bldg. 636, where firing of projectiles and other activities occur (Fig. 15.8). The other two, SS14-3 and SS14-4, were collected from the eastern end of Bldg. 638 (the sand-filled bunker into which projectiles are fired).

The analytical data, summarized in Table 15.15, shows that sulfate concentrations at 3,900 to 4,500 ppm were elevated in that they are above 0.1%. It is possible that these values are due to Site activities; however more data on the type of sand (e.g., whether or not it contains gypsum) would be needed to make a definite statement about the source. Concentrations of lead, arsenic, cadmium, and zinc are higher in the firing area than in the bunker. Explosives were not detected in any of the samples.

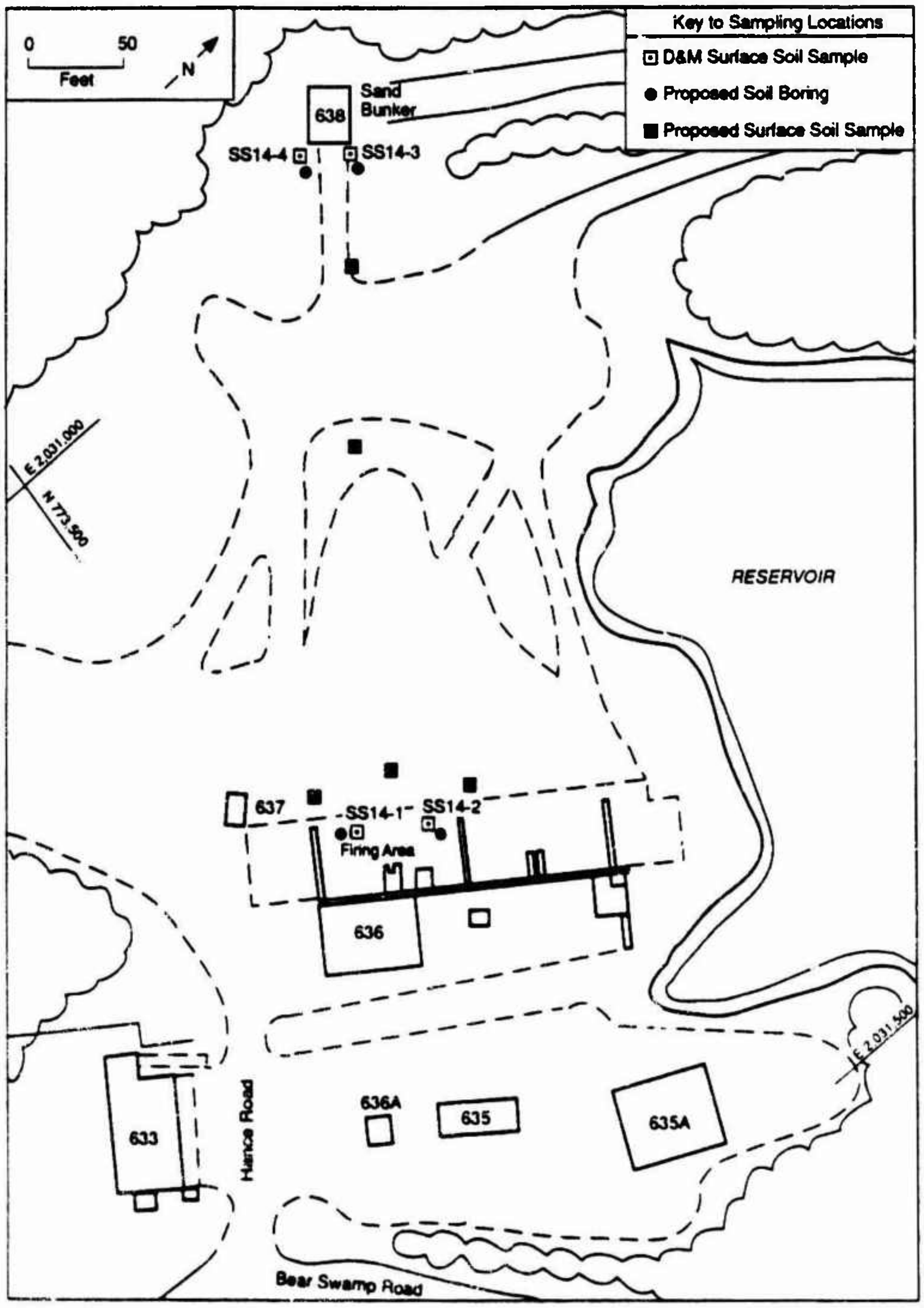

FIGURE 15.8 Layout of Site 14, the Munitions Test Area near Building 636 (Sources: Map adapted from USACE 1984b; sampling locations from Dames & Moore 1989)

TABLE 15.15 Selected Analytical Results for Soil Samples from Site 14 (ppm)[a]

	Bldg. 636 Samples		Bunker Samples	
Parameter	SS14-1	SS14-2	SS14-3	SS14-4
Arsenic	4.44	6.82	BDL	BDL
Cadmium	2.90	2.00	0.0542	0.064
Chromium, total	12	10	15	31
Lead	36	42	2.9	3.4
Barium	55.1	22.1	31.5	25.8
Beryllium	0.48	BDL	0.95	0.681
Copper	43.1	19.5	BDL	43.2
Zinc	61	58.2	BDL	BDL
Sulfate	BDL	BDL	4,500	3,900

[a]BDL mean below detection limit. Table lists only the parameters that were detected in one or more samples.

Source: Dames & Moore 1989.

15.9.4 Proposed RI Plan

15.9.4.1 Phase I

A surface reconnaissance of the Site should first be conducted to locate any obvious signs of contamination. This survey should be followed by a geophysical survey to locate UXO, drums, and other buried objects. All UXO located by the survey should be removed, and any located buried drums should be sampled and removed.

Surface soil samples should be collected to a depth of 0.15-0.3 m (6-12 in.) in the area between the firing area and the bunker to supplement those collected by Dames & Moore. Three samples should be collected 15 m (50 ft) northwest of sampling locations SS14-1 and -2, one should be collected about halfway between Bldgs. 636 and 638, and another should be collected 15 m (50 ft) southeast of sampling locations SS14-3 and -4. Locations are shown in Fig. 15.8. In addition one sample should be collected from each area of obvious soil discoloration, disturbance, or other indicators of possible contamination not previously sampled.

Three samples should be collected from each spent sand pile in the wetlands. It is estimated that about nine sand-pile samples will be collected and submitted for analysis.

To determine the extent of contamination at depth, one soil boring should be drilled at each of the four Dames & Moore soil sampling locations shown in Fig. 15.8.

All samples should be analyzed for TCL metals, explosives, propellants, nitrate, nitrite, sulfate, gross alpha, and gross beta.

Air samples should be collected at two locations, one downwind from the sand bunker (Bldg. 638) and the other downwind from the firing area, during dry periods in the summer and fall and during tests. The samples should be analyzed for explosives and propellants, TCL metals, and TCL volatiles.

15.9.4.2 Phase II

If significant contamination is detected during Phase I, an effort should be made to locate its source and extent. To accomplish this, it may be necessary to resample all locations indicating contamination, collect additional surface soil samples, drill soil borings, and install groundwater monitoring wells. It is not possible, at this time, to accurately define the number of surface soil samples or soil borings that would be needed. However, the number should be sufficient to fully define the contaminated areas. Additional air samples may be needed.

The presence and extent of groundwater contamination should be determined during Phase II by drilling and installing groundwater monitoring wells. The number of wells required will depend upon the extent of contamination. At a minimum, one well should be located upgradient of any contaminated area and two downgradient of the area.

All samples collected during Phase II should be analyzed for any significant parameters identified during the Phase I investigation.

16 AREA O: LAKE DENMARK

16.1 INTRODUCTION

Area O contains two Sites. The Area is quite large and contains Lake Denmark, which is located in part in the northern portion of the Arsenal. Potential contaminants include propellants and possible UXO in the lake.

16.2 SITE 54 — LAKE DENMARK

16.2.1 Site History

Lake Denmark, located in the northern part of PTA, is a man-made lake about 70 ha (174 acres) in size with a storage capacity of 1,251 million L (331 million gal) (Fig. 16.1). The lake has an average depth of 1.8-2.1 m (6-7 ft) and is part of PTA's water source. The lake is managed as a recreational resource by the DEH Land Management Division and the Morale Support Activity.

The perimeter of the lake consists mostly of natural wild growth. The 1200 area, which contains storage magazines, is the only development around the lake. The magazines have been used for for at least 40 years to store explosive materials. No spills have been reported. The lake has been treated with copper sulfate to stem algal growth.

Lake Denmark has a long history of being the repository of munitions and their associated waste. After the 1926 explosion, unexploded munitions were dumped into the lake. Since that time the lake has been used as an impact area for experimental mortar rounds and other explosive or pyrotechnic munitions.

16.2.2 Geology and Hydrology

Lake Denmark is fed by Burnt Meadow Brook and a large wetlands marsh at its northern border. The outfall from the lake flows into Green Pond Brook and then into Picatinny Lake (PTA 1988b). Precambrian gneiss bedrock underlies the lake.

16.2.3 Existing Contamination

While there have been rumors of possible dumping by Radiation Technology, which operated in the area, major contamination is not suspected. For a short period, inert mortar rounds were fired into the lake from the 1200 area, probably in the late 1970s. Water quality has always tested as good and meets drinking water standards (PTA 1988b).

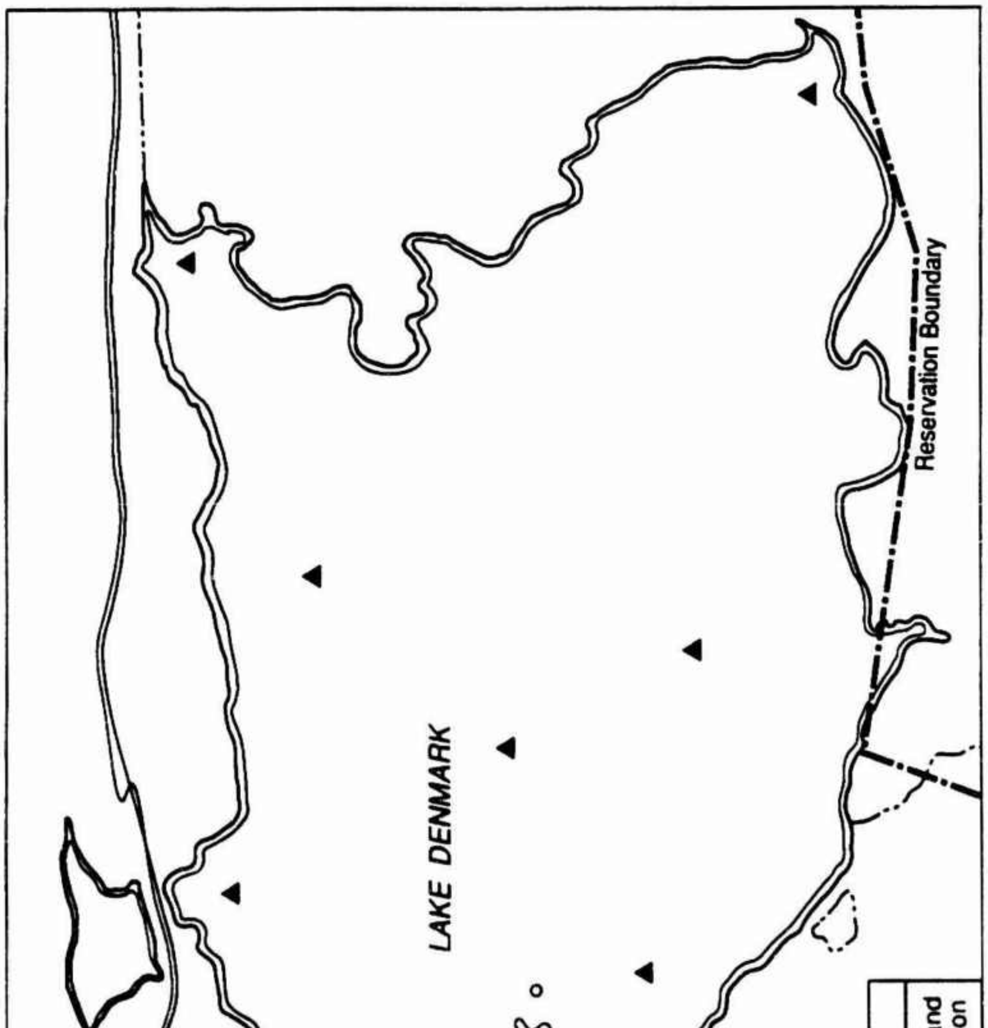

FIGURE 16.1 Layout of Site 54, Lake Denmark (Source: Adapted from USACE 1984a)

No records exist on the type and quantity of the munitions fired into Lake Denmark over the years. In 1976 and 1981, samples of lake water were collected and analyzed for dissolved mineral matter (Table 16.1) and volatile organics. Analysis showed that the lake contained nitrate at a concentration of 4.0 mg/L. A sample from Lake Denmark collected on June 12, 1981, showed the presence of 6.1 µg/L chloroform (ICM 1981). While this concentration may represent contamination, no other organics were detected.

16.2.4 Proposed RI Plan

16.2.4.1 Phase I

To evaluate the pollution potential of this Site, 10 surface water and 10 lake bottom sediment samples should be collected and analyzed for TCL volatiles, TCL semivolatiles, TCL metals, explosives, PCBs, pesticides, herbicides, gross alpha, gross

TABLE 16.1 Results of the Inorganics Analysis for Water Samples from the Lake Denmark Outfall[a]

Parameter	Concentration (mg/L)[b]
Iron	0.09
Nitrate	4.0
Ammonia	0.17
Cadmium	0.0021
Chloride	10.0
Sulfate	15.8
pH	7.2
Lab. oxygen demand	9.2
COD	36.C

[a]Samples collected on July 12-15, 1976.

[b]Except for pH.

Source: Wingfield 1976.

beta, nitrate, nitrite, and macroparameters (water samples only). Tentative collection locations are shown in Fig. 16.1 with exact locations to be determined by field inspections and results of attempts to locate UXO. Water samples should be taken quarterly for one year and analyzed for the above parameters. The program should be reviewed after one year.

An effort should be made to locate UXO and other metallic debris on the lake bottom. Techniques to be considered include geophysical surveying and use of underwater television cameras. Any UXO, or other dangerous items that are located, should either be removed or the location marked (e.g., with a buoy).

16.2.4.2 Phase II

If significant contamination is found in any of the water and sediment samples, then additional samples would be needed to determine the extent of contamination. The parameters to be analyzed would depend on those found in the Phase I samples.

16.3 SITE 164 — BUILDING 1217, GENERAL PURPOSE MAGAZINE

16.3.1 Site History

Building 1217 is located on 24th Avenue just south of Lake Denmark; a map of the Site is shown in Fig. 16.2. Building 1217 was built in 1944 as a magazine and is still in use. It has been used to store propellants.

16.3.2 Geology and Hydrology

The surface elevation at Site 164 is about 780 ft above MSL. Soils in the area belong to the Rockaway Series, and the bedrock is Precambrian gneiss. Surface water and runoff from the area would flow southwest into Burnt Meadow Brook.

16.3.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported that propellant material (presumably in containers) was taken outdoors and opened. No more information is available.

16.3.4 Proposed RI Plan

16.3.4.1 Phase I

The area around the building should be visually inspected to locate areas of any soil disturbance or staining. If disturbed or stained areas are found, then one surface soil

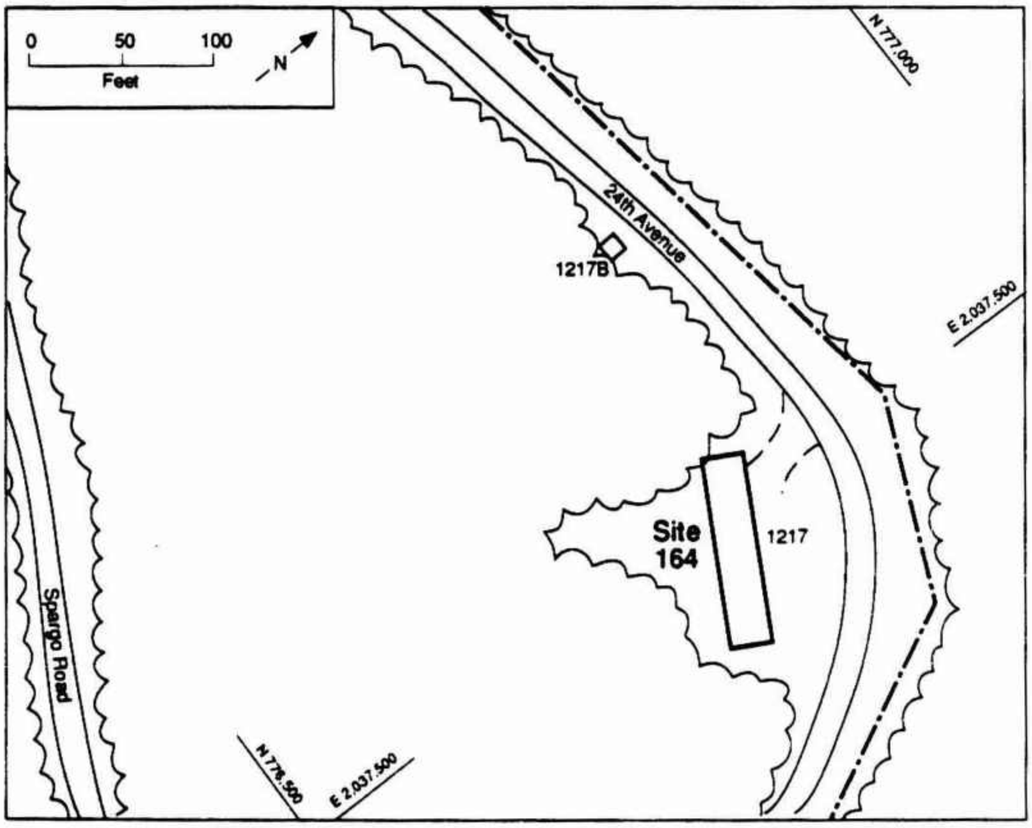

FIGURE 16.2 Layout of Site 164, the General Purpose Magazine at Building 1217 (Source: Adapted from USACE 1984b)

sample should be collected from the center of each stained area to a depth of 0.3 m (1 ft). All surface soil samples should be analyzed for propellants, explosives, nitrate, and nitrite.

16.3.4.2 Phase II

If significant contamination is found in the surface soil samples, soil borings should be drilled near the areas of contaminated soil identified during Phase I. Samples should be collected from the borings and analyzed for propellants, explosives, nitrate, and nitrite.

17 AREA P: MISCELLANEOUS STORAGE

17.1 INTRODUCTION

Area P includes six storage Sites located in the southwestern part of the Arsenal. Potential contaminants include a variety of chemical parameters that may have leaked from storage areas.

17.2 SITE 27 — FORMER SALT STORAGE AREA

17.2.1 Site History

Site 27 is located in the southern part of the Arsenal near Shinkle Road about 0.25 mi west of Green Pond Brook. Figure 17.1 provides details of the Site. The Site consists of a corrugated steel Quonset hut covering 3,000 ft^2 and having an asphalt floor. Until 1983, it was used to store road salt and cinders. The deteriorated condition of the hut may have allowed the contents to be leached by precipitation. In spring 1983, the contents were transferred to new storage areas. The building is slated for demolition.

17.2.2 Geology and Hydrology

The USGS has characterized PTA in several studies. Information regarding specific geology and hydrology at Site 27 is limited. The bedrock directly underlying the Site is the Leithsville Formation.

Generally, the soils in this area are classified as the Preakness Series. These soils have moderately rapid permeability and a seasonally high water table, and they are subject to flooding. A dark surface variant of the Preakness sandy loam occupies the area adjacent to Green Pond Brook. It has a black mucky surface layer not found in the typical Preakness sandy loam, which is more commonly found in the upland areas (Sargent 1988).

17.2.3 Existing Contamination

17.2.3.1 Soil

Recent soil sampling data are limited to chloride analyses. The results are presented in Table 17.1. If concentrations found in soil samples 1 and 3 and the sediment sample leached to the surface water or the groundwater, chloride would exceed the New Jersey Secondary Drinking Water Standard of 250 mg/L.

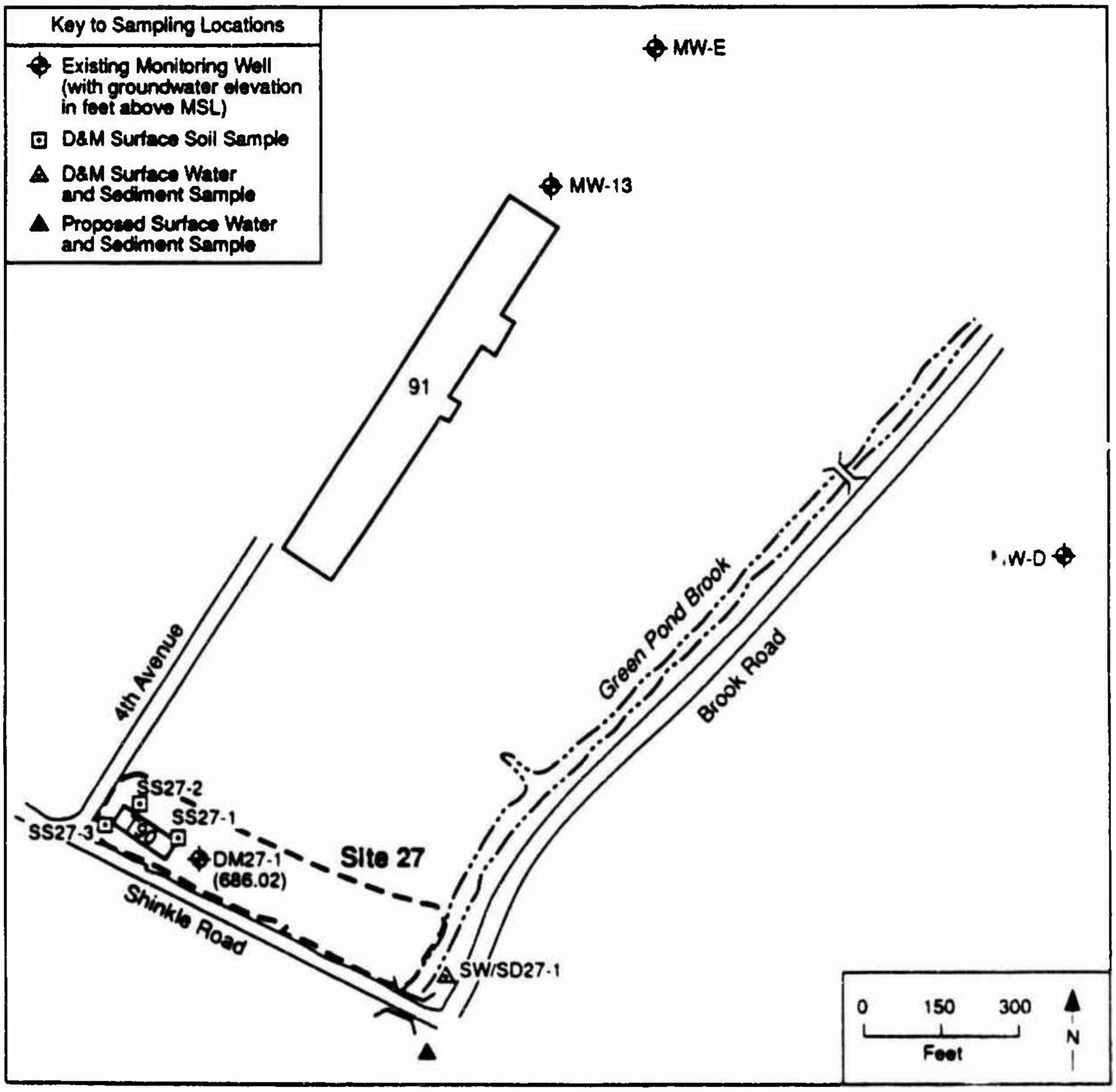

FIGURE 17.1 Layout of Site 27, the Former Salt Storage Area (Source: Adapted from Dames & Moore 1989)

17.2.3.2 Water

There is one groundwater monitoring well located at this Site (DM27-1), and it was sampled for pH and conductance in April 1988. The results showed an extremely high value for conductivity (33,000 umhos) and a neutral pH (6.28). The surface water showed values comparable to those from other Sites (170 umhos and 6.74).

17.2.4 Proposed RI Plan

Due to the Site's proximity to Green Pond Brook and its ultimate use, downstream surface water and well DM27-1 should be monitored for two quarters.

TABLE 17.1 Chloride Concentrations in Soil Samples from Site 27

Sample	Sampling Depth (ft)	Concentration (ppm)
SD27-1	19.7	263
SS27-1	4.9	331
SS27-2	4.9	25.0
SS27-3	4.9	377

Source: Dames & Mocre 1989.

Figure 17.1 shows the suggested sampling location (about 20 ft downstream). Samples should be analyzed for macroparameters and cyanide.

In addition to chloride, macroparameters will give information on contaminants that are governed by health based standards for total dissolved solids, barium, and sodium. The secondary drinking water standard for TDS, based on the water's taste and laxative effects, is 500 mg/L. The MCL for barium is 1,000 µg/L, and the New Jersey Secondary Drinking Water Standard for sodium is 50 mg/L. Cyanide analyses are needed because a cyanide complex has been used as an anticaking agent in road salt (Ohno 1990). Sampling results should be monitored for degradation of water quality (exceedance of primary and secondary water quality standards).

17.3 SITE 78 - BUILDING 91, OPTICS PROTOTYPE FACILITY

17.3.1 Site History

Building 91 is located near Shinkle Road about 0.25 mi west of Green Pond Brook in the southern portion of PTA. Details of the Site are given in Fig. 17.2. It was built in 1942 as a storehouse and supply building and has an area of 60,105 ft^2. Since 1981, the northeast section of the building has been used for optics prototype processing.

In 1984, Bldg. 91 was designated as a secure area for classified activities. Small quantities of waste solvent, waste oil, metal, and corrosives are produced. Operations include degreasing, stripping metal plating from glassware, washing glassware, and machining. Containerized wastes are accumulated inside the building on concrete flooring and are transferred to Bldg. 3100 within 90 days (Solecki 1989c; Foster Wheeler 1988b). The Site, which did not have interim status, will be closed in accordance with New Jersey hazardous waste regulations.

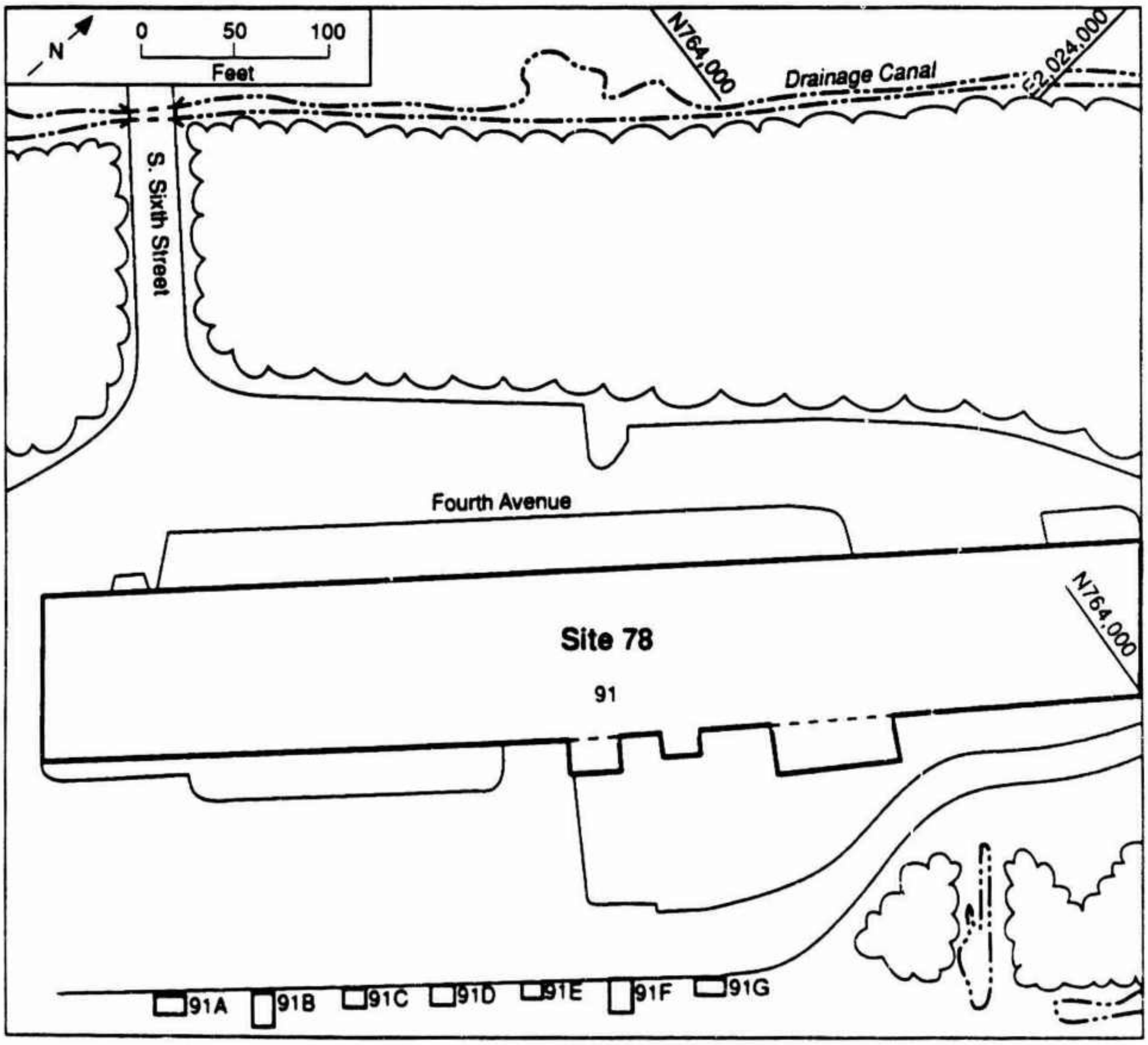

FIGURE 17.2 Layout of Site 78, the Building 91 Optics Prototype Facility (Source: Adapted from USACE 1984b)

17.3.2 Geology and Hydrology

Information regarding Site-specific geology and hydrology at Site 78 is limited. The bedrock directly underlying the Site is the Leithsville Formation, which contains water-bearing fractures and cavities with moderate yields. Groundwater flow is estimated to be south-southeast toward Green Pond Brook.

In general, the soils in this area are classified as the Preakness Series. These soils have a moderately high permeability and a seasonally high water table; they are subject to flooding. A dark surface variant of the Preakness sandy loam occupies the area adjacent to Green Pond Brook. It has a black mucky surface layer not found in the typical Preakness sandy loam, which is more commonly found in the upland areas (Sargent 1988).

17.3.3 Existing Contamination

No previous investigations have been performed for this Site. Records indicate that wastes include sodium hydroxide solution, degreasing agents, and cutting oil. Small quantities of miscellaneous wastes that have accumulated due to suspension of past operations and process modifications include epoxy waste (10 lb/yr), nitric acid used to strip copper (1 gal/yr), sulfuric acid (1 gal/yr), and paint and solvents (unknown quantities) (Foster Wheeler 1988b). No spills or releases have been reported for this Site.

17.3.4 Closure Plan

Areas included in the closure plan are the loading docks in the east wing. Activities include removal and disposal of stored chemicals, decontamination, and confirmation sampling (Foster Wheeler 1988b).

17.3.5 Proposed RI Plan

In order to address the potential for contamination resulting from Site operations, a phased investigation is recommended. The following RI sampling plan will be carried out independently of the closure sampling plan. If clean closure is not possible, the RI plan should be modified as new information becomes available.

17.3.5.1 Phase I

The current condition of the Site should be assessed by inspecting all areas to locate visible contamination, drains, and other migration pathways. If visible staining is found, one composite soil sample should be collected from each area of stained soil.

In addition to the sampling of visibly contaminated areas, three surface soil samples should be collected over a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.

All samples should be analyzed for TCL volatiles, TCL semivolatiles, TCL metals, nitrate, and sulfate.

17.3.5.2 Phase II

If significant contaminant concentrations are found in the surface soil samples, it will be necessary to determine the extent of contamination. One soil boring should be drilled to groundwater or 3 m (10 ft), whichever comes first, in each contaminated area. Subsurface soil samples should be collected from each boring. All samples should be analyzed for parameters that were elevated in the surface samples. Based on the results of the soil borings, it may be necessary to install a minimum of one upgradient and three downgradient monitoring wells.

17.4 SITE 94 — BUILDINGS 1600, 1601, 1604, 1609, AND 1610

17.4.1 Site History

The 1600 area is located about 400 ft southeast of Little Picatinny Road and along Phipps Road in the southwestern part of the PTA. A map of the Site is shown in Fig. 17.3. The 1600 area was a pyrotechnic area, known as "Little Picatinny," that was used for manufacturing and testing flares.

Building 1600 was built in 1949 as a test chamber; it was listed as an explosive firing facility in 1971 and as a range facility in 1977. Building 1601 was built in 1949 as a test chamber; it was listed as a dark room in 1971 and as a general purpose laboratory in 1977. Building 1604 was built in 1942 as a process building; it was listed as a pyrotechnic assembly plant in 1971 and as an ordnance facility in 1977. Building 1609 was built in 1942 as a machine shop and was still listed as a machine shop in 1971 but as an ordnance facility in 1977. Building 1610 was built in 1942 as an office building and was listed as a general purpose administration building in both 1971 and 1977.

17.4.2 Geology and Hydrology

The 1600 area is about 710 ft above MSL, rises to about 850 ft behind the buildings to Berkshire Trail, and slopes very gradually in front of the buildings to the southwest to Green Pond Brook at about 690 ft above MSL. Soils in the area belong to the Rockaway Series, and the bedrock is Precambrian gneiss. The aquifers under the Site are as described for other Sites in the area. Surface water and runoff from the 1600 area would flow slowly (because of the gentle slope) toward Green Pond Brook.

17.4.3 Existing Contamination

During 1989 interviews with ANL staff, PTA personnel reported the following information related to Site 94: A flare fire occurred at Bldg. 1601 or 1610, killing four people. Photochemicals were released from Bldg. 1601 into the drain and dry well. Liquid waste from Bldg. 1604 (a plating shop) was released into the lagoon at the north end of the building; the building, which was later used for flare loading, reportedly blew up. Building 1609 was used for flare manufacture and had too much waste stored in it. Work on nuclear materials, nuclear adaptation kits, atomic cannon, and explosive lenses in the 1600 area was also reported by PTA personnel.

A list of satellite waste accumulation areas shows that waste photographic developer, generated at a rate of 10 lb/yr, was stored inside Bldg. 1600 (Solecki 1989c). Also, waste generated at Bldg. 1609 (oil, oily rags, acetone, methanol, aerosol cans) and flammable liquids are stored outside in a steel box. It is also reported (anonymous undated) that contamination of the soil by heavy metals and other contaminants is suspected.

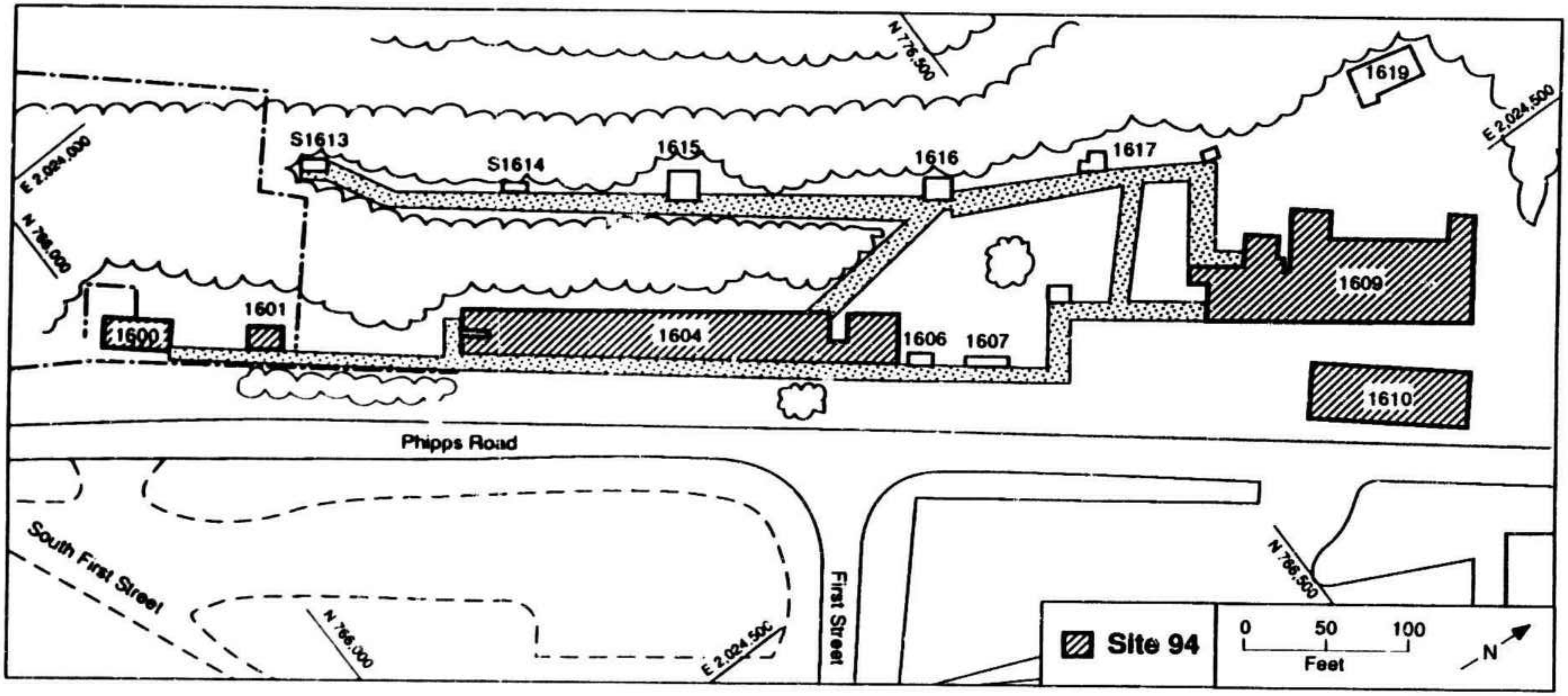

FIGURE 17.3 Layout of Site 94, Buildings 1600, 1601, 1604, 1609, and 1610 (Source: Adapted from USACE 1984b)

Because Bldg. 1604 has a corrugated asbestos roof, any cleanup or decommissioning plans for the building should consider the need to first remove friable asbestos and otherwise minimize worker exposure to asbestos.

17.4.4 Proposed RI Plan

17.4.4.1 Phase I

To evaluate the extent of surface soil contamination in the 1600 area, soil samples should be collected to a depth of 0.3 m (1 ft) near Bldgs. 1800, 1601, 1604, and 1609. Sample locations should be near exits, along building perimeters, and in stained areas. The samples should be analyzed for explosives, TCL volatiles, TCL semivolatiles, TCL metals, gross alpha, and gross beta.

If the dry well outside Bldg. 1601 can be located, and if it is open, then one soil sample should be collected from the bottom of the well and analyzed for explosives, TCL volatiles, TCL semivolatiles, and TCL metals. If the well has filled up with soil, then one soil boring should be drilled at its center. Samples should be collected from the boring over 0.6-m (2-ft) intervals from the top to the bottom of the boring. The subsurface samples should be analyzed for explosives, TCL metals, TCL semivolatiles, TCL volatiles, gross alpha, and gross beta.

Two sediment samples should be collected to a depth of 0.3 m (1 ft) from the lagoon at the north end of Bldg. 1604 and analyzed for explosives, TCL volatiles, TCL semivolatiles, TCL metals, gross alpha, and gross beta.

17.4.4.2 Phase II

If significant contamination is found in the Phase I soil samples, then one soil boring should be drilled in the center of each area of contaminated soil identified during Phase I. Subsurface soil samples should be collected from each boring and analyzed for explosives, TCL volatiles, TCL semivolatiles, TCL metals, gross alpha, and gross beta.

If significant contamination is found in the sediment samples, then additional sediment samples and surface water samples should be collected from the lagoon. These samples should be analyzed for explosives, TCL volatiles, TCL semivolatiles, TCL metals, gross alpha, and gross beta.

17.4.4.3 Phase III

If either the dry well or soil boring samples are found to be significantly contaminated, then the installation of monitoring wells will be necessary to evaluate the movement of contaminants into groundwater. The number and location of the wells would depend on the location of the contaminated soil boring samples.

17.5 SITE 119 — BUILDINGS 46, 47, AND 48, PROPELLANT STORAGE

17.5.1 Site History

Buildings 46, 47, and 48 are located at the foothill of Green Pond Mountain, in the southwestern part of PTA (Fig. 17.4). The buildings are three of several magazines on 1st Avenue west of the Museum (Bldg. 2). Each building was built in 1940. Each has hollow-tile walls, a corrugated roof, and an area of 388 m^2 (4,180 ft^2). The buildings were originally designed and have been used since 1940 for propellant storage (PTA 1971).

17.5.2 Geology and Hydrology

The Site is situated in Green Pond Brook valley against the foothill of Green Pond Mountain. The surface of the Site slopes very gently toward the southeast, to a brook about 170 m (1,800 ft) away.

Soils of the Preakness Series occupy the area (Sargent 1988). The soils have a sandy loam texture and moderately rapid permeability. Because of a seasonally high water table, the soils are poorly drained. Occasionally, organic muck may be found near the surface. Groundwater probably flows down from Green Pond Mountain into the brook. Quaternary sediments about 200 ft thick overlie the Cambrian Leithsville Formation and/or the Silurian Green Pond Conglomerate (Lacombe et al. 1986).

17.5.3 Existing Contamination

There are no data regarding contamination on the Site. Due to operational practices, minor contamination may be present inside and outside of the buildings.

17.5.4 Proposed RI Plan

17.5.4.1 Phase I

A field inspection should be conducted to locate any signs of contamination around each building. If contaminated areas are visually identified, one surface soil sample, to a depth of 0.3 m (1 ft), should be collected from the center of each area and analyzed for propellants. Also, one surface soil sample should be collected to a depth of 0.3 m (1 ft) at the entrance to each building and analyzed for propellants.

17.5.4.2 Phase II

If contamination is found in the Phase I samples, one soil boring should be drilled in the center of each contaminated area. Samples should be collected and analyzed

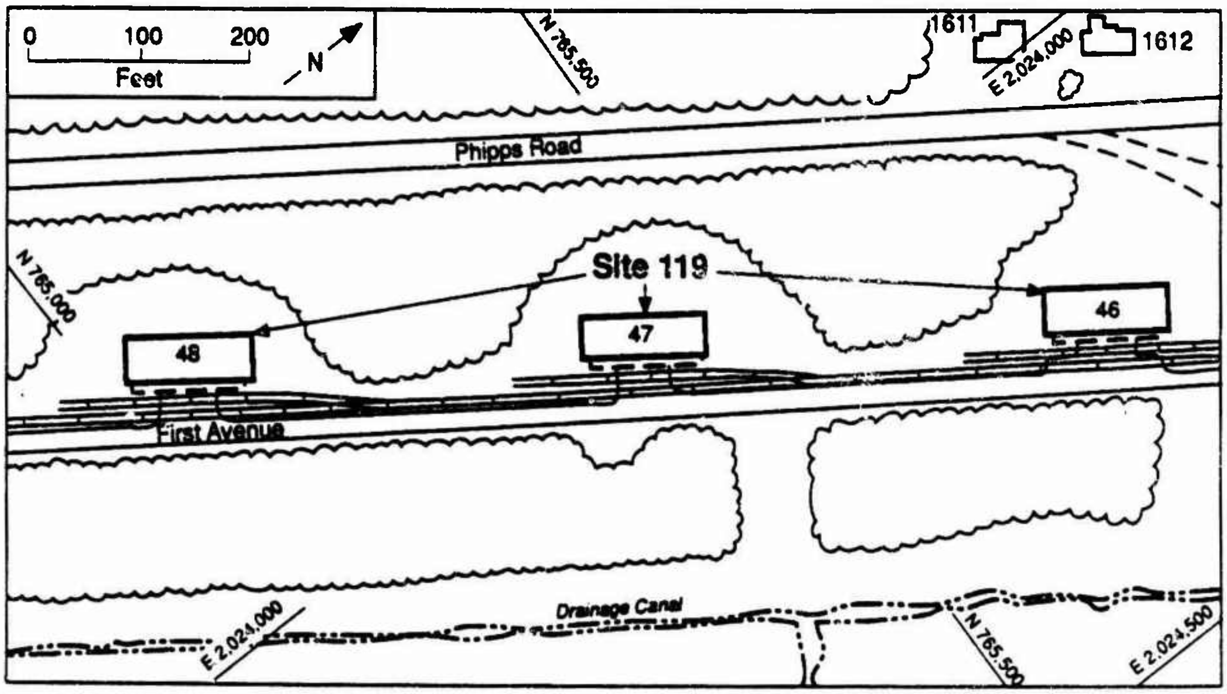

FIGURE 17.4 Layout of Site 119, Propellent Storage at Buildings 46, 47, and 48 (Source: adapted from USACE 1984b)

for contaminants found in the Phase I samples. Additional groundwater samples, soil samples, and surface-water samples may be required to delineate the extent of the contamination, depending on the results.

17.6 SITE 120 — BUILDING 50, PROPELLANT STORAGE

17.6.1 Site History

Building 50 is located at a foothill of Green Pond Mountain in the southwestern part of PTA. It is one of several magazines built in 1940 on 1st Avenue (Fig. 17.5) and has an area of 388 m^2 (4,180 ft^2), a corrugated asbestos roof, and hollow-tile walls. The building was originally designed for propellant storage and has been used as a propellant plant and then for propellant storage since 1940 (PTA 1971).

17.6.2 Geology and Hydrology

The geologic setting and the hydrologic condition in the Site are similar to those at Site 119. See Sec. 17.5 for information.

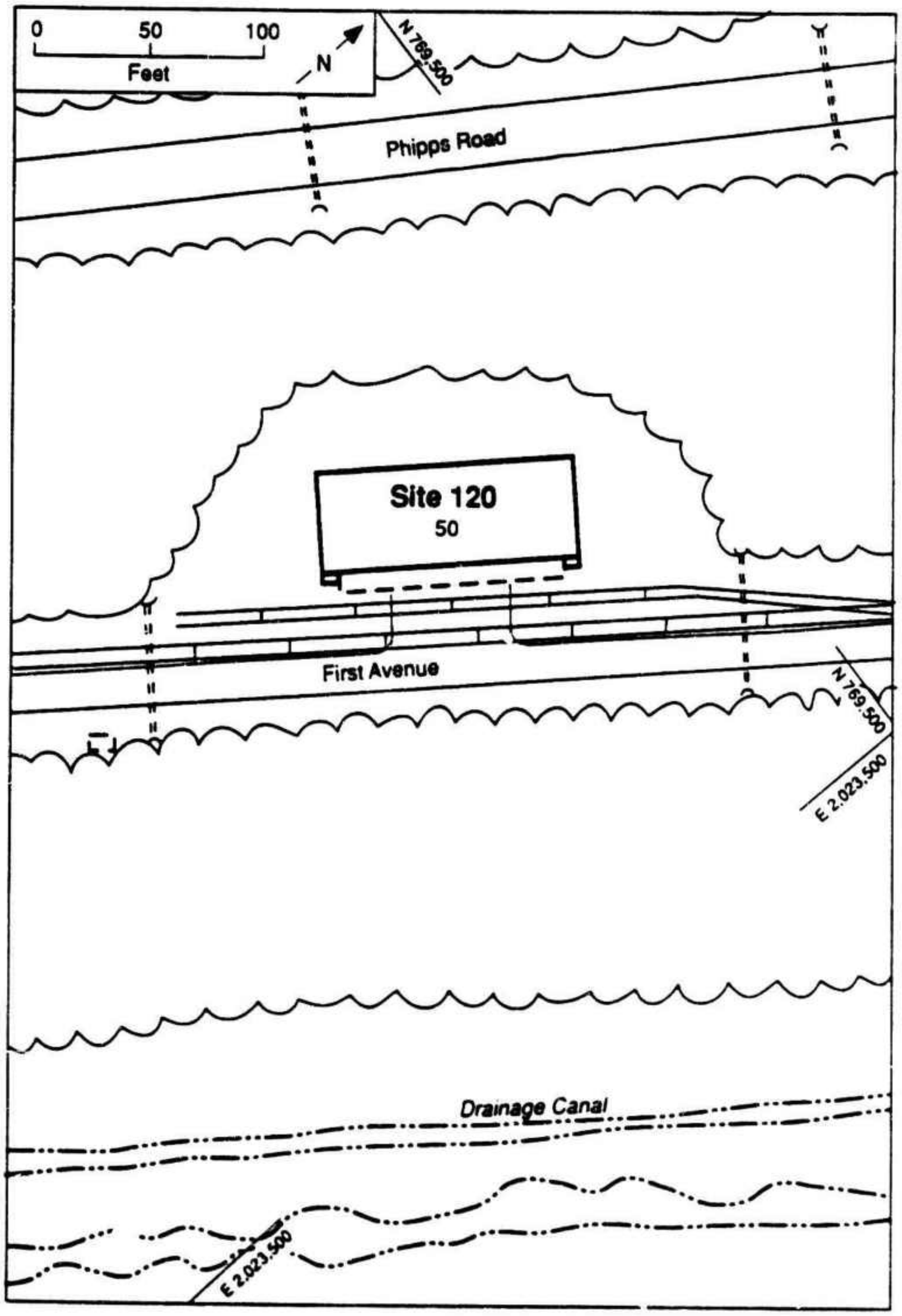

FIGURE 17.5 Layout of Site 120, Propellent Storage at Building 50 (Source: Adapted from USACE 1984b)

17.6.3 Existing Contamination

There are no soil or water data for the Site, making the extent of possible contamination unclear. During interviews, PTA personnel reported that containers of propellants were taken outdoors and opened on the ground. No more information is available to ANL.

17.6.4 Proposed RI Plan

17.6.4.1 Phase I

A field inspection should be performed to locate signs of visibly contaminated areas and in the area in which propellant containers were reportedly opened. One surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each contamination area located by the survey. One surface water sample and one 0.3-m (1-ft) deep sediment sample should be collected from the unnamed ditch southeast of the building. The exact location will be determined from field inspection. All soil, surface water, and sediment samples should be analyzed for propellants.

17.6.4.2 Phase II

In case contamination is found in the Phase I tests, soil samples should be collected from one soil boring drilled in the center of each area of surface soil contamination. Samples should be analyzed for contaminants found in the Phase I samples. Additional surface-water and groundwater samples may be required to delineate the extent of the contamination, depending on the Phase I results.

17.7 SITE 121 — BUILDING 57, CHEMICAL STORAGE

17.7.1 Site History

The Site is located near the southwestern corner of PTA, at the south end of 3rd Avenue (Fig. 17.6). The building was built in 1941 with hollow-tile walls and a corrugated asbestos roof, and its area of 4,180 ft^2 is devoted to storage (PTA 1971). PTA personnel reported during interviews that the building was used as a lumber yard in the past. Presently, it is reportedly used for storage of chemicals, nitrogen gas, and oxygen gas.

17.7.2 Geology and Hydrology

The Site is situated in Green Pond Brook valley and bounded by a small drainage ditch on the southwest. The surface of the Site is flat. Green Pond Brook is about 305 m (1,000 ft) to the southeast.

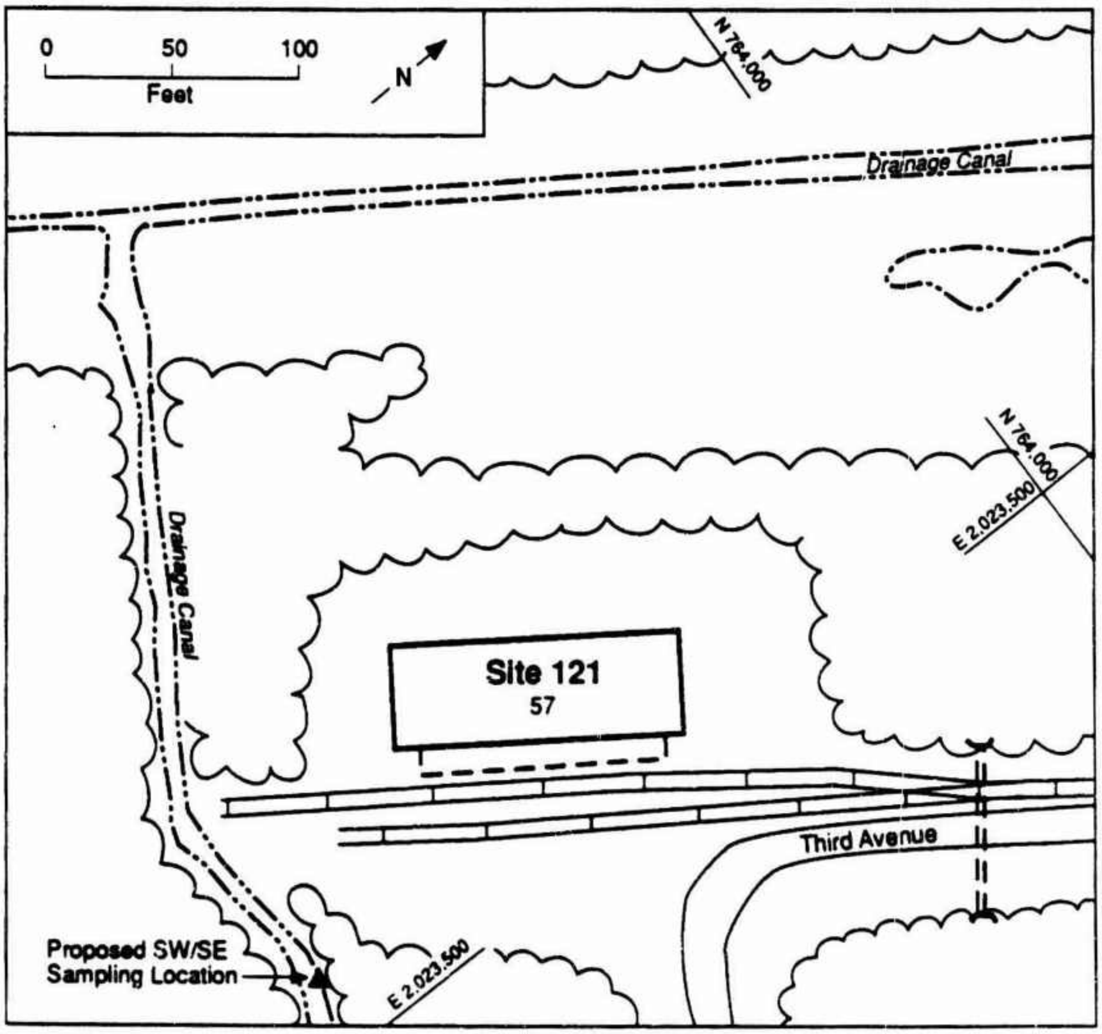

FIGURE 17.6 Layout of Site 121, Chemical Storage at Building 57 (Source: Adapted from USACE 1984b)

The soils on the Site belong to Adrian Muck (Eby 1976 in Sargent 1988), a kind of poorly drained organic soil underlain by sandy deposits. The soils usually have high water tables and are permeable. Groundwater recharge is from the northwest, and discharge is to the southeast to Green Pond B: ɔok. Quaternary deposits at the Site, which are about 76 m (250 ft) thick, are primarily of fluvial and lacustrine origins.

17.7.3 Existing Contamination

During interviews, PTA personnel reported that leaking containers of chemicals were found in storage. There are no data regarding any chemical contamination in groundwater, soil, or surface water on the Site.

17.7.4 Proposed RI Plan

17.7.4.1 Phase I

A field inspection should be performed to locate signs of visible contaminated areas, such as stained soil or lack of vegetative growth. If contaminated areas are located, one surface soil sample should be collected to a depth of 0.3 m (1 ft) from the center of each area outside the building.

In addition, one surface soil sample should be collected to a depth of 0.3 m (1 ft) near the entrance of Bldg. 57. One sediment sample, 0.3 m (1 ft) deep, and one surface-water sample should be collected from the unnamed ditch southeast of the Site. The suggested location of the sample is shown in Fig. 17.6. All the above samples should be analyzed for TCL volatiles, TCL semivolatiles, and TCL metals. A composite soil sample, which is prepared from the mixing of three surficial soil samples taken from the area near the PCB transformer, should be tested for PCBs. The three samples should be collected to a depth of 0.15 m (6 in.). No further action is needed if contamination is not found.

17.7.4.2 Phase II

If contamination is found in the Phase I tests, one soil boring should be drilled at the center of each contaminated area. Soil samples should be collected from each boring and analyzed for contaminants found in the Phase I samples. Additional surface-water samples and monitoring-well samples may be required to delineate the extent of the contamination.

18 REFERENCES*

Anderson, A.W., 1988a, Letter plus attachment (Subject: preliminary chemical data reports for Picatinny Arsenal), USATHAMA, Aberdeen Proving Ground, Md., Aug. 16.

Anderson, A.W., Chief, Installation Restoration Division, USATHAMA, 1988b, Letter plus attachments (Subject: additional information on each of the EPA sites of concern), Aug. 22.

Anonymous, 1980, Appendix D, Inventory of Above-Ground Storage Facilities, Oct. 23.

Anonymous, undated, ARDEC Employee Environmental Input.

ARDEC (Army Armament Research, Development, and Engineering Center), 1986, *ARDEC Facilities Directory (Draft)*, June 6.

ARDEC, 1988, *Revised RCRA Part A Permit Application, Picatinny Arsenal, Dover, N.J.*, April 5.

ARDEC, undated, *ARDEC Closure Plans for Buildings 722, 1515, 1518, 3517, and 3801.*

Bayha, D.C., 1985, *Groundwater Monitoring Study* No. *38-36-0457-8, Appendix M*, file copy, PTA Environmental Office, March.

Bayley, W.S., H.B. Kummel, and R.D. Salisbury, 1914, *Geologic Atlas of New Jersey, Raritan Folio*, U.S. Geological Survey.

Chemtech, 1989, Laboratory data sheets on VOC analyses of samples from Ames Brook, Dec. 12, 1988 to May 3, 1989.

Clune, M.F., 1988a, Letter from Chief, Division of Engineering and Housing, U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., to Mr. Shotwell, New Jersey Department of Environmental Protection (Subject: diesel fuel spill), March 17.

Clune, M.F., 1988b, Letter from Chief, Division of Engineering and Housing, U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., to K. Siet, Section Chief, Ground Water Quality Control, New Jersey Department of Environmental Protection (Subject: response to DEP's comments on closure plans for surface impoundments at Bldgs. 24 and 95), Sept. _2.

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*Unless noted otherwise, personal communications are to one or more of the authors. Copies of unpublished materials can be obtained by contacting Argonne National Laboratory, Environmental Assessment and Information Sciences Division, 9700 South Cass Avenue, Argonne, Illinois 60439.

Clune, M.F., and J.F. Milio, 1988, *Pest Management Reports and Inventories of Chemicals Stored in Buildings 39, 41, and 3157*, U.S. Army ARDEC, Picatinny Arsenal, Dover, N.J.

Crane, G., Chief, Branch A Support Contracting Division Procurement Directorate, 1982, Letter plus attachments to Aqua Tech Inc., Port Washington, Wis. (Subject: removal of chemical inventory from Bldg. 3045), Jan. 20.

Dames & Moore, 1988, Well logs and records for wells installed at Picatinny Arsenal, Dover, N.J.

Dames & Moore, 1989, *Site Investigation of Picatinny Arsenal, New Jersey, Volumes I and II*, Draft report prepared for U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Providing Ground, Md., by Dames & Moore, Bethesda, Md., Feb. 8.

Drake, A.A., Jr., 1969, *Geology of Selected Areas in New Jersey and Eastern Pennsylvania and Guide Book of Excursions*, Geological Society of America, pp. 51-132.

Eby, C.F., 1976, *Soil Survey of Morris County, New Jersey*, Soil Conservation Service, U.S. Department of Agriculture.

Edson, D., 1962, *Test Facilities Data Book*, Thiokol Chemical Corp., Reaction Motors Div., Denville, N.J., March.

EPA (U.S. Environmental Protection Agency), 1980, *A Method for Determining the Compatibility of Hazardous Wastes*, Report EPA-600/2-80-076, April.

EPA, 1987d, *Test Methods for Evaluating Solid Waste*, Revised Report SW-846, April.

Foster Wheeler, 1987a, *Closure Plans for Underground Systems, Surface Impoundments, and Hazardous Waste Storage Areas*, prepared for Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Livingston, N.J., Aug.

Foster Wheeler, 1987b, *RCRA Part B Permit Application*, prepared for Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Livingston, N.J., Aug.

Foster Wheeler, 1987c, *Closure/Post-Closure Plans for Surface Impoundments at Buildings 24 and 95, EPA ID No, NJ 321 002 0704*, prepared for U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Clinton, N.J., Nov. 20.

Foster Wheeler, 1988a, *Resource Conservation and Recovery Act Buildings to Be Exempted and Closed, Part II*, prepared for Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Clinton, N.J., Sept.

Foster Wheeler, 1988b, *Resource Conservation and Recovery Act Buildings to Be Exempted and Closed, Part I*, prepared for Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Clinton, N.J., Sept.

Foster Wheeler, 1988c, *Resource Conservation and Recovery Act Buildings to Be Exempted and Closed, Part III*, prepared for Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Clinton, N.J., Nov.

Foster Wheeler, 1988d, *Resource Conservation and Recovery Act Part B Permit Application*, prepared for Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Clinton, N.J., Nov.

Foster Wheeler, 1988e, *Resource Conservation and Recovery Act Part B Upgrade Including Subpart X for Open Burning and Open Detonation*, prepared for Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Clinton, N.J., Nov.

Foster Wheeler, 1989, *Revised and Consolidated Sampling and Analysis Plan for RCRA Part B Permit Facilities and Buildings to Be Exempted and Closed*, prepared under Contract DAAA 21-89-D-0011 for Army Armament Research, Development and Engineering Center, Picatinny Arsenal, N.J., by Foster Wheeler USA Corp., Clinton, N.J., July.

Fusillo, T.V., T.A. Ehlke, and M. Martin, 1987, *Movement and Fate of Chlorinated Solvents in Ground Water: Research Activities at Picatinny Arsenal, New Jersey*, U.S. Geological Survey Open-File Report 87-395.

Gabel, T., 1990, Letter and attachments from Project Manager for Environmental Restoration, Picatinny Arsenal, N.J., May 24.

Gagas, A.P., 1980a, Information paper (Subject: beryllium contamination of an area in the vicinity of Bldg. 1505), Picatinny Arsenal, Dover N.J., Jan. 21.

Gagas, A.P., 1980b, Memorandum for the record (Subject: AEHA survey of beryllium-contaminated area), Picatinny Arsenal, Dover, N.J., Feb. 12.

Gaven, E., 1986, *RCRA Facility Assessment for Picatinny Arsenal* (with Attachments A through DD), prepared by New Jersey Department of Environmental Protection, Division of Water Resources, Dec.

Gross, D., et al., 1976, Reports of interviews with personnel at Picatinny Arsenal (Interviewers: D. Gross, A. Boyce, B. Collins, E. Worthley, and J. Scott), July.

Hanson, R.L., LTC(P), MSC Director, Environmental Quality, USAEHA, 1980, Letter plus attachment to Commander, U.S. Army Materiel Development and Readiness Command, Alexandria Va. (Subject: survey of area potentially contaminated with beryllium), April 23.

Harte, P.T., B.P. Sargent, and E.F. Vowinkel, 1986, *Description and Results of Test Drilling Program at Picatinny Arsenal, New Jersey, 1982-84*, U.S. Geological Survey Open-File Report 86-316.

Haven and Emerson, Inc., 1981, *Operations and Maintenance Manual for Building 24*, prepared for Picatinny Arsenal, N.J.

ICM (Industrial Corrosion Management Inc.), 1981, Water quality data sheets, prepared for Army Armament Research Development and Engineering Center by ICM, Randolph, N.J., May 20, May 27, and June 8.

ICM, 1984, Dredge pile sample data, prepared for Army Armament Research Development and Engineering Center by ICM, Randolph, N.J., Aug.

Kummel, H.B., and S. Weller, 1902, *The Rocks of the Green Pond Mountain Region*, New Jersey Geological Survey, Annual Report of the State Geologist, 1901, Trenton, N.J., pp. 1-51.

Kurisko, P.C., 1985, Letter plus attachment from Chief, Bureau of Industrial Waste Management, Water Quality Management, NJDEP, Trenton, N.J., to Army Research and Development Center (ARDC), Dover, N.J. (Subject: Final NJPDES Permit NH0002500), June 11.

Lacombe, P., et al., 1986, *Determination of Geohydrologic Framework and Extent of Ground-Water Contamination Using Surface Geophysical Techniques at Picatinny Arsenal, New Jersey*, U.S. Geological Survey Water-Resources Investigations Report 86-4051.

Ludemann, W.D., et al., 1981, *Addendum to Installation Assessment of Picatinny Arsenal, New Jersey (Headquarters, ARRADCOM)*, Chemical Systems Laboratory, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground Md., May.

Malloy, W., 1986, Letter plus attachment (Subject: Compliance evaluation inspection, Picatinny Arsenal) from Supervisor, Compliance Monitoring Unit, Northern Bureau of Regional Enforcement, New Jersey Department of Environmental Protection, Parsippany-Troy, N.J., to Picatinny Arsenal, Dover, N.J. (ATTN: Col. T. Flemming), Jan. 29.

Martin, B., undated, Description and diagram of the interior of Bldg. 3157 based on Real Property Records.

Meyer, W.K., 1985, U.S. Environmental Protection Agency Hazardous Waste Permit Application, Picatinny Arsenal, Nov. 6.

Moran, R., 1988, USATHAMA, Personal communication, June.

Ohno, T., 1990, *Levels of Total Cyanide and NaCL in Surface Waters Adjacent to Road Salt Storage Facilities*, Environmental Pollution, Vol. 67, pp. 123-132 (1990).

Orlandini, L., 1987, "Fish Contaminated with Explosives," *Daily Record*, Northwest New Jersey, Sec. B, p. B1, June 26.

PTA (Picatinny Arsenal), 1971, *Master Plan, Building Information Schedule*, Facilities and Equipment Division, Picatinny Arsenal, N.J.

PTA 1975, *Arsenal Facilities Directory*, Dec. 4.

PTA, 1976, Report from the Water & Sewage Control Unit, Waterborne Waste Monitoring Program (Green Pond and Ames Brook), Dover, N.J., Jan. 6, 1975, to Jan. 7, 1976.

PTA, 1988a, *PCB Plant Survey and Risk Evaluation; PCB Transformer Inventory*, Dover, N.J.

PTA, 1988b, General site information, Picatinny Arsenal, Dover, N.J., unpublished.

Pugliese, V.J., 1985, Accutest Laboratory analysis reports, North Brunswick, N.J., April 30, May 1, Sept. 3, Sept. 5, Nov. 12, and Dec. 6.

Reibel, P., 1988, Picatinny Arsenal, Telephone conversations (Subjects: present contents of Bldg. 3045, types and generation rates for waste at Building 3315), Sept. 12 and 13.

Rigassio, L.G., et al., 1975, *Land Management Plan for Picatinny Arsenal, Dover, New Jersey*, 3rd Revision, May 1.

Sargent, B.P., et al., 1986, *Ground-Water-Quality Data for Picatinny Arsenal, New Jersey, 1958-85*, U.S. Geological Survey Open-File Report 86-58.

Sargent, B.P., U.S. Geological Survey, 1988, personal communication (Subject: Groundwater contamination in the area of Bldg. 24), July.

Sargent, B.P., 1989, Personal communication from U.S. Geological Survey, West Trenton, N.J., to J. Murphy, USATHAMA, Aberdeen Proving Ground, Md. (Subject: groundwater contamination in the area of Bldg. 95), March 28.

Sargent, B.P., 1990, Personal communication from U.S. Geological Survey, Trenton, N.J., Jan.

Simpson, M., 1986, *Site Analysis, Picatinny Arsenal and Radiation Technology, Inc., Morris County, New Jersey*, prepared by The Bionetics Corp., Warrenton, Va., for Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Las Vegas, Nov.

Sitton, M.D., 1989, *Installation Assessment, Picatinny Arsenal, Morris County, New Jersey, Volumes I and II*, NTIS Report No. TS-PIC-89328, prepared by Bionetics Corp., Warrenton, Penn., for U.S. Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Las Vegas, March.

Snyder, D., 1988, Personal communication from DEH, U.S. Army Research, Development, and Engineering Center, Picatinny Arsenal, N.J., June.

Snyder, D., 1989, Personal communication from DEH, U.S. Army Research, Development, and Engineering Center, Picatinny Arsenal, N.J. (Subject: List of TECUP buildings and location of guncotton line), March.

Solecki, T., 1989a, Unpublished information provided by Environmental Affairs Office, Picatinny Arsenal, N.J. (subject: Revisions to RCRA Part B permit sampling plans), Oct. 24.

Solecki, T., 1989b, Letter from Environmental Affairs Office, Picatinny Arsenal, N.J., to P.A. Benioff, Argonne National Laboratory, Ill., Nov. 1.

Solecki, T., 1989c, Unpublished information provided by Environmental Affairs Office, Picatinny Arsenal, N.J., March.

Solecki, T., 1989d, Unpublished information provided by Environmental Affairs Office, Picatinny Arsenal, N.J. (Subject: Revisions to closure plans for Bldgs. 3517 and 3801), Oct. 24.

Solecki, T., 1989e, Letter and attachments from Environmental Affairs Office, Picatinny Arsenal, N.J., Feb. 10.

Solecki, T., 1990, Letter and attachments from Environmental Affairs Office, Picatinny Arsenal, N.J., May 16.

Tectonic, 1984, *Implementation Schedule for Elimination of Excessive Inflow/Infiltration from Sanitary Sewer System in Sub-Basins 6 and 7, Picatinny Arsenal, Dover, New Jersey*, prepared for U.S. Army, New York District Corps of Engineers by Tectonic PA, Somerville, N.J., Sept. 5.

USACE (U.S. Army Corps of Engineers), 1984a, *General Site Map, Picatinny Arsenal*, Dwg. No. 18-02-01, Sept. 1.

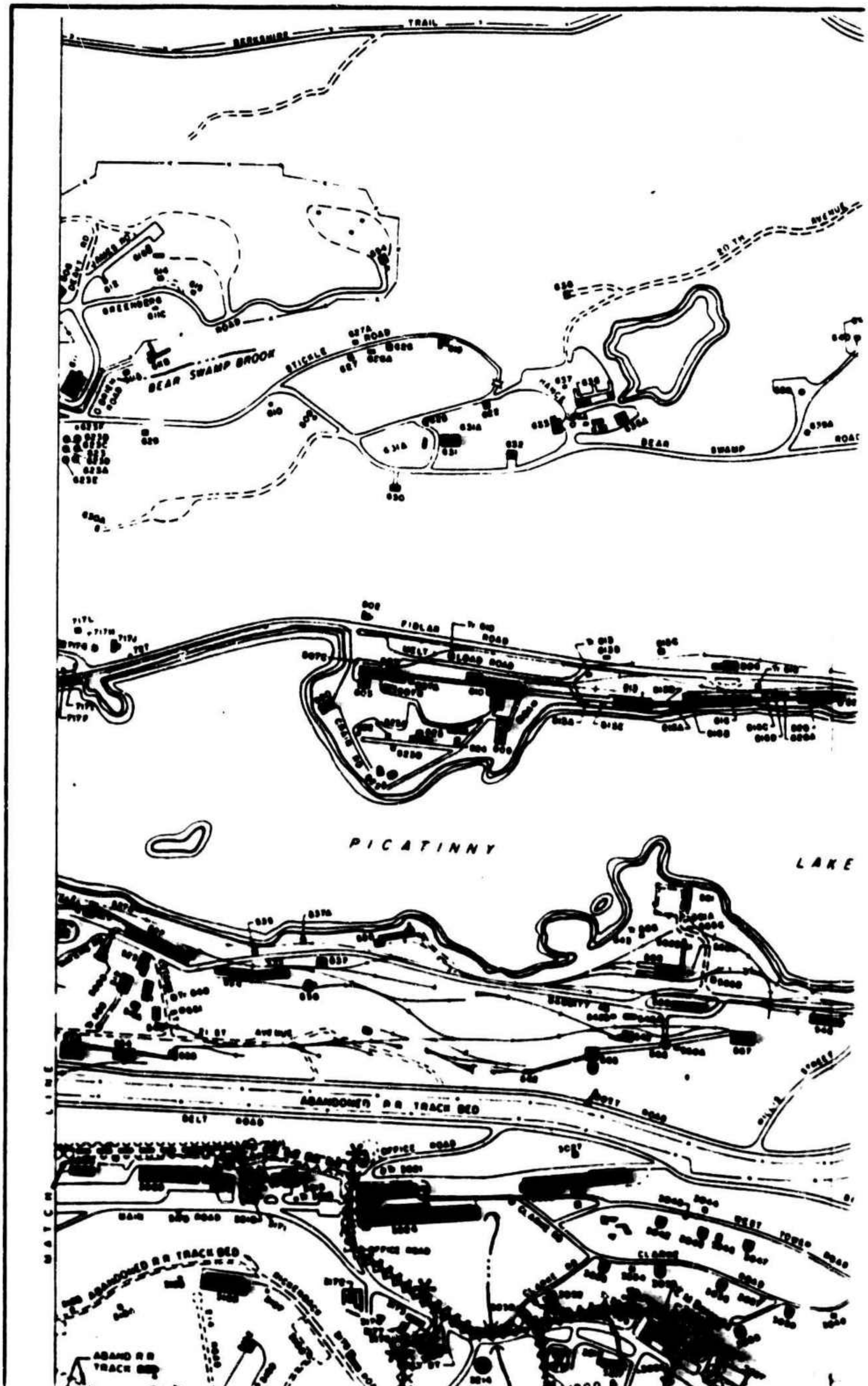
USACE, 1984b, *Master Plan Detail Plats*, (Scale: 1 inch = 50 feet) *and Key Map for Master Plan - Detail Plans* (Scale: 1 inch = 400 feet), Picatinny Arsenal.

USAEHA, 1979a, *Installation Pest Management Program Review* No. *16-61-0535-80, U.S. Army Armament Research and Development Command (Picatinny), Dover, New Jersey, 11-15 June 1979*, Aberdeen Proving Ground, Md., Oct. 24.

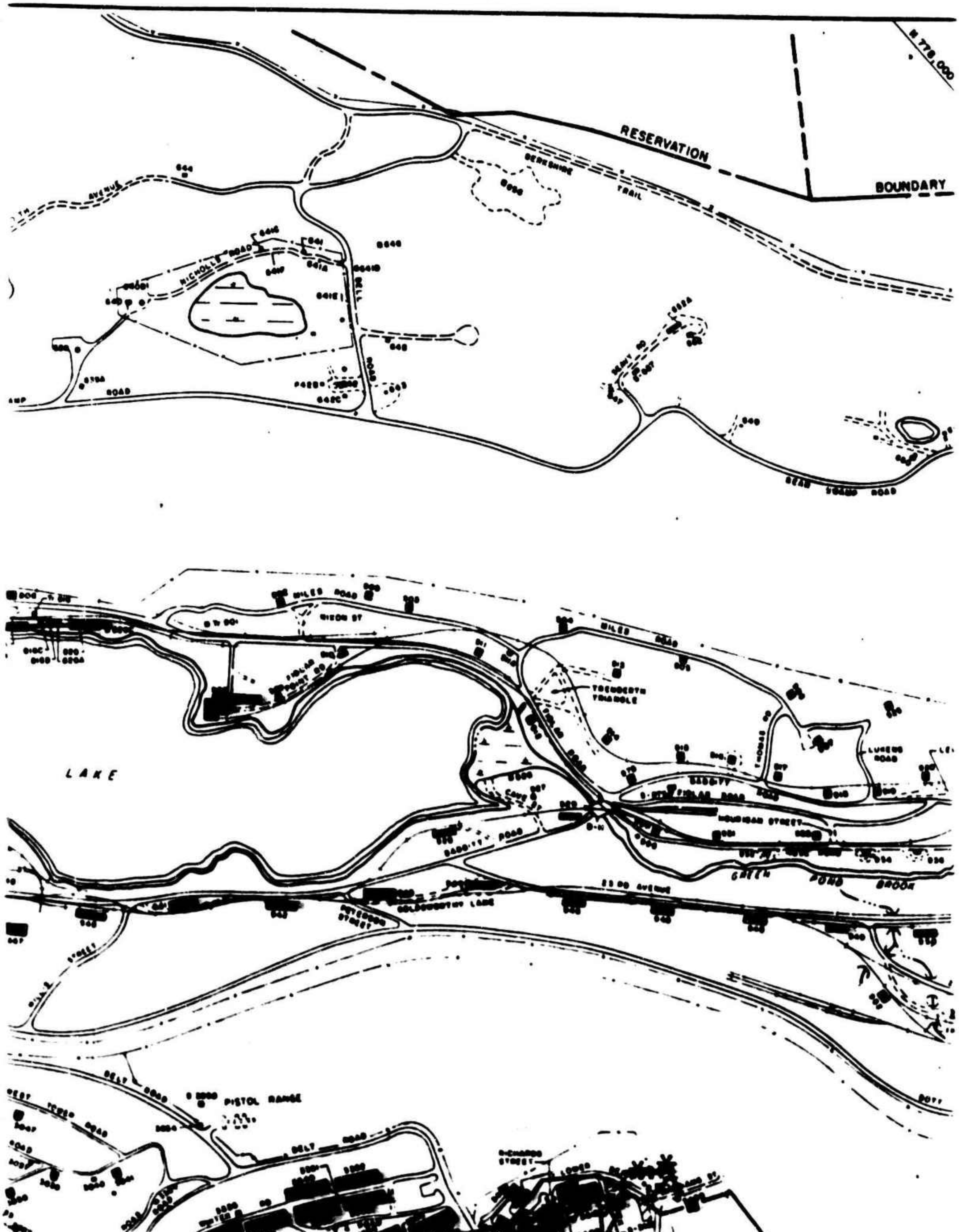
USAEHA, 1979b, *Geohydrologic Consultation* No. *31-24-0181-79, U.S. Army Armament Research and Development Command, Dover, New Jersey*, Aberdeen Proving Ground, Md., May 21-24.

CORPS OF ENGINEERS

2-A



2-B



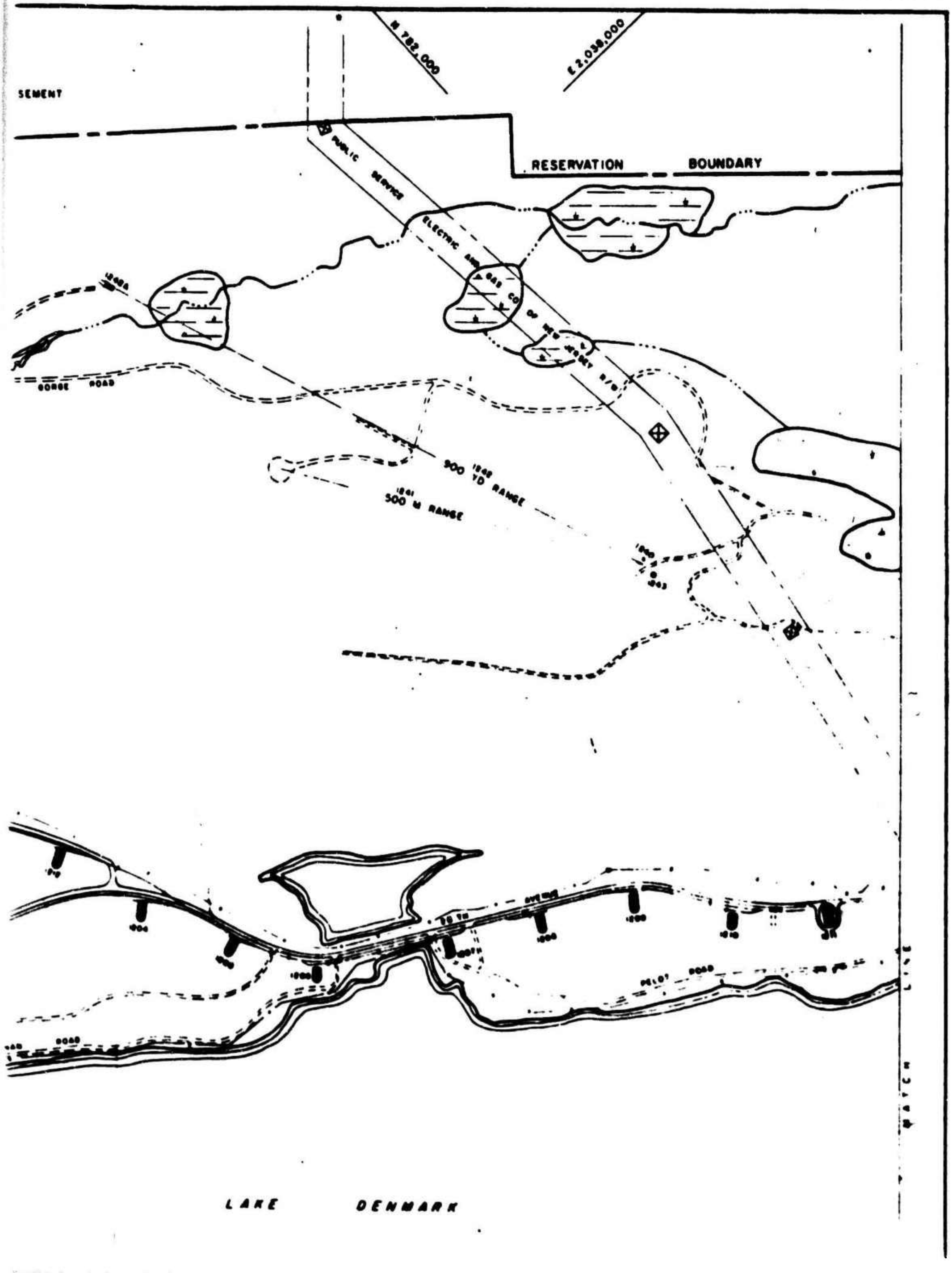
RESERVATION
BOUNDARY
BERKSHIRE
TRAIL
NICHOLLS ROAD
AVENUE
ROAD
LAKE
MILES ROAD
NIXON ST
TRENBERTH
TRIANGLE
THOMAS RD
GREEN POND BROOK
PISTOL RANGE
BELT ROAD
RICHARDS
STREET

2-C

N 779,000
E 2,034,000
N 780,000
E 2,036,000
RESTRICTIVE
EASEMENT
UNDARY
GREEN POND BROOK
GORGE ROAD
20 TH AVENUE

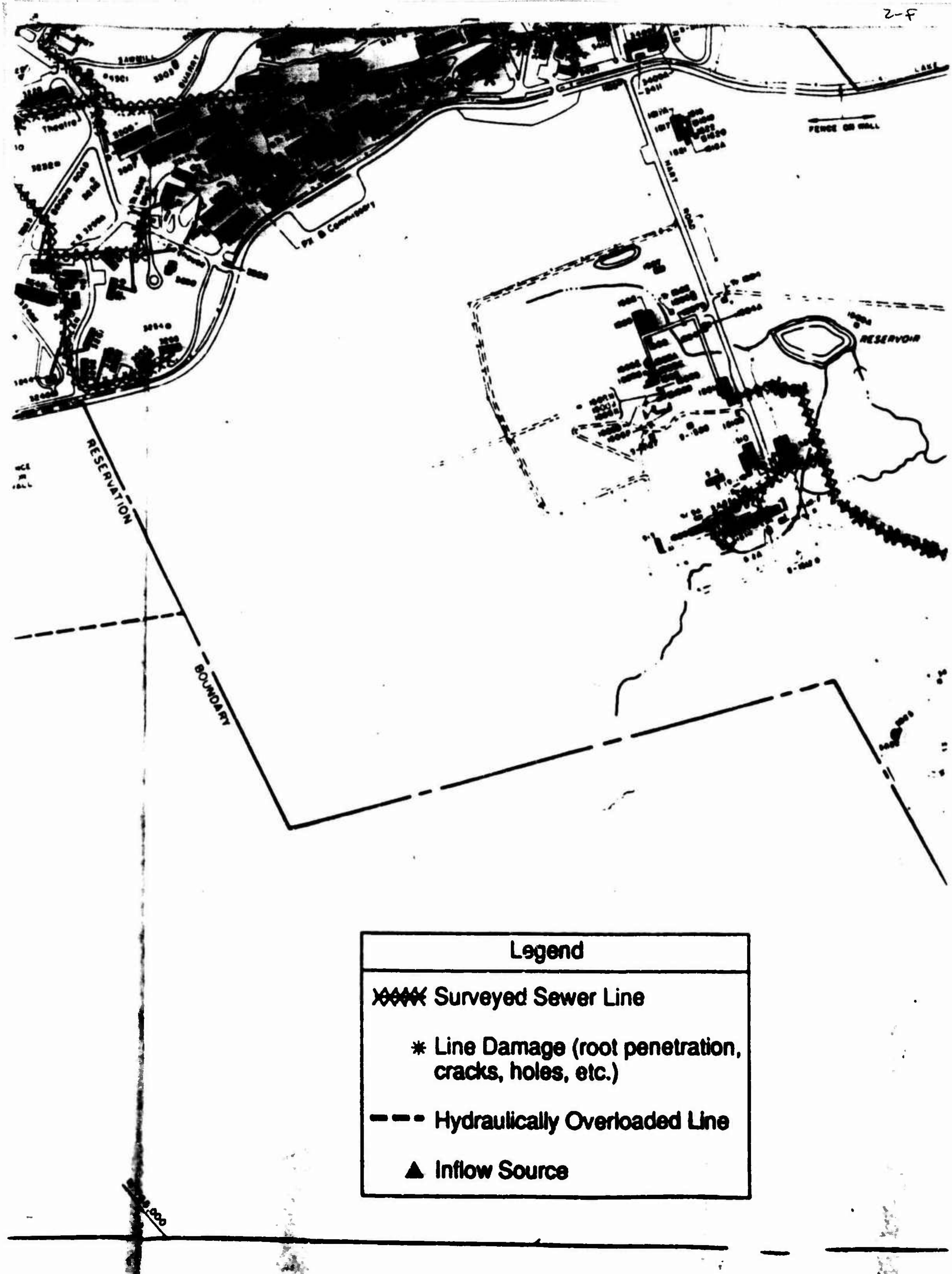
2-D

U. S. ARMY

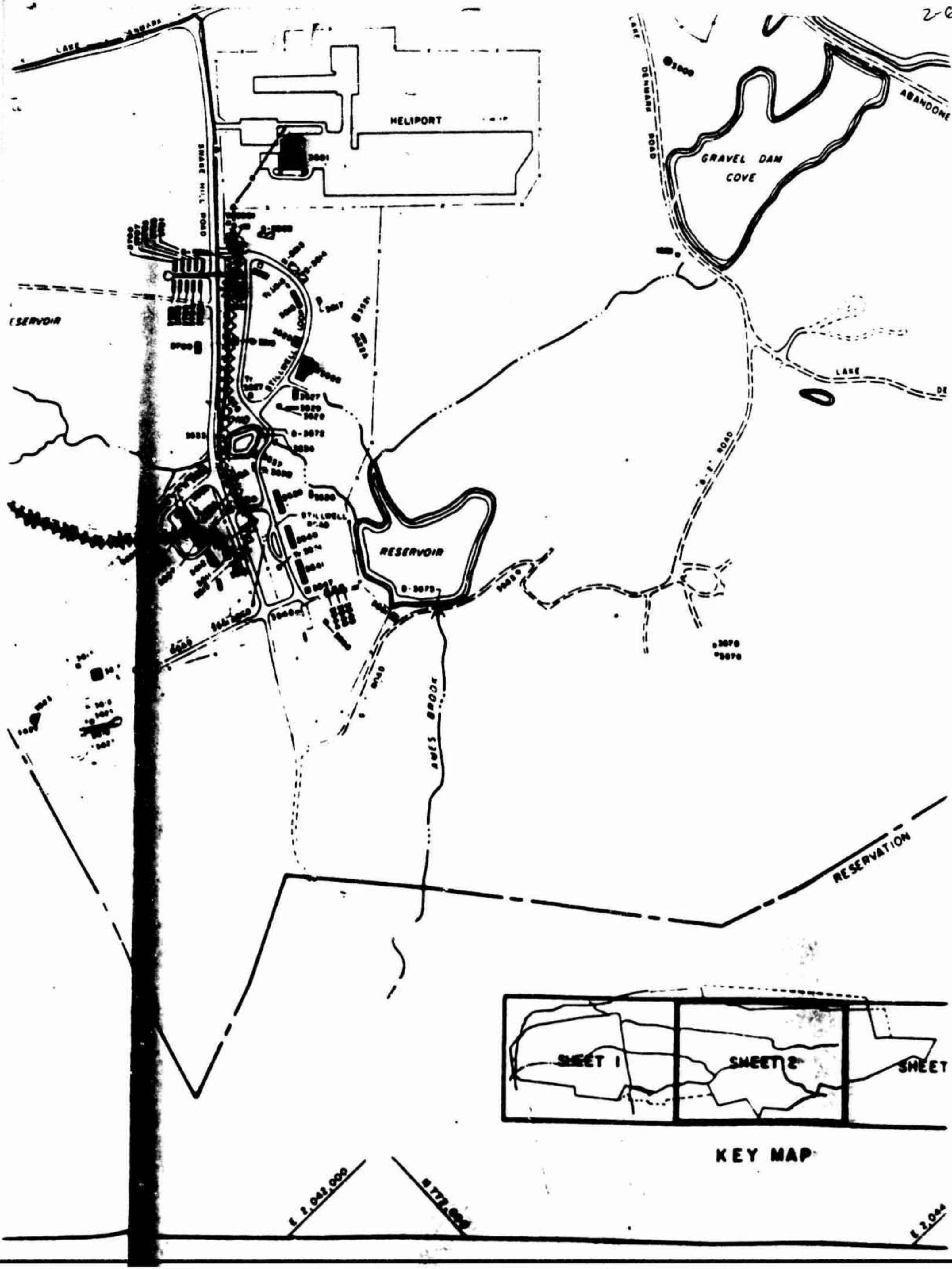

SEMENT
N 782,000
E 2,038,000
RESERVATION BOUNDARY
PUBLIC SERVICE ELECTRIC AND GAS CO OF NEW JERSEY R/W
GORGE ROAD
900 YD RANGE
500 M RANGE
PELOT ROAD
MATCH LINE
LAKE DENMARK

2-E


ABAND R R TRACK
NORTH BASIN
SOUTH BASIN
RESERVOIR
WALSH ROAD
EAST TOWER RD
SHELL BURIAL GROUND
Theatre
SAWMILL
QUARRY
BELT ROAD
LAKE DENMARK ROAD
Gymnasium & Bowling Alleys
FENCE ON WALL
RESERVATION
BOUNDARY
RESTRICTIVE EASEMENT


2-F
RESERVATION
BOUNDARY
RESERVOIR
FENCE OR WALL
Theatre
LAKE
Legend
Surveyed Sewer Line
Line Damage (root penetration, cracks, holes, etc.)
Hydraulically Overloaded Line
Inflow Source

2-6


HELIPORT
GRAVEL DAM
COVE
ABANDONE
LAKE
DE NMARK ROAD
ESERVOIR
STILLWELL LOOP
STILLWELL ROAD
RESERVOIR
AMES BROOK
RESERVATION
SHEET 1
SHEET 2
SHEET
KEY MAP
E 2,042,000
E 2,044

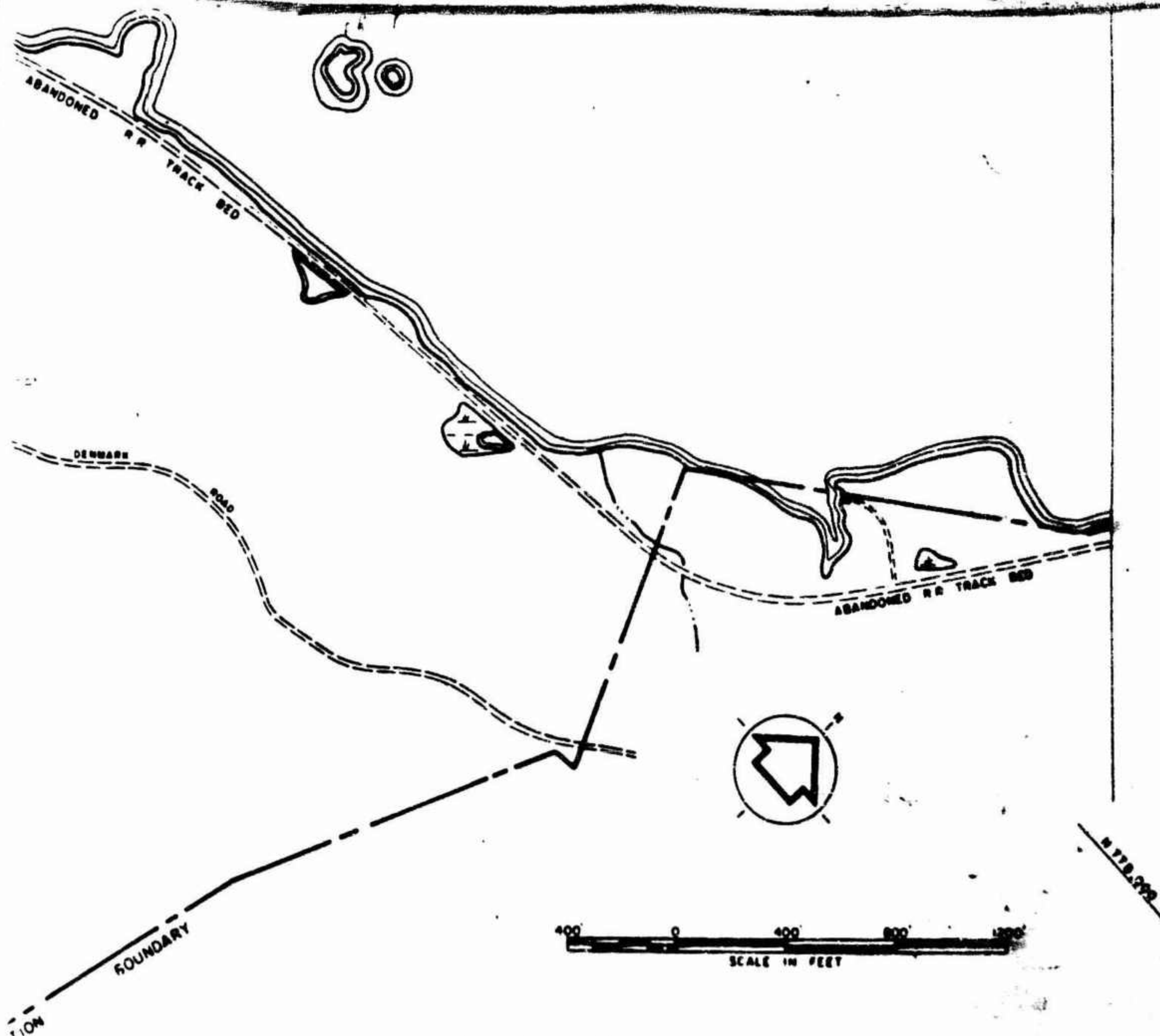


PLATE 2.1

JOHN J. KASSNER & CO., INC ARCHITECT - ENGINEER LAKE SUCCESS, NEW YORK	CORPS OF ENGINEERS - U.S. ARMY OFFICE OF THE DISTRICT ENGINEER NEW YORK DISTRICT - NEW YORK, NEW YORK

MAP OF PICATINNY ARSENAL SHOWING RESULTS OF THE SURVEY OF SEWER LINE SUBBASINS 6 AND 7 (CONTINUED)

DATE

DATE

SHEET NO. 2 of 2

USAEHA, 1981a, Purgeable organics analysis reports, U.S. Army Environmental Hygiene Agency, Environmental Chemistry Division, Mass Spectrometry Laboratory, May, June, and Aug.

USAEHA, 1981b, *Phase 1 Ground Water Quality Assessment No. 38-26-0153-82, Picatinny Arsenal, Dover, New Jersey, 5-9 January, 11-22 May, 9-10 July, and 27-31 July 1981*, U.S. Army Environmental Hygiene Agency, Aberdeen Proving Ground, Md., Dec. 14.

USAEHA, 1984a, *Water Quality Biological Study No. 32-24-0544-84, Pesticide, Metal, and Explosive Residues in Fish Tissue and Water of Seven Lakes, U.S. Army Armament Research and Development Center, Cover, New Jersey, 3-7 October 1983*, Aberdeen Proving Ground, Md., Aug.

USAEHA, 1984b, *Final Report, Ground-Water Quality Assessment No. 38-26-0153-84, ARRADCEN Picatinny Arsenal Support Activity, Dover, New Jersey, 5-13 July and 9-12 August 1983*, Aberdeen Proving Ground Md., Feb. 9.

USAEHA, 1989, *Pesticide Risk Management Study No. 44-23-7130-89, Picatinny Arsenal, Dover, New Jersey, 18-22 July 1988*, Aberdeen Proving Ground, Md., May.

U.S. Army, 1978, *Installation Assessment of Joliet Army Ammunition Plant*, Record Evaluation Report 128, Office of the Project Manager for Chemical Demilitarization and Installation Restoration, Aberdeen Proving Ground, Md., Sept.

USATHAMA (U.S. Army Toxic and Hazardous Materials Agency), 1976, *Installation Assessment of Picatinny Arsenal, Volumes I and II*, Report 102, Aberdeen Proving Ground, Md., Nov.

USATHAMA, 1987a, *Installation Restoration Quality Assurance Program*, 2nd Ed., U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Md., March.

USATHAMA, 1987b, *Geotechnical Requirements for Drilling, Monitor Wells, Data Acquisition, and Reports*, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Md., March.

USGS (U.S. Geological Survey), 1981, Photorevised survey map, Dover Quadrangle (Scale: 1:24,000).

USGS, 1988, *Proposal for Additional Investigation of Ground-Water Contamination in the Area of Building 95, Picatinny Arsenal, New Jersey*, U.S. Geological Survey, New Jersey District, West Trenton, N.J., May.

USGS, 1989, *Groundwater Contamination Investigation at the Building 95 and Open Burning Sites, Picatinny Arsenal, New Jersey — Scope of Work, Monitoring Well Installation, Sampling and Analysis Plan, Quality Assurance Plan, Health and Safety Plan*, Water Resources Division, New Jersey District, West Trenton, N.J., March.

Vogt, M., 1980, Interviews with Picatinny personnel, Dover, N.J., Oct. 22.

Vowinkel, E.F., et al., 1985, *Preliminary Evaluation of Ground-Water Contamination at Two Wastewater Treatment Facilities at Picatinny Arsenal, Morris County, New Jersey*, U.S. Geological Survey Water-Resources Investigation 85, Jan.

Wagner, C., 1988, Reportable incidents (spills), Picatinny Arsenal, Dover, N.J.

Ward, W.B. Col., GS Chief of Staff, 1988, Letter plus attachments to Commander, U.S. Army Armament Research, Development, and Engineering Center, SMCAR-SF, Picatinny Arsenal (Subject: radiological material usage inventory), Sept. 14.

Weast, R.C., ed., 1976, *CRC Handbook of Chemistry and Physics*, CRC Press, Cleveland.

Wingfield, D.D., 1976, *Installation Assessment of Picatinny Arsenal*, U.S. Army Toxic and Hazardous Materials Agency Report 102, Vol. 1, Aberdeen Proving Ground, Md., Nov.

York, R.J., 1989a, Letter and attachments from Installation Restoration Division, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Md., to S. Tsai, Argonne National Laboratory, Ill., March 9.

York, R.J., 1989b, Letter and attachments from Installation Restoration Division, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Md., to S. Tsai, Argonne National Laboratory, Ill., April 25.

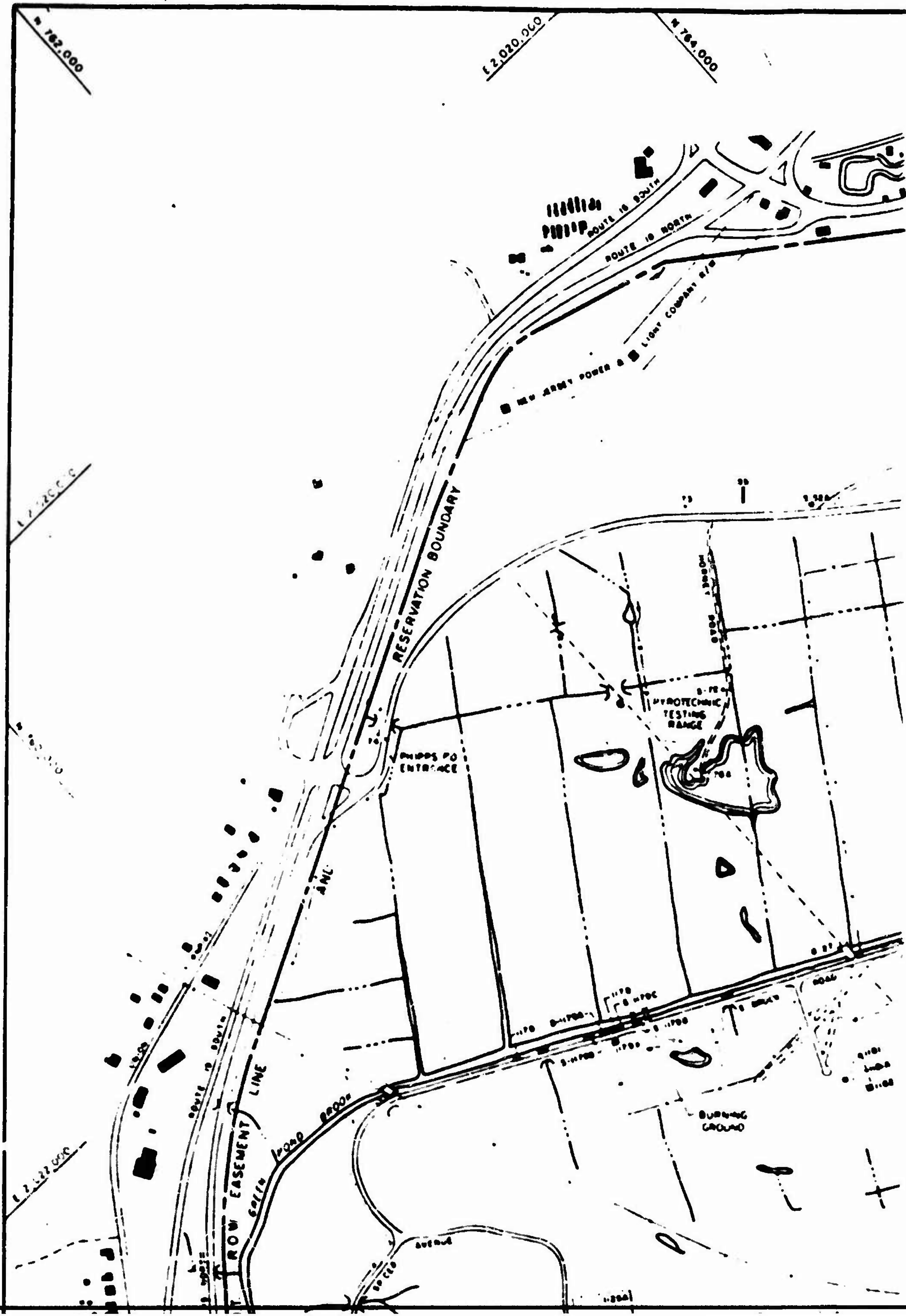
York, R.J., 1989d, Letter and attachment from Chief, Installation Restoration Division, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Md., to S. Tsai, Argonne National Laboratory, Ill. (Subject: identification of unknown organic compounds), Jan. 23.

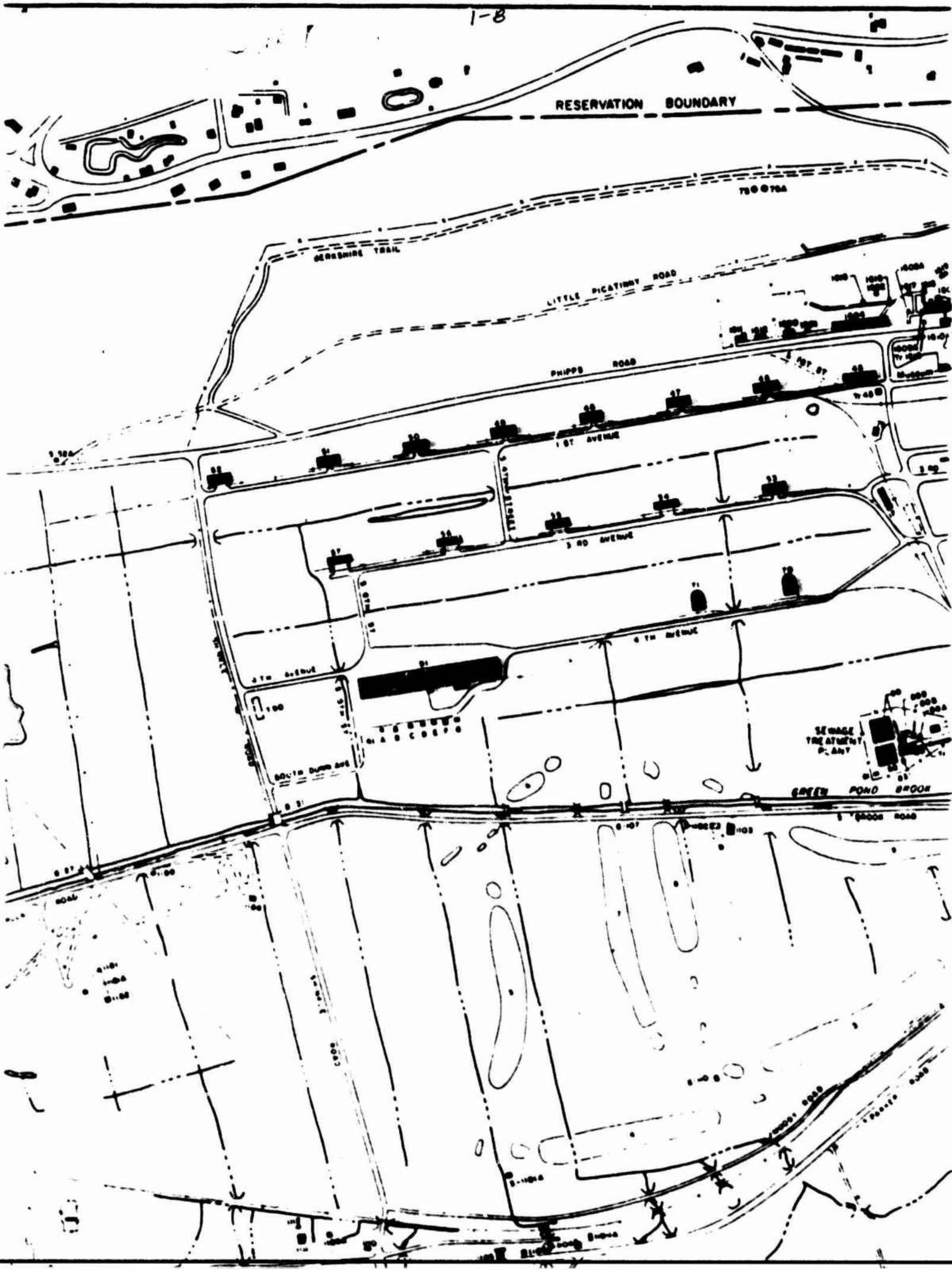
York, R.J., 1990, Letter and attachments from Chief, Installation Restoration Division, U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, Md., to S. Tsai, Argonne National Laboratory, Ill. (Subject: Comments on draft RI concept plan), April 27.

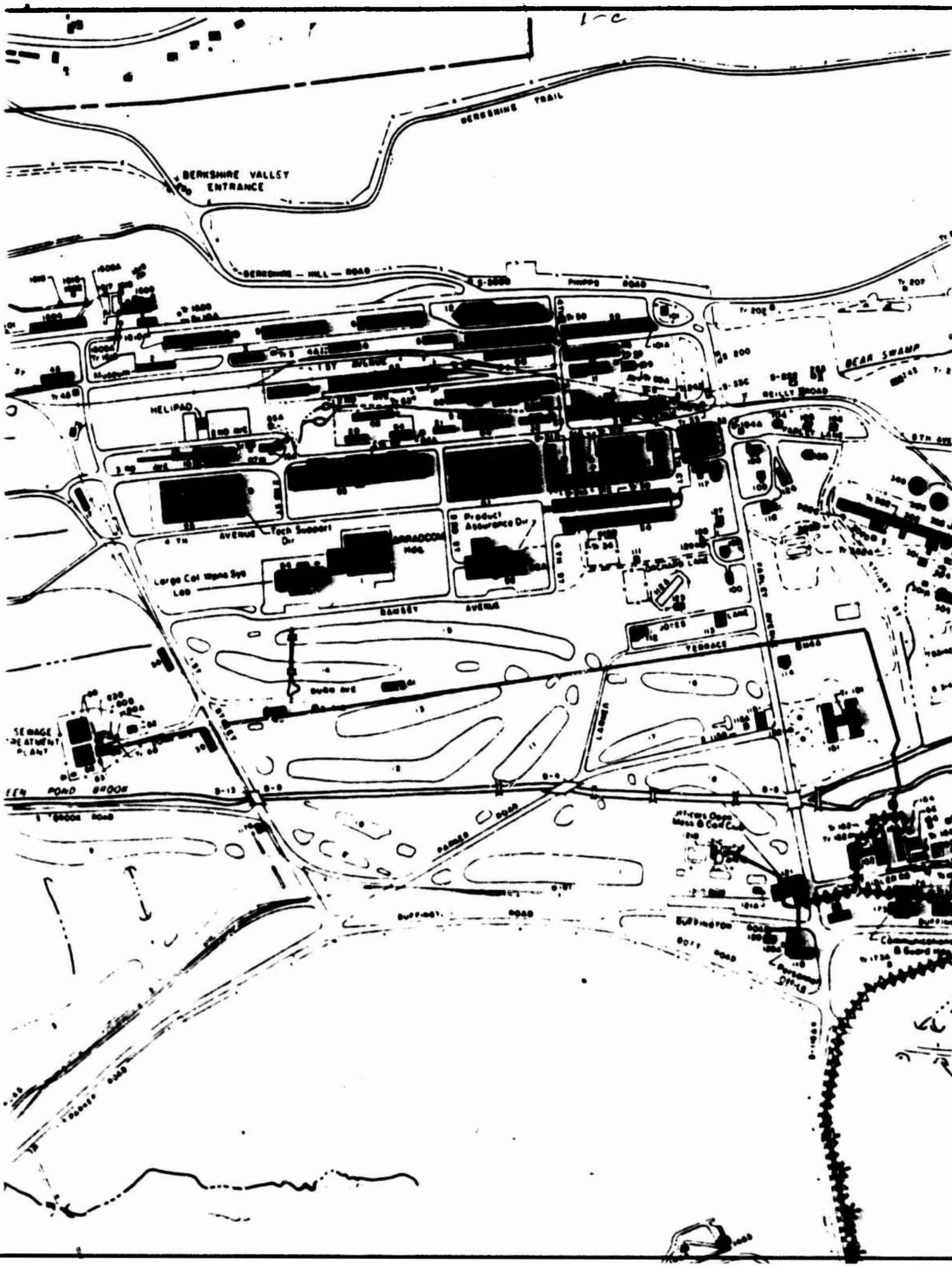
Young, 1969, *Contamination, Decontamination and Layaway of Facilities, Picatinny Arsenal, Dover, N.J.*

Zarra, et al., undated, Notes on Buildings 809 and 810.

CORPS OF ENGINEERS 1-H



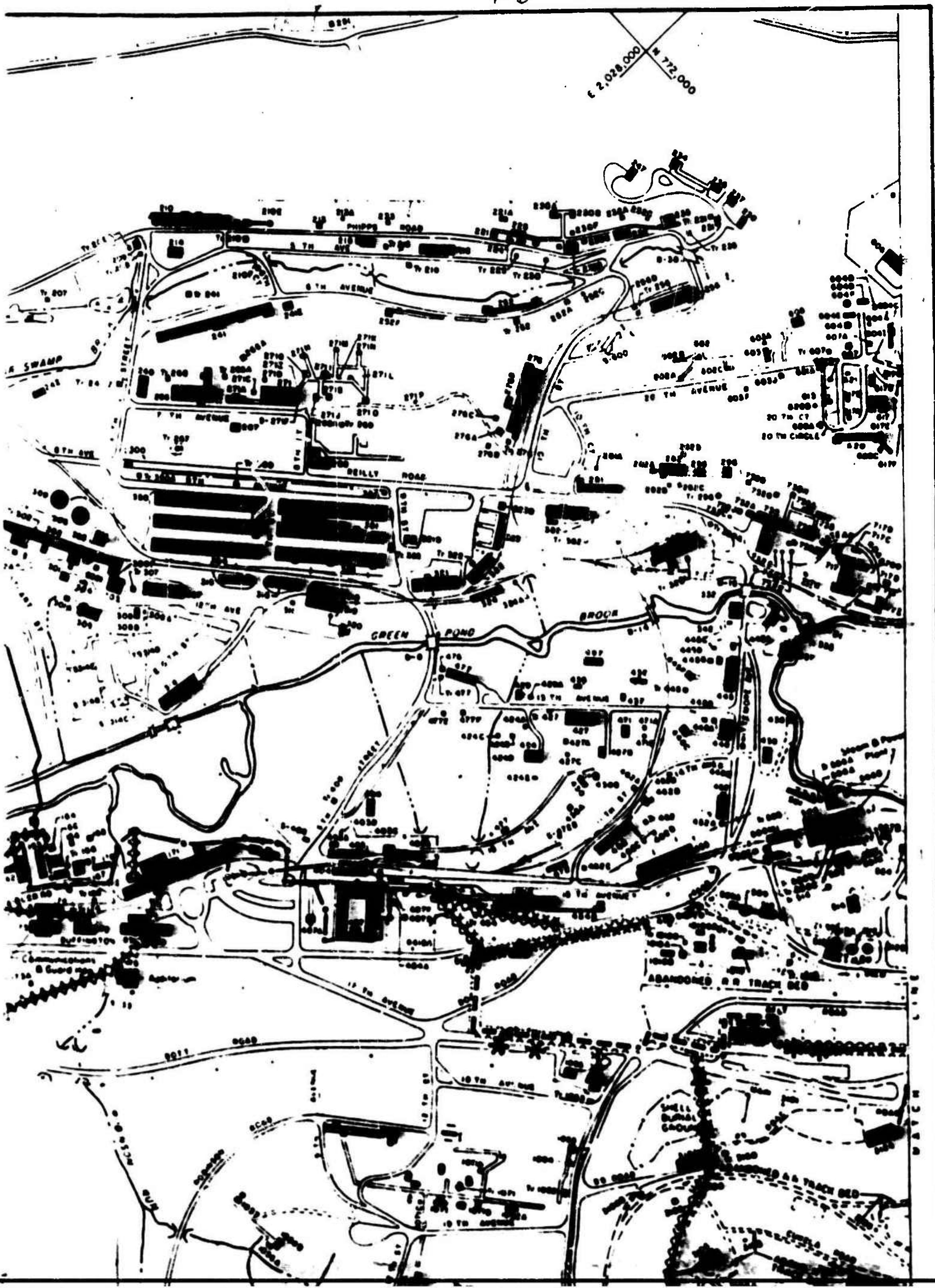

RESERVATION BOUNDARY
BERKSHIRE TRAIL
LITTLE PICATINNY ROAD
PHIPPS ROAD
1ST AVENUE
3RD AVENUE
5TH AVENUE
4TH AVENUE
SOUTH BURMA AVE
SEWAGE TREATMENT PLANT
GREEN POND BROOK



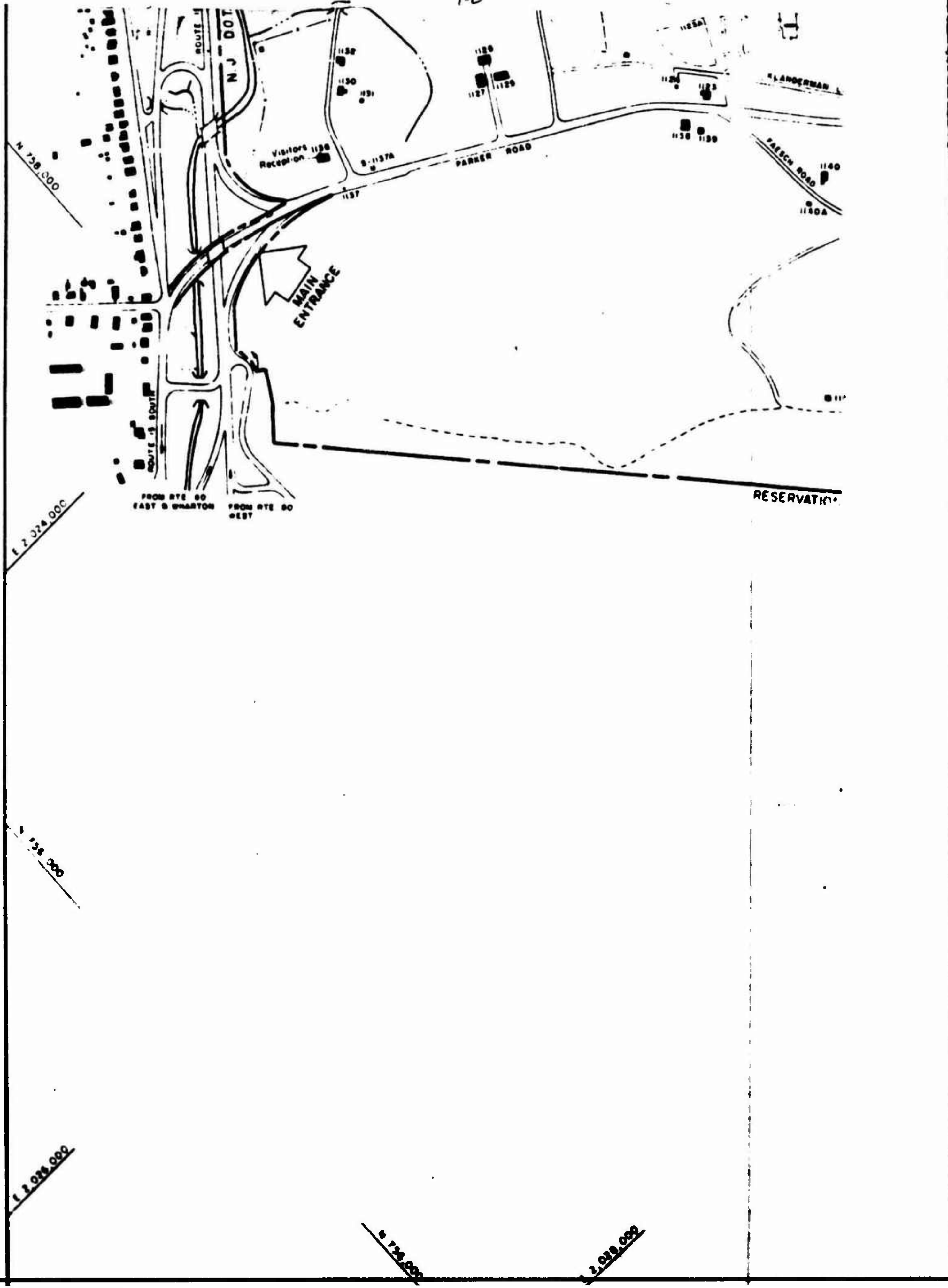
BERKSHIRE TRAIL
BERKSHIRE VALLEY ENTRANCE
BERKSHIRE — HILL — ROAD
HELIPAD
Museum
BEAR SWAMP
REILLY ROAD
Tech Support Div
ARRADCOM HQS
Product Assurance Div
Large Cal Wpns Sys Lab
RAMSEY AVENUE
SEWAGE TREATMENT PLANT
BUFFINGTON ROAD
Communications & Guard
Personnel Office

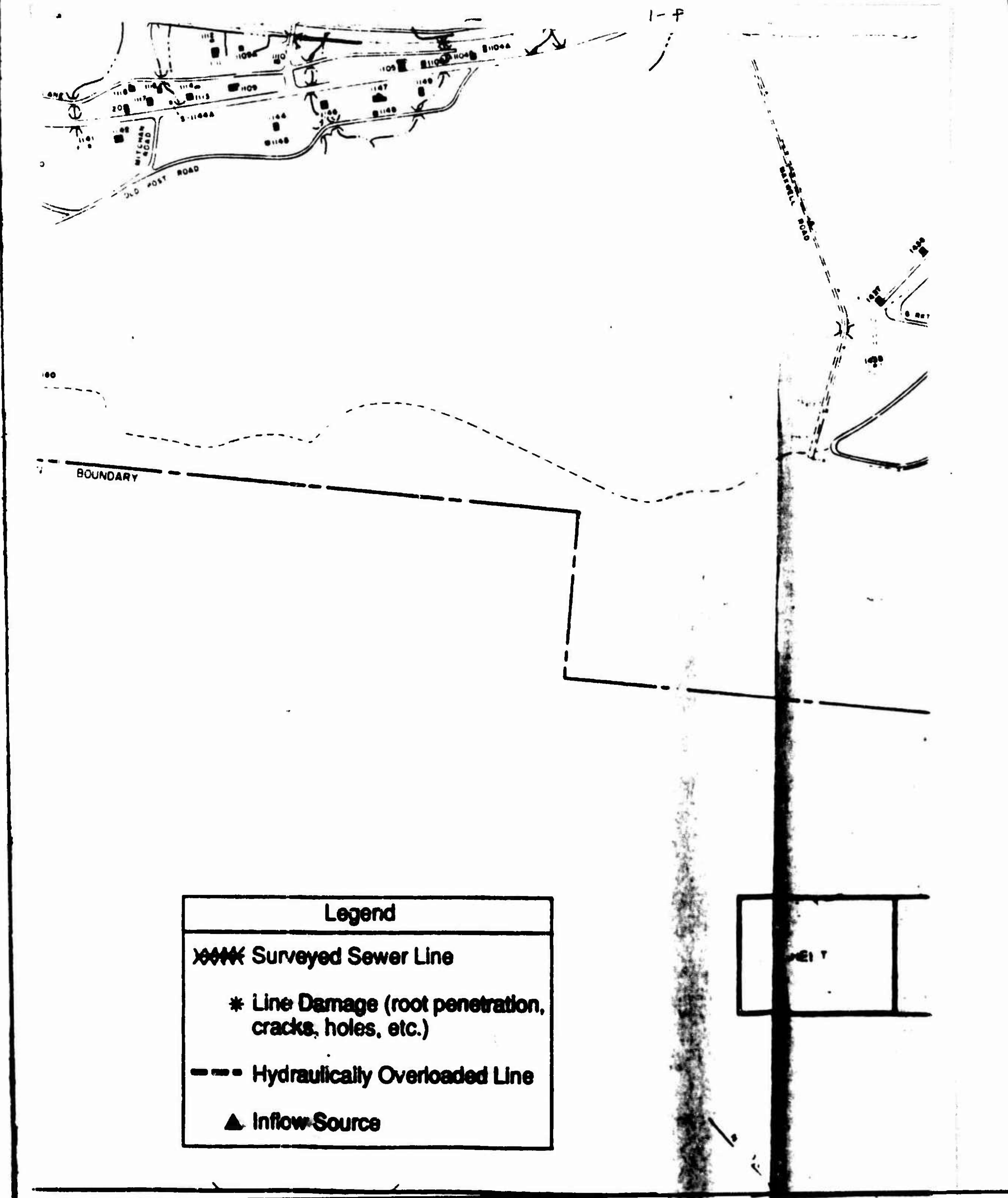
1-D

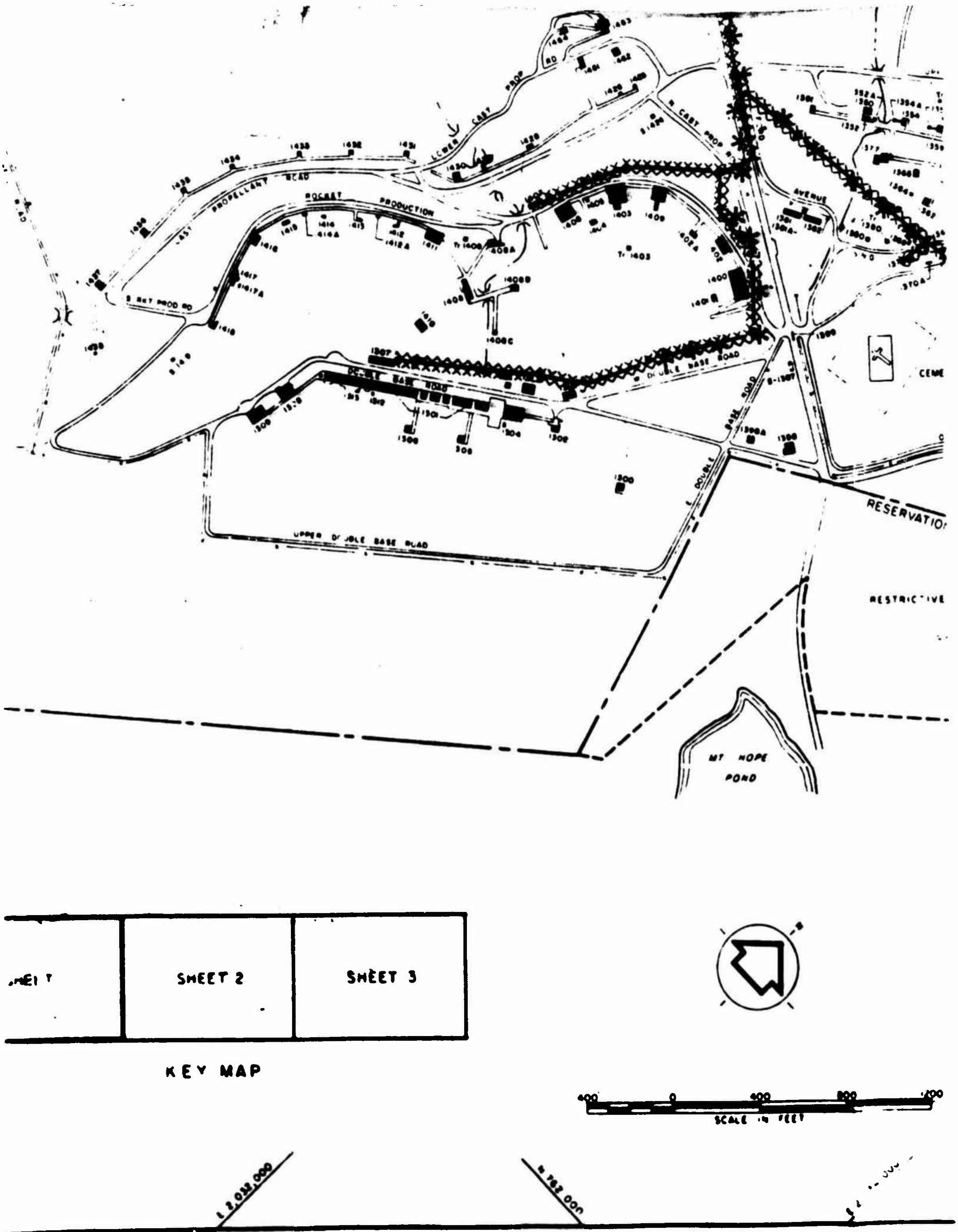
U. S. ARMY


E 2,028,000
N 772,000
PHIPPS ROAD
6 TH AVENUE
7 TH AVENUE
REILLY ROAD
20 TH AVENUE
20 TH CIRCLE
GREEN POND BROOK
10 TH AVENUE
ABANDONED R.R. TRACK BED
SHELL BURIAL GROUND

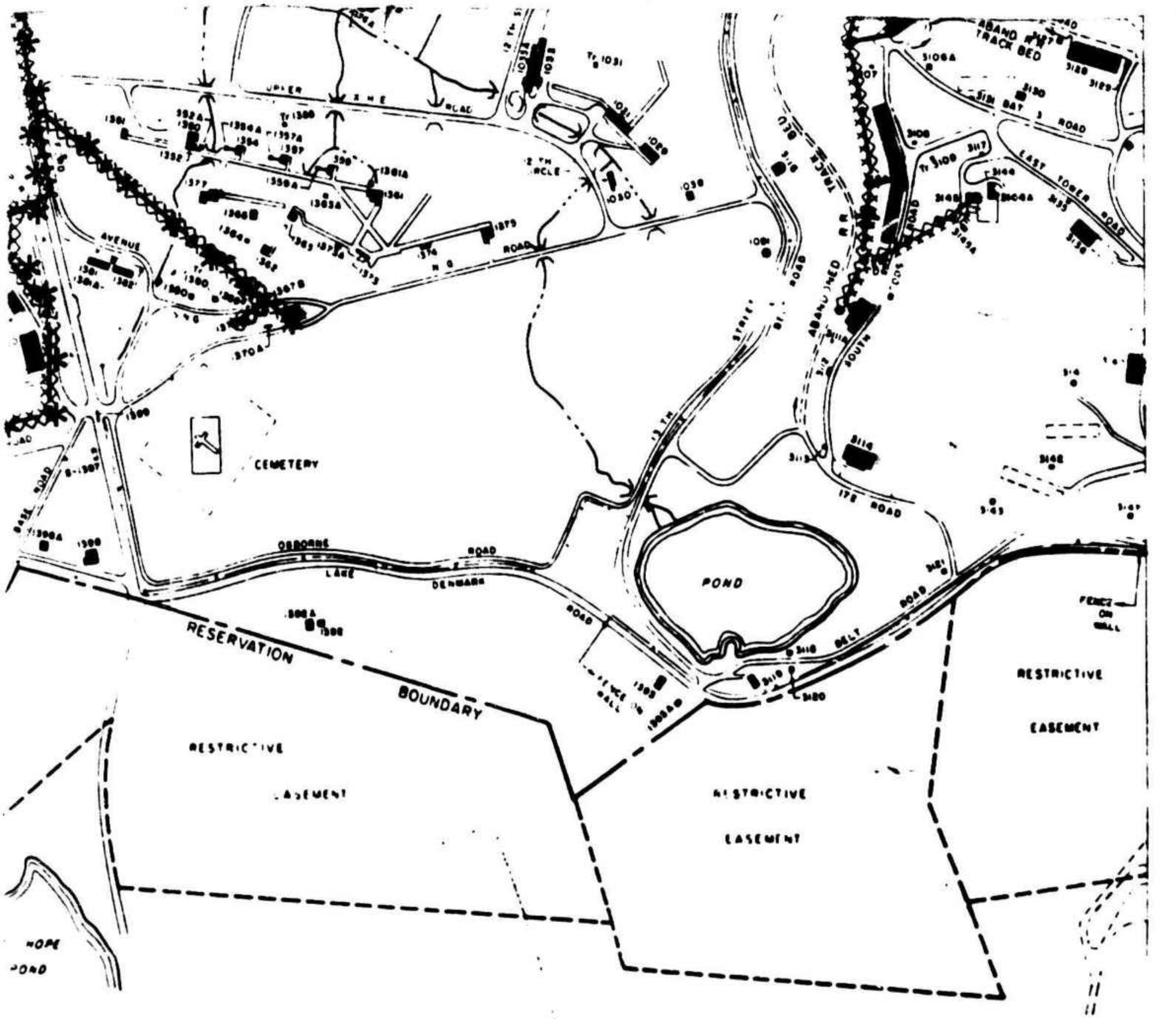
1-E


N J DOT
Visitors Reception
1136
PARKER ROAD
MAIN ENTRANCE
FAESCH ROAD
1132
1130
1131
1128
1127
1129
1137
1138
1139
1140
1140A
ROUTE 15 SOUTH
FROM RTE 80 EAST & WHARTON
FROM RTE 80 WEST
N 758,000
E 2,024,000
E 2,028,000


OLD POST ROAD
BOUNDARY
Legend
Surveyed Sewer Line
Line Damage (root penetration, cracks, holes, etc.)
Hydraulically Overloaded Line
Inflow Source


ROCKET PRODUCTION
PROPELLANT ROAD
LOWER CAST PROP
DOUBLE BASE ROAD
UPPER DOUBLE BASE ROAD
AVENUE
RESERVATION
RESTRICTIVE
MT HOPE
POND
CEME
SHEET 2
SHEET 3
KEY MAP
SCALE IN FEET
400
0
400
800
1200
E 2,032,000
N 762,000

— 1-4



400 800 1200
SCALE IN FEET

PLATE 2.1

JOHN J. KASSNER & CO., INC ARCHITECT - ENGINEER LAKE SUCCESS, NEW YORK	CORPS OF ENGINEERS - U.S. ARMY OFFICE OF THE DISTRICT ENGINEER NEW YORK DISTRICT - NEW YORK, NEW YORK

MAP OF PICATINNY ARSENAL SHOWING RESULTS OF THE SURVEY OF SEWER LINE SUBBASINS 6 AND 7

RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL

DATE

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DATE	DRAWING NO
SHEET NO.	FILE NO
1 of 2	

DATE