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Toxic and Hazardous Materials Agency

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# Remedial Investigation Concept Plan for Picatinny Arsenal

## Volume 1: Environmental Setting, Applicable Regulations, Summaries of Site Sampling Plans, Sampling Priorities, and Supporting Appendixes

March 1991 *(Final Report)*

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

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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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# Remedial Investigation Concept Plan for Picatinny Arsenal

## Volume 1: Environmental Setting, Applicable Regulations, Summaries of Site Sampling Plans, Sampling Priorities, and Supporting Appendixes

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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*prepared for*
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*Biological and Medical Research Division, ANL.*

## CONTENTS

## TABLES

TABLES (Cont'd)

## TABLES (Cont'd)



## FIGURES

## NOTATION

### ACRONYMS, INITIALISMS, AND ABBREVIATIONS

| | |
|---|---|
| ANL | Argonne National Laboratory |
| App. | appendix |
| ARAR | applicable or relevant and appropriate requirement |
| ARDEC | Armament Research, Development and Engineering Center |
| BDAT | best demonstrated available technology |
| Bldg. | building |
| BTX | benzene, toluene, and xylenes |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act of 1980 |
| CFR | Code of Federal Regulations |
| Chap. | chapter |
| 2,4-D | 2,4-dichlorophenoxyacetic acid |
| DDT | dichlorodiphenyltrichloroethane |
| DEH | Division of Engineering and Housing |
| Div. | division |
| DNT | dinitrotoluene |
| DOD | U.S. Department of Defense |
| DRMO | Defense Reutilization and Marketing Office |
| DU | depleted uranium |
| $EC_{50}$ | effective concentration 50 |
| EM | electromagnetic |
| EOD | explosive ordnance demolition |
| EP | extraction procedure |
| EPA | U.S. Environmental Protection Agency |
| Fed. Reg. | Federal Register |
| Fig. | figure |
| HEPA | high-efficiency particulate air (filter) |
| HMX | cyclotetramethylene tetranitramine |
| HSWA | Hazardous and Solid Waste Amendments of 1984 |
| ISAL | interim soil action level |
| $LC_{50}$ | lethal concentration 50 |
| $LD_{50}$ | lethal dose 50 |
| MCL | maximum contaminant level |
| MCLG | maximum contaminant level goal |
| MH | manhole |
| MSL | mean sea level |

| | |
|---|---|
| N | nitrogen |
| 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 |
| PCB | polychlorinated biphenyl |
| PTA | Picatinny Arsenal |
| 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 |
| Rm. | room |
| SARA | Superfund Amendments and Reauthorization Act of 1986 |
| SDWA | Safe Drinking Water Act |
| Sec. | section |
| TCL | target compound list |
| TCLP | toxicity characteristic leaching procedure |
| TDS | total dissolved solids |
| TECUP | Toxic Energetics Cleanup Program |
| tetryl | 2,4,6-trinitrophenylmethylnitramine |
| TNB | trinitrobenzene |
| TNT | trinitrotoluene |
| TOC | total organic carbon |
| TOH | total organic hydrocarbons |
| TOX | total organic halogens |
| TPH | total petroleum hydrocarbons |
| 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 |
| WWI | World War I |
| WWII | World War II |

UNITS OF MEASURE

| | |
|---|---|
| °C | degree(s) Celsius |
| Ci | curie(s) |
| $cm^2$ | square centimeter(s) |
| d | day(s) |
| °F | degree(s) Fahrenheit |
| ft | foot (feet) |
| $ft^2$ | square foot (feet) |
| $ft^3$ | cubic foot (feet) |
| gal | gallon(s) |
| h | hour(s) |
| ha | hectare(s) |
| in. | inch(es) |
| kCi | kilocurie(s) |
| lb | pound(s) |
| L | liter(s) |
| m | meter(s) |
| mCi | millicurie(s) |
| mg | milligram(s) |
| mi | mile(s) |
| $mi^2$ | square mile(s) |
| mL | milliliter(s) |
| mm | millimeter(s) |
| pCi | picocurie(s) |
| ppb | part(s) per billion |
| ppm | part(s) per million |
| s | second(s) |
| ton | short ton(s) |
| yr | year(s) |
| μCi | microcurie(s) |
| μg | microgram(s) |

# REMEDIAL INVESTIGATION CONCEPT PLAN FOR PICATINNY ARSENAL

## SUMMARY

This plan assesses the environmental status and describes additional data needs for 156 Sites grouped into 16 Areas at Picatinny Arsenal (PTA) near Dover, New Jersey. The concept plan was developed to comply with the hazardous waste and water quality regulations of the state of New Jersey and federal regulations as stated in the Hazardous and Solid Waste Amendments (HSWA) of 1984 and the Superfund Amendments and Reauthorization Act (SARA) of 1986.

The report describes the study area, including the geological and hydrological aspects and the history and activities of PTA, and some aspects of the relevant state and federal regulations. The reasons for grouping Sites into the Area are given briefly for each Area. For each Site, a brief description of the history, geology, and hydrology is followed by a discussion of the available data and information pertaining to the existing contamination at the Site. Based on the existing data, a remedial investigation (RI) action plan is proposed for each Site. Each action plan describes additional data needed to adequately characterize and monitor existing and potential contamination at the Site.

The report also includes a ranking or prioritization of the 16 Areas in terms of their potential for impact on public health and the environment. The ranking has been approved by the U.S. Environmental Protection Agency (EPA) and the New Jersey Department of Environmental Protection (NJDEP).

The report is divided into two volumes. Volume 1 contains descriptions of the study area and state and federal regulations, brief descriptions of the Areas and Sites and the process by which they were chosen, summaries of the proposed RI sampling plans, and a priority ranking of the Areas; also included are summaries of munitions loading production and chemical and radioactive materials usage at PTA. Volume 2 contains a description of the Site history, geology, and hydrology; the nature and extent of contamination; and the proposed RI plan for each Site in each Area. The ordering of Areas and of Sites within each Area is the same in the text and tables in both volumes.

Several sources of information were used to produce the report. The Site histories are based on information supplied by PTA personnel during interviews, information in closure plans and other reports, and information supplied by PTA. The descriptions of existing contamination are based on the interviews, closure plans, and available sampling data. The proposed RI plans are based on the existing data and the relevant state and federal regulations. For those Sites for which closure plans have already been developed, the RI plans are designed to complement closure sampling and avoid duplication of sampling activities. In Volume 2, the RI plans are also described in sufficient detail to constitute, in essence, a summary work plan.

# 1 INTRODUCTION

## 1.1 BACKGROUND

Picatinny Arsenal, officially known as the U.S. Army Armament Research, Development and Engineering Center (ARDEC), was established by the U.S. War Department in 1880. In the latter part of the 18th century, the arsenal area contained iron forges for producing cannon, shot, bar iron, and other materiel for George Washington's army during the American Revolution. Iron ore for the forges came from nearby iron mines, which were active in the 18th and 19th centuries. After the war, the forges continued to produce bar iron for several decades.

When PTA was established, it was used as a storage and powder depot. Later, it was expanded to assemble powder charges for cannons and to fill projectiles with maximite (a propellant). During World War I (WWI), PTA produced all sizes of projectiles. In the years following WWI, PTA began projectile melt-loading operations and began to manufacture pyrotechnic signals and flares on a production basis (War Plans Division 1931). During World War II (WWII), PTA produced artillery ammunition, bombs, high explosives, pyrotechnics, and other ordnance. After WWII, PTA's primary role became the research and engineering of new ordnance. However, during the Korean and Vietnam conflicts, PTA resumed the production and development of explosives, ammunition, and mine systems.

In recent years, PTA's mission has shifted to conducting and managing research, development, and life-cycle engineering and to acquiring assigned items and systems. This includes life-cycle procurement, production of some components of nuclear munitions, and support of other military weapons and weapon systems. The facility has virtually total responsibility for the research and development of all armament items.

Investigations of the quality of soils and groundwater within PTA's boundaries, such as those conducted by the U.S. Geological Survey (USGS), have identified several potential environmental problems. PTA, with the assistance of the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA), has been conducting environmental assessment and restoration activities at various potential hazardous waste sites located throughout PTA. However, assessments have not yet been completed to determine the spatial extent, magnitude, direction, and rate of contaminant migration in the aquifers beneath the disposal areas. To assess the current environmental status of PTA and determine the potential of off-site migration of contaminants, USATHAMA contracted Argonne National Laboratory (ANL) to prepare a RCRA/CERCLA* Concept Plan.

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*Resource Conservation and Recovery Act of 1976/Comprehensive Environmental Response, Compensation, and Liability Act of 1980.

## 1.2 OBJECTIVE

The objective of this study is to develop a conceptual plan for a remedial investigation for PTA to protect human health and the environment. The U.S. Army, working with Region II of the EPA and the NJDEP, initially selected 55 Sites for further environmental characterization and remediation studies. An additional 101 Sites were selected based on the results of interviews by ANL staff and others with current and former PTA employees and review by USATHAMA. The interview information was also used to expand some of the original 55 Sites to include additional nearby areas or buildings. Based on location and types of activity carried out at each Site, the 156 Sites have been grouped into 16 Areas.

This RI concept plan presents an in-depth assessment of the current environmental status of each Site in each Area, a discussion of the need for site investigation, and a recommendation of possible alternatives for remedial action. The plan takes into account the listing of PTA on the National Priority List (i.e., as a Superfund site) in March 1990. This plan has been developed to comply with hazardous waste regulations of the NJDEP and with regulations stipulated in the HSWA of 1984 and the SARA of 1986. It will be used by the Army as a working document for accomplishing a comprehensive RI at each of the 16 Areas on PTA.

## 1.3 APPROACH

The study began when ANL staff visited PTA to acquaint themselves with its environment and to interview PTA personnel about the operational history and activities at each Site. Two additional visits were needed to complete the interviews and see the additional Sites. ANL staff searched the literature for available geohydrological and groundwater quality data, as well as data on soil contamination at the Sites. The data were used to characterize the hydrogeological conditions both at PTA as a whole and at each Site and to characterize the soil and groundwater contamination at each Site. All available data for samples collected before May 1989 were used in the study. May 1989 was also taken to be the cutoff date for data used in the study. Data quality and completeness were also evaluated.

The study further assessed the potential public health and environmental impacts associated with site contamination by comparing contaminant concentration levels with regulatory limits set forth by the EPA and NJDEP. The impact assessment results were used to identify additional data needed for each Site. This RI concept plan was then developed, based on existing environmental data, to identify the Sites requiring no further action, additional data, or periodic monitoring. For Sites requiring additional data or monitoring, phased sampling plans were developed. Analyses of remedial action needs and restoration alternatives are outside the scope of this study.

As a final step, the 16 Areas were ranked according to their need for remedial action. The ranking was based on existing data and site information and environmental criteria such as potential or actual risk to human health and the environment.

# 2 DESCRIPTION OF STUDY AREA

## 2.1 LOCATION AND GEOGRAPHY

Picatinny Arsenal is located about 4 mi north of the city of Dover in Rockaway Township, Morris County, New Jersey (Fig. 2.1). State Route 15 skirts the southern end of PTA; Interstate 80 is about 1 mi and U.S. Route 46 about 1.5 mi southeast of the main entrance.

The PTA land area consists of 6,491 improved and unimproved acres, of which 5,848 are in fee (in absolute and legal possession), 639 in restrictive easement, and 4 in lease. The arsenal is situated in an elongated valley trending northeast-southwest between Green Pond Mountain and Copperas Mountain on the northwest and an unnamed hill on the southeast. Within the boundaries of PTA, the land surface ranges in elevation from 1,240 ft above mean sea level (MSL) along the crest of Green Pond Mountain to just under 700 ft above MSL where Green Pond Brook leaves the Arsenal. The Green Pond and Copperas mountains rise precipitously above Picatinny Lake and Lake Denmark. Slopes on these mountains are steep and rugged. The slopes on the southeast side of the Arsenal with elevations approaching 1,000 ft above MSL are not as rugged or steep as other PTA slopes, however. Most of the PTA buildings and other facilities are located on the narrow valley floor or on the slopes along the southeast side. Several firing and testing ranges are located on Green Pond Mountain.

In general, the areas that surround the Arsenal are suburban and summer vacation areas because of the numerous small lakes and many mountains. The environs contain the densest population in Morris County. Some of the nearby populous areas are Morristown, Morris Plains, Parsippany, Troy Hills, Randolph Township, and Sparta Township. Morris County political units in the immediate vicinity of PTA include:

- Wharton, a borough 3 mi south of PTA (population of about 5,500).
- Dover, a town 4 mi south of PTA (population of 15,000).
- Rockaway, a borough 4 mi southeast of PTA (population of 6,500).
- Denville, a township 6 mi southeast of PTA (population of 14,000).
- Boonton, a town 8 mi southeast of PTA and bisected by Routes 387 and 202 (population of about 9,000).
- Morristown, the county seat, 15 mi southeast of PTA (population of 18,000).

Lake Hopatcong is the largest lake in the state; it is situated in two counties, Morris and Sussex. This 9-$mi^2$ lake, together with a state park and an amusement park, is a favorite recreation area, and is located about 4 mi west of Picatinny Arsenal.

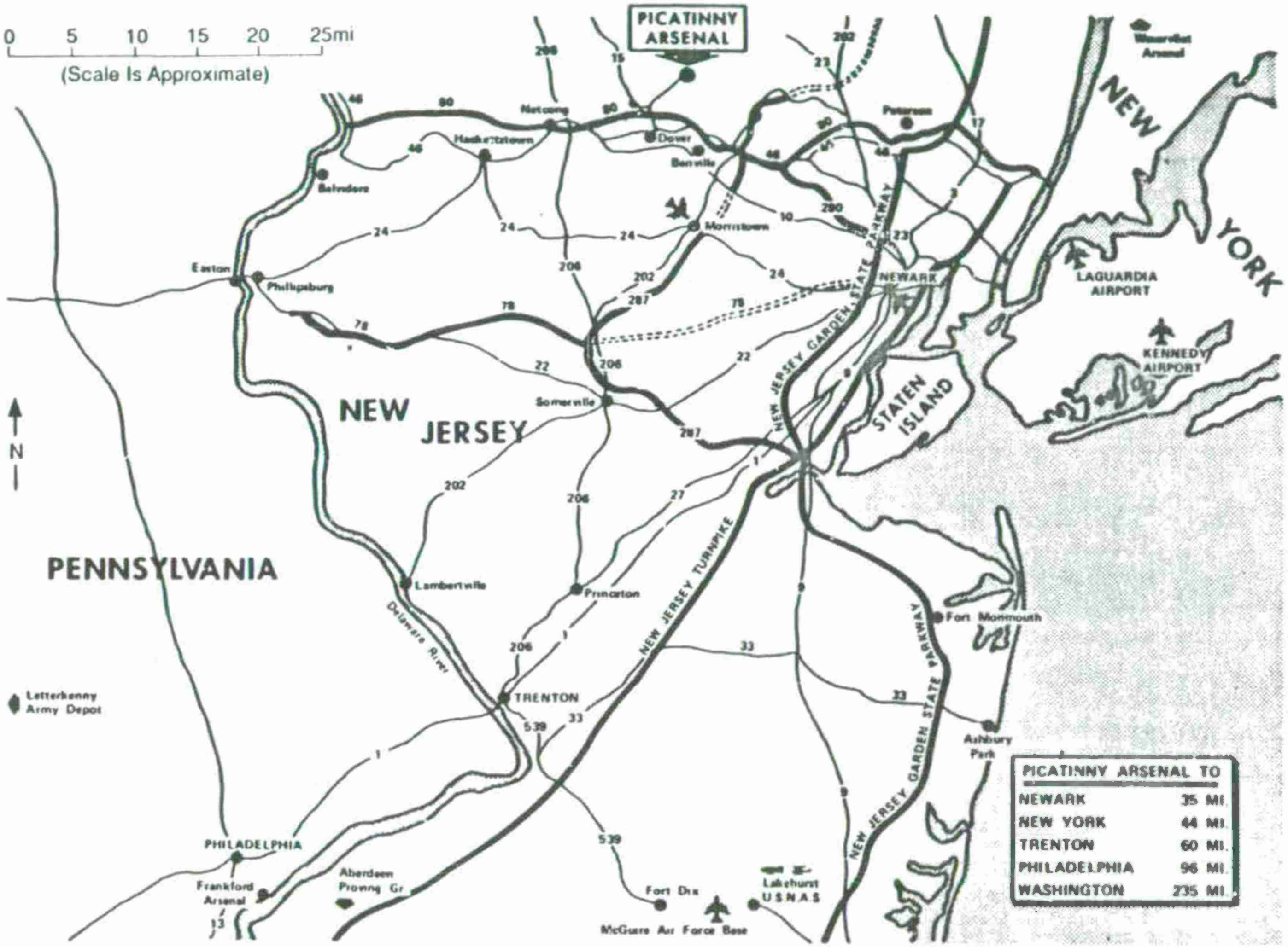


FIGURE 2.1 Location of Picatinny Arsenal (Source: USATHAMA 1976)

## 2.2 CLIMATE

The area around PTA, although humid and temperate, has a continental climate that is minimally influenced by the ocean. The temperature, wind, and precipitation data that follow were taken from 1951-1980 records at the nearest cooperative weather station, at Boonton (U.S. Department of Commerce 1982).

The temperature in summer seldom exceeds 100°F, but temperatures in the middle or upper 90s occur frequently. The highest mean annual temperature, 72.4°F, occurs during July. The coldest month is January, with an average of 27.4°F.

The average length of the growing season in Morris County is about 159 d. The average date of the last killing freeze in spring is May 2, and that of the first in fall is October 8 (Eby 1976).

The prevailing winds are from the northwest during the period October through April and from the southwest during the period March through September (Gill and Vecchioli 1965).

The mean annual precipitation is 47.85 in., and the monthly averages show that precipitation is well distributed throughout the year. Rainfall is heaviest in July and August. Much of the rainfall accompanies thunderstorms; the area has about 33 such storms per year (Eby 1976; U.S. Department of Commerce 1982).

## 2.3 SOILS AND GEOLOGY

### 2.3.1 Soils

Soils at PTA are acidic and predominantly derived from glacial deposits. However, the northwestern mountains contain rugged, rocky slopes and rough, stony land. The southern end of this mountain range and the easterly slopes across the valley are not as rugged and are composed mostly of stoney land and sandy clay loam. The central or valley section of PTA contains loam, silt, sand, and gravel clay pan soils, with considerable muck and peat in a swampy area. Practically all of the soils in the Arsenal's cantonment area are highly permeable. Figure 2.2 shows the areal distribution of PTA surface soil types, as mapped by the U.S. Department of Agriculture (USDA). Eighteen individual units, which are portrayed on the map, consist of loam, silt, sands, clays, gravels, and rock outcrops. Table 2.1 provides a description of each soil unit and its characteristics.

The southern end of PTA is bordered by a terminal moraine that has only a moderate topographic expression in the surrounding valley. These soils consist mainly of poorly sorted sands, gravels, and boulders. The western flank of PTA is blanketed by a thin layer of glacial till consisting of poorly sorted sands, gravels, and boulders. This layer may reach a thickness up to 20 ft in some areas. The eastern flanks have much gentler slopes and more uniform till, ranging from 10 to 25 ft thick. The valley is underlain by both till and drift, which consists of clay, sand, and gravel. The thickness of

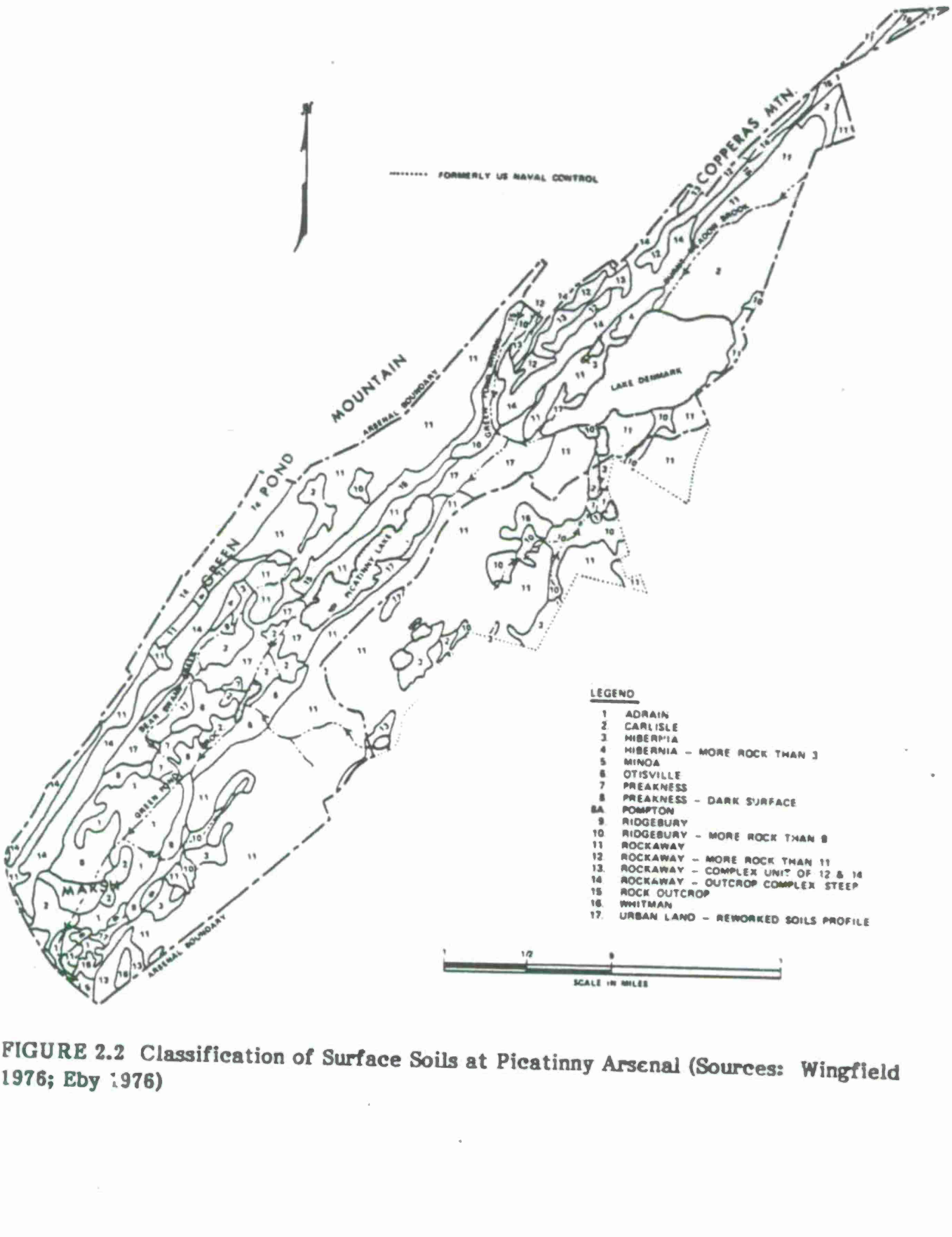


**FIGURE 2.2** Classification of Surface Soils at Picatinny Arsenal (Sources: Wingfield 1976; Eby 1976)

**TABLE 2.1 Characteristics of Surface Soil Units at PTA[a]**

| Map Unit[b] | Soil Series | Description | Typical Depth (in.) | USCS Classification[c] | Fractions Passing Sieve Numbers (%): No. 4, 4.7 mm | No. 10, 2.0 mm | No. 40, 0.42 mm | No. 200, 0.074 mm | Permeability (in./h) | Soil pH |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Adrian | Very poorly drained organic soils, in depressions or kettles in the uplands having a muck surface texture and a brown peat subsurface layer over loamy sand substratum | 0-42 | Pt | - | - | - | - | 6 | 5.6-6.5 |
| | | | 42-60 | SM | 90-100 | 85-100 | 50-75 | 15-30 | 6 | 5.6-6.5 |
| 2 | Carlisle | Deep, very poorly drained black organic soils in depressions and beside upland streams; normally has a muck surface and brown subsurface layer several feet deep | 0-60 | Pt | Highly organic deposits | | | | 6 | 5.6-6.5 |
| 3 | Hibernia | Deep, somewhat poorly drained loamy soils of the uplands formed in glacial till derived from granite gneiss; underlying rock is mostly gneiss | 0-7 | SM | 70-85 | 65-75 | 55-70 | 30-45 | 0.6-2.0 | 4.5-5.5 |
| | | | 7-20 | SM | 70-90 | 65-80 | 60-75 | 25-45 | 0.6-2.0 | 4.5-5.5 |
| | | | 20-46 | SM | 70-90 | 65-80 | 55-70 | 25-45 | 0.2 | 4.5-5.5 |
| | | | 46-60 | SM | 80-95 | 60-75 | 55-70 | 25-35 | 0.2-0.6 | 4.5-5.5 |
| 4 | Hibernia | Generally same as unit 3 but is classified as containing more rock | | | | | | | | |
| 5 | Minoa | Deep, somewhat poorly drained soils of the Passaic basin soils having a silt loam surface texture and a mottled silt loam subsoil; substratum is a fine sand | 0-6 | ML,CL | 90-100 | 85-100 | 60-80 | 60-80 | 0.6-2.0 | 5.6-7.0 |
| | | | 6-30 | ML,CL | 95-100 | 85-100 | 80-95 | 45-85 | 0.2-2.0 | 5.1-6.5 |
| | | | 30-60 | SM,SC | 95-100 | 85-100 | 75-90 | 15-80 | 0.6-6.0 | 6.7-7.3 |
| 6 | Otisville | Deep, excessively drained sandy soil of the glacial uplands and outwash plains; the subsoil and substratum are gravelly loamy sand to very gravelly sand | 0-14 | SM,GM SP,SM | 55-70 | 50-80 | 30-45 | 10-20 | 6.0 | 4.5-6.0 |
| | | | 14-60 | SM,GM | 55-80 | 50-80 | 20-35 | 10-25 | 6.0 | 4.5-6.0 |

**TABLE 2.1 (Cont'd)**

| Map Unit[b] | Soil Series | Description | Typical Depth (in.) | USCS Classification[c] | Fractions Passing Sieve Numbers (%): No. 4, 4.7 mm | No. 10, 2.0 mm | No. 40, 0.42 mm | No. 200, 0.074 mm | Permeability (in./h) | Soil pH |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | Preakness | Deep, poorly drained grayish sandy soil on outwash plains and terraces | 0-8 | SM,SC | 95-100 | 90-100 | 60-75 | 30-40 | 2.0-6.0 | 4.5-5.5 |
| | | | 8-30 | SM,SC | 85-100 | 90-100 | 35-50 | 30-40 | 2.0-6.0 | 4.5-5.5 |
| | | | 30-60 | SP,SM SM | 75-100 | 50-100 | 35-50 | 15-35 | 2.0-6.0 | 4.5-5.5 |
| 8 | Preakness, dark surface | Dark surface variant is a moderately deep, very poorly drained grayish sandy soil formed in outwash plains | 0-8 | Pt | - | - | - | - | 6.0 | 4.5-6.0 |
| | | | 8-32 | SM | 85-100 | 65-80 | 35-50 | 20-35 | 2.0-6.0 | 5.1-6.0 |
| | | | 32-60 | SM,SP | 60-100 | 55-100 | 35-50 | 10-30 | 2.0-6.0 | 4.0-6.0 |
| 8A | Pomptor | Deep, somewhat poorly drained moderately sandy soils of the uplands and outwash plains; substratum is sand and gravel | 0-7 | SM,SC | 85-100 | 85-100 | 70-85 | 30-40 | 2.0-6.0 | 4.5-5.0 |
| | | | 7-36 | SM | 85-100 | 80-100 | 70-85 | 25-40 | 2.0-6.0 | 5.1-5.5 |
| | | | 36-60 | SM,GM | 70-100 | 60-100 | 60-90 | 10-25 | 6.0 | 4.5-5.5 |
| 9 | Ridgebury | Deep, poorly drained stony soil with a very stony loam surface; moderately developed fragipan occurs 12-24 in. below the surface; underlying rock is gneiss | 0-9 | GM,GC, SM,SC | 65-80 | 60-80 | 50-65 | 30-50 | 0.6-2.0 | 4.5-5.0 |
| | | | 9-14 | SM,SC | 80-95 | 65-80 | 60-75 | 30-45 | 0.6-2.0 | 4.5-5.0 |
| | | | 14-36 | SM | 85-95 | 65-80 | 55-70 | 25-40 | 0.2 | 4.5-5.0 |
| | | | 36-60 | SM | 85-100 | 65-80 | 60-75 | 25-40 | 0.6-2.0 | 4.5-5.5 |
| 10 | Ridgebury | This unit has same characteristics as unit 9 but is classified as having a higher percentage of stones than unit 9 | | | | | | | | |
| 11 | Rockaway | Deep, moderately well drained soils of the uplands; 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 | 0-8 | SM,SC | 70-85 | 60-75 | 55-70 | 25-40 | 0.6-2.0 | 4.5-5.5 |
| | | | 8-20 | SM,SC | 75-90 | 65-85 | 60-75 | 25-40 | 0.6-2.0 | 4.5-5.5 |
| | | | 20-40 | SM,SC | 75-90 | 65-80 | 55-70 | 25-45 | 0.2 | 4.5-5.5 |
| | | | 40-60 | SM,SC | 80-95 | 65-80 | 55-70 | 25-45 | 0.2-2.0 | 4.5-5.5 |

TABLE 2.1 (Cont'd)

| Map Unit[b] | Soil Series | Description | Typical Depth (in.) | USCS Classification[c] | Fractions Passing Sieve Numbers (%) No. 4, 4.7 mm | No. 10, 2.0 mm | No. 40, 0.42 mm | No. 200, 0.074 mm | Permeability (in./h) | Soil pH |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | Rockaway | Extremely stony sandy loam (other data similar to unit 11) | | | | | | | | |
| 13 | Rockaway | Rock outcrop complex | | | | | | | | |
| 14 | Rockaway | Steep outcrop complex | | | | | | | | |
| 15 | Rock outcrop | Large stones and boulders 724 in. in diameter | Not suitable for sampling | | | | | | | |
| 16 | Whitman | Deep, very poorly drained grayish soil in depressions | 0-8 | ML,CL, SM,SC | 85-95 | 80-90 | 70-85 | 45-60 | 2.0-6.0 | 4.5-6.0 |
| | | and drainageways of glaciated uplands; soils are | 8-20 | ML,SM, CL,SC | 80-95 | 75-90 | 75-90 | 45-60 | 0.6-2.0 | 4.5-6.0 |
| | | stony and have firm subsoil | 20-40 | SM | 80-95 | 75-90 | 65-80 | 30-50 | 0.2 | 4.5-6.0 |
| | | overlying a loamy sand or gravelly loamy sand | 40-60 | SM | 80-95 | 75-90 | 65-80 | 15-30 | 0.2-2.0 | 4.5-6.0 |
| 17-18 | Urban Land complex | Soil has been reworked so that the profile has been destroyed | Data not determined. | | | | | | | |

[a]All units are characterized as having a low shrink-swell potential.

[b]See Fig. 2.2.

[c]Group symbols are as follows: CL = inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays. GC = clayey gravels, gravel-sand-clay mixtures. GM = silty gravels, gravel-sand-silt mixtures, few or no fines. ML = inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity. SC = clayey sands, sand-clay mixtures. SM = silty sands, sand-silt mixtures. SP = poorly graded sands, gravelly sands, few or no fines. Pt = peat and other highly organic soils.

Sources: Wingfield 1976; USATHAMA 1976.

these deposits reaches 200 ft in depth, as shown in the generalized cross-section in Fig. 2.3.

### 2.3.2 Geology

PTA is located in the Green Pond syncline, a structural region within the New Jersey Highlands Physiographic Province. The New Jersey Highlands, or Reading Prong, is composed of a northeast-southwest system of folded and faulted Proterozoic-to-Devonian rocks that form a sequence of valleys and ridges. The ridges are typically broad, rounded, or flat-topped, and the valleys are typically deep and narrow. Generally, a 400- to 600-ft difference in altitude separates ridge crest from valley floor (Wolf 1977).

The Green Pond syncline is a narrow, northeast-trending, faulted syncline containing a thin section of Paleozoic sediments. Paleozoic rocks typically sit unconformably atop the Precambrian basement, on the eastern side of the syncline (Fig. 2.4). However, thrust faults and folds in the Paleozoic section have removed the original contact between the basement and cover rocks (Lyttle and Epstein 1987).

A significant strike-slip component of movement is possible on the normal faults in the Green Pond syncline (Lyttle and Epstein 1987). Two faults are of interest at PTA, the Green Pond and the Mount Hope. The Green Pond fault is longitudinal, running along and parallel to the trend of the western side of the valley (Sims 1958). The displacement is about 1,500 ft, with uplift on the west side and a dip steeply to the northwest (Kummel and Weller 1902). The Mount Hope fault runs across the valley trend and is a high-angle, strike-slip fault (horizontal movement). It has a general strike of north 78° west and an average dip of 60° southwest. Uplift is on the north side of the fault (Sims 1958). The

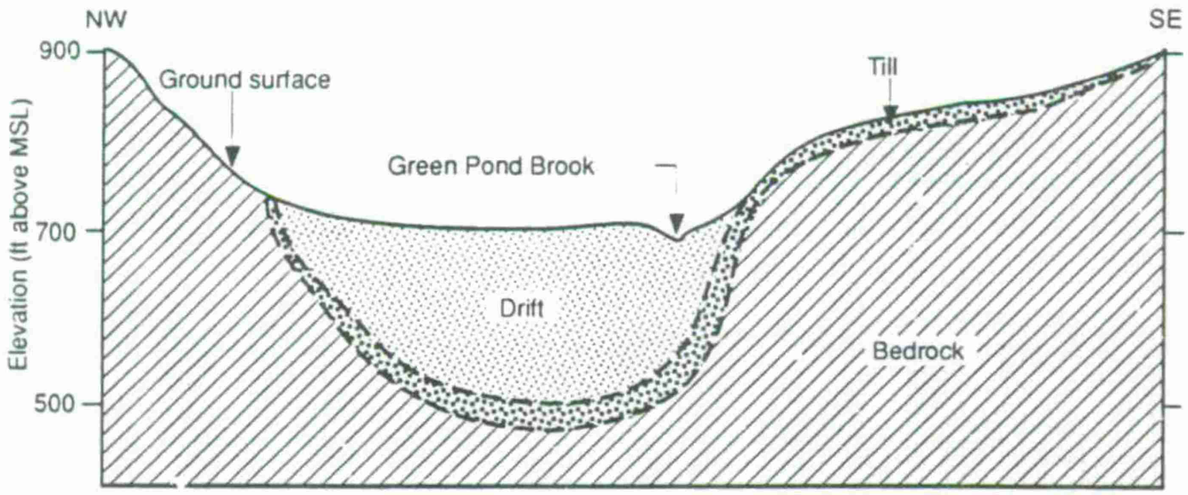


**FIGURE 2.3 Generalized Cross-Section Showing the Surficial Deposits and Bedrock Southwest of Picatinny Lake (Sources: Adapted from Wingfield 1976; Vowinkel et al. 1985)**

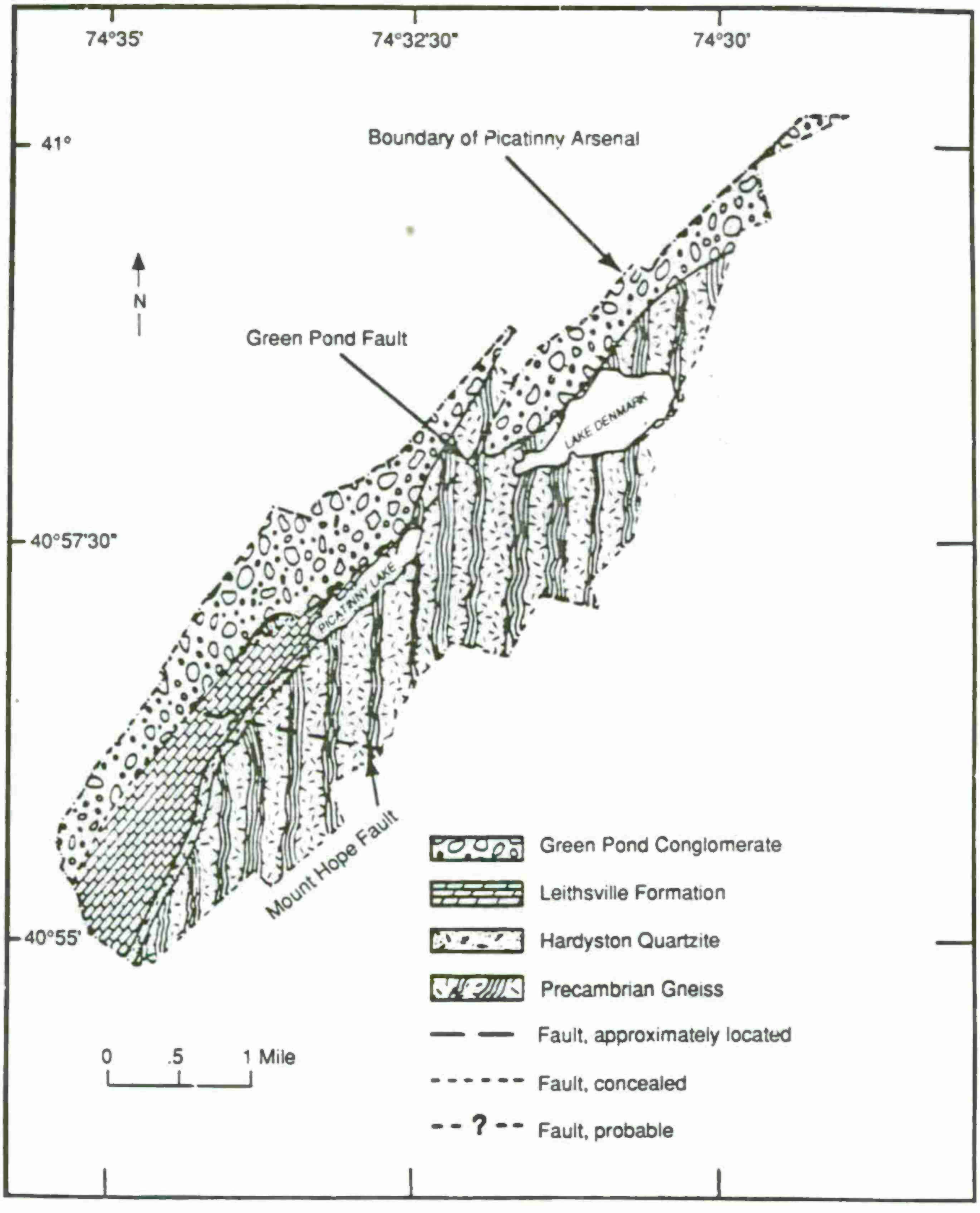


**FIGURE 2.4 Generalized Bedrock Geology of Picatinny Arsenal (Source: Adapted from Vowinkel et al. 1985)**

Mount Hope Mine shafts indicate little rotation of the fault, with little difference in its attitude and displacement between the surface and a depth of 2,100 ft. The net slip is about 300 ft. The fault in the mine workings is a brecciated and shattered zone 20-30 ft wide. Sims (1958) reported that the fault is very permeable and that a flow of several hundred gallons per minute will develop when the surface is intersected by a mine working. No evidence of this fault exists on the ground surface.

#### 2.3.2.1 Bedrock

PTA is underlain by four bedrock formations ranging in age from Precambrian to Silurian. Throughout most of the area, especially in the valley, the bedrock is obscured by unconsolidated glacial till and stratified drift deposits of varying thickness (Vowinkel et al. 1985). A terminal glacial moraine occurs at the southwestern boundary of the arsenal (Vowinkel et al. 1985). Table 2.2 presents descriptions of rock units found in the vicinity of PTA.

The bedrock units and unconsolidated glacial deposits in the PTA area are gneiss and other metamorphic rocks (Precambrian), Hardyston quartzite (Cambrian), Leithsville dolomite (Cambrian), Green Pond Conglomerate (Silurian), and till and stratified drift (Pleistocene).

The hornblende granite and associated alaskite of Precambrian-age is the oldest basement unit, which is exposed at the southeastern entrance to the arsenal (Puffer 1980). The granite is pinkish to greenish buff, with a distinct gneissoid structure. It is composed principally of microperthite, quartz, hornblende, and plagioclase and has small amounts of magnetite, ilmenite, apatite, zircon, biotite, and fluorite (Puffer 1980). Numerous xenoliths and pemalites are present. The granite is mapped as an alaskite, with a mafic mineral content of less than 5% (by volume), and the alaskite facies is closely associated with magnetite ore deposits (mined east of PTA).

The Hardyston quartzite is a lower Cambrian fine- to medium-grained, white to dark-gray, thin- to medium-bedded, feldspathic quartzite interbedded with arkose, quartz-pebble conglomerate, and silty shale or phyllite. The lower contact with the Precambrian granite is generally unconformable and abrupt. Thickness of this unit ranges from 0 to 100 ft in New Jersey (Lyttle and Epstein 1987). The unit underlies a small area of the valley-fill glacial deposits and forms a narrow ridge on the eastern flank of PTA. It does not outcrop at PTA (Harte, Sargent, and Vowinkel 1986).

The Leithsville Formation is an Early to Middle Cambrian formation that consists of dolomite with some thin beds of quartz and dolomitic sandstone. Mud cracks, ripple marks, and graded beds are common in this formation (Wolf 1977). The lower contact is gradational with the underlying Hardyston quartzite. The Leithsville Formation underlies a large area of the valley fill deposits and outcrops on the western shore of Picatinny Lake (Harte, Sargent, and Vowinkel 1986).

The Leithsville Formation is subdivided into three members: the Wallkill, Hamburg, and Califon. The Califon member, which is the basal Leithsville unit, averages

**TABLE 2.2 Generalized Stratigraphic Sequence and Associated Geohydrology of Rock Units at PTA**

| Geologic Era and Stratigraphic System and Series | Geologic Unit | Max. Thickness (ft) | Lithology | Geohydrology |
|---|---|---|---|---|
| Cenozoic era, Quaternary system: | | | | |
| Holocene series | Alluvium | 10 | Ranges from sandy loam in the valley to stony gravel on hillsides | Too thin to be tapped |
| | Swamp deposits | 30 | Black, brown, and gray organic material | High permeability along organic layers |
| Pleistocene series | Stratified drift | 200+ | Present as glaciofluvial and glaciolacustrine deposits; mostly sand- to clay-size sediments; exhibits stratification and some rhythmic lamination | Yields depend on sorting and grain size; well-sorted, coarse-grained deposits are good aquifers and yield up to 2,200 gal/min; clay and silt deposits are generally unsuitable as aquifers |
| | Unstratified drift | 100+ | Present as ground, terminal, and recessional moraine; deposits are generally tightly packed and poorly sorted; grain sizes range from boulders to clay | Yields depend on sorting and packing, generally low yields |
| Paleozoic era: | | | | |
| Silurian system | Green Pond conglomerate | 1,500+ | Unconformity: coarse quartz conglomerate interbedded with and grading upward into quartzite and sandstone; mostly massive and red, with some white and green beds | Generally yields small amounts of water from fractures and joints |
| Cambrian system | | | | |
| Middle series | Leithsville formation | 1,000+ | Unconformity: present mostly as light- to medium-gray, microcrystalline, locally stylolithic rock to fissile, siliceous to dolomitic micrite rock; often weathered to a medium-yellow silty clay | Contains water-bearing fractures and cavities that generally have moderate yields of up to 380 gal/min |

TABLE 2.2 (Cont'd)

| Geologic Era and Stratigraphic System and Series | Geologic Unit | Max. Thickness (ft) | Lithology | Geohydrology |
|---|---|---|---|---|
| Cambrian (cont'd) Lower series | Hardyston quartzite | 200 | Gradational: orthoquartzite to conglomerate, generally well indurated | Generally few fractures; yields small amounts of water |
| Precambrian era: | Alaskite | | Medium- to coarse-grained predominantly granitoid gneiss composed principally of microperthite, quartz, and oligoclase; includes local bodies of microantiperthite granite and granite pegmatite; amphibolite inclusions are common | Groundwater occurs in fractures and joints; yields are generally low, ranging from 26 to 75 gal/min |
| | Hornblende granite | Basement | Medium- to coarse-grained predominantly granitoid gneiss composed principally of microperthite, quartz, oligoclase, and hornblende; includes local bodies of biotite granite, hornblende granite gneiss, granodiorite, and granite pegmatite, amphibolite inclusions are common | Groundwater occurs in fractures and joints; yields are generally low, ranging from 26 to 75 gal/min |
| | Biotite-quartz-feldspar gneiss | | Varying composition of medium- to coarse-grained gneiss, predominant facies is composed of biotite, quartz, and oligoclase; minor facies are characterized by abundant garnet and microperthite, with local sillimanite and graphite | Groundwater occurs in fractures and joints; yields are generally low, ranging from 26 to 75 gal/min |

Sources: Sims 1958, Plate 1; Gill and Vecchioli 1965, Table 3; Vowinkel et al. 1985, as modified from Drake 1969, Table 20.

100 ft thick and is a light- to dark-gray, dense, fine- to medium-grained megacrystailine, locally laminated dolomite. The Hamburg member, 35-100 ft thick, is a dark- to light-gray, fine- to coarse-grained sandstone, siltstone, shale, and dense conchoidal-breaking dolomite. Overlying the Hamburg, the Wallkill member is a dark, gray, patchy dolomite with an estimated thickness of 350-500 ft (Markewicz and Dalton 1980).

The Green Pond Conglomerate is Upper Silurian in age, the youngest bedrock unit at the arsenal. Green Pond Mountain is composed primarily of this formation. This conglomerate is made up of gray and reddish-gray sandstone and conglomerate with predominantly white quartz and minor gray, green, red, and yellow chert; red shale; and red sandstone cobbles. The lower contact is separated from the Leithsville by the Green Pond fault. Conglomerate thickness varies from 984 to 1,394 ft (Lyttle and Epstein 1987).

#### 2.3.2.2 Unconsolidated Sediments

Unconsolidated glacial deposits cover much of the bedrock throughout the New Jersey Highlands area. During the Pleistocene series, glaciers advanced from the north to cover much of the Highlands. During the last glacial stage, the Wisconsin, the glaciers only extended as far south as PTA. Evidence of this is noted by the 25- to 40-ft-high terminal moraine at the southeast corner of PTA. A recessional moraine is also located just south of Picatinny Lake (Harte, Sargent, and Vowinkel 1986).

As the glacial front retreated, the mountains and valleys became covered with a great variety of glacial till and stratified drift deposits; streams and lakes developed, depositing stratified sediments in the valley. These deposits, composed of interbedded layers of sand, silt, and clay, are formed under depositional environments different from the unstratified clay, silt, sand, gravel, and boulder till deposits.

At PTA, the drift thickness varies from 80 ft near Picatinny Lake to more than 185 ft at the southwestern boundary (Vowinkel et al. 1985). In general, the sediments become finer toward the southwest, where varved silts and clays of lacustrine origin are present.

The unstratified clay, silt, sand, gravel, and boulder till deposits are generally less than 25 ft thick where slopes are steep. The highland along the southeast side of the valley is covered with till 10-25 ft in thickness (Sargent 1988). The moraine contains generally poorly sorted and tightly packed sand or gravel in a silty clay matrix.

Test drilling at PTA by the USGS during the mid-1980s has shown that the bedrock is deeper than 125 ft below the ground surface. Vowinkel et al. (1985) report that a boulder bed was encountered while drilling the cafeteria well cluster, wells 242-245 (Fig. 2.5). Wells 129 and 130 (Fig. 2.6), drilled by Layne-NY in 1948, were originally thought to be screened at the top of the bedrock surface at about 125 ft below the ground surface (Vowinkel et al. 1985). However, the deep well at the cafeteria cluster indicated that wells 129 and 130 were actually terminated above a boulder bed more than 40 ft thick in some areas.

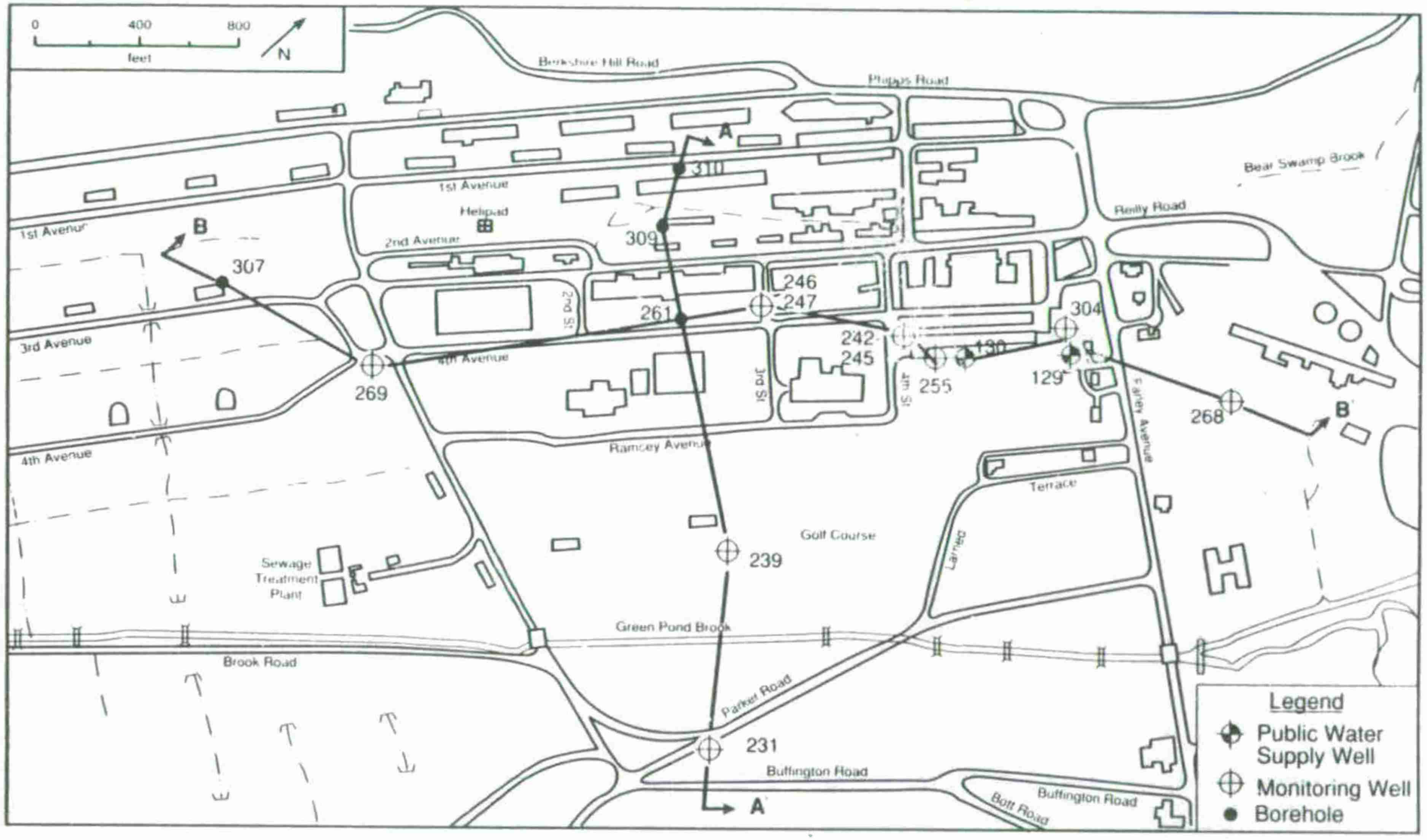


**FIGURE 2.5 Locations of Hydrogeologic Sections A-A' and B-B' in the Central PTA Area (Source: Adapted from Vowinkel et al. 1985)**

## 2.4 HYDROLOGY

### 2.4.1 Surface Water

Surface waters at PTA consist of lakes, ponds, reservoirs, enclosed basins, and drainageways (Fig. 2.6). The major surface drainage within PTA is from the northeast to southwest. The direction of flow is controlled by topographic elevations that border PTA on the east and west. A minor amount of the surface runoff flows in an easterly direction near building areas 3000 and 1500 and east of Lake Denmark Road. Although the annual precipitation is between 45 and 48 in., the annual runoff is about 25 in. (Wingfield 1976).

Two man-made lakes, Lake Denmark (174 acres, 331 million gal/d storage capacity) and Picatinny Lake (108 acres, 165 million gal/d storage capacity), are located within PTA. Lake Denmark is in the northern sector at an elevation of about 840 ft above MSL. The lake has a maximum length of 7,000 ft, with depths to 20 ft (Wingfield 1976). An extensive marsh borders the lake on the northeast. Both lakes are used for industrial water supply and recreation. A power generating station is located on the southwestern edge of Picatinny Lake (Vowinkel et al. 1985).

Picatinny Lake, located almost in the center of PTA, is elongate in shape with an overall length of over 1 mi, an average width of 1,000 ft, and a maximum depth of 20 ft (Wingfield 1976). Burnt Meadow Brook drains Lake Denmark and discharges into Green Pond Brook, which then flows into Picatinny Lake.

The major drainageways at PTA are Green Pond Brook and two of its tributaries, Burnt Meadow Brook and Bear Swamp Creek. Many small drainageways also occur throughout PTA. Green Pond Brook originates from Green Pond, north of the Arsenal; enters PTA 1.5 mi southeast of Green Pond; and flows southeasterly to the junction with Burnt Meadow Brook (Wingfield 1976). From this junction, Green Pond Brook flows southwest into Picatinny Lake; 3,400 ft south of the lake, the brook receives surface drainage originating at the intersection of Lake Denmark and Belt roads near the eastern boundary (Wingfield 1976). The elevation in the vicinity of this intersection is 900 ft above MSL (Wingfield 1976). After passing under First Street, Green Pond Brook flows through a large lowland (less than 700 ft above MSL) before exiting PTA at the southern boundary. Artificial drainage channels have been cut in the lowland. Green Pond Brook empties into the Rockaway River near the town of Wharton, about 1.5 mi southeast of PTA (Wingfield 1976).

Green Pond Brook flows through the center of PTA, and the terrain provides natural storm drainage for most of the developed areas; thus, relatively few storm sewers are required except in the comparatively flat southern part of PTA (Wingfield 1976).

Green Pond Brook is the outlet of Picatinny Lake and a tributary of Rockaway River (Vowinkel et al. 1985). The river discharges into the Boonton Reservoir, which is the source of water for Jersey City (Vowinkel et al. 1985). The reservoir at the rocket test area (Site 1) is also fed by two small brooks, which depend on natural drainage from

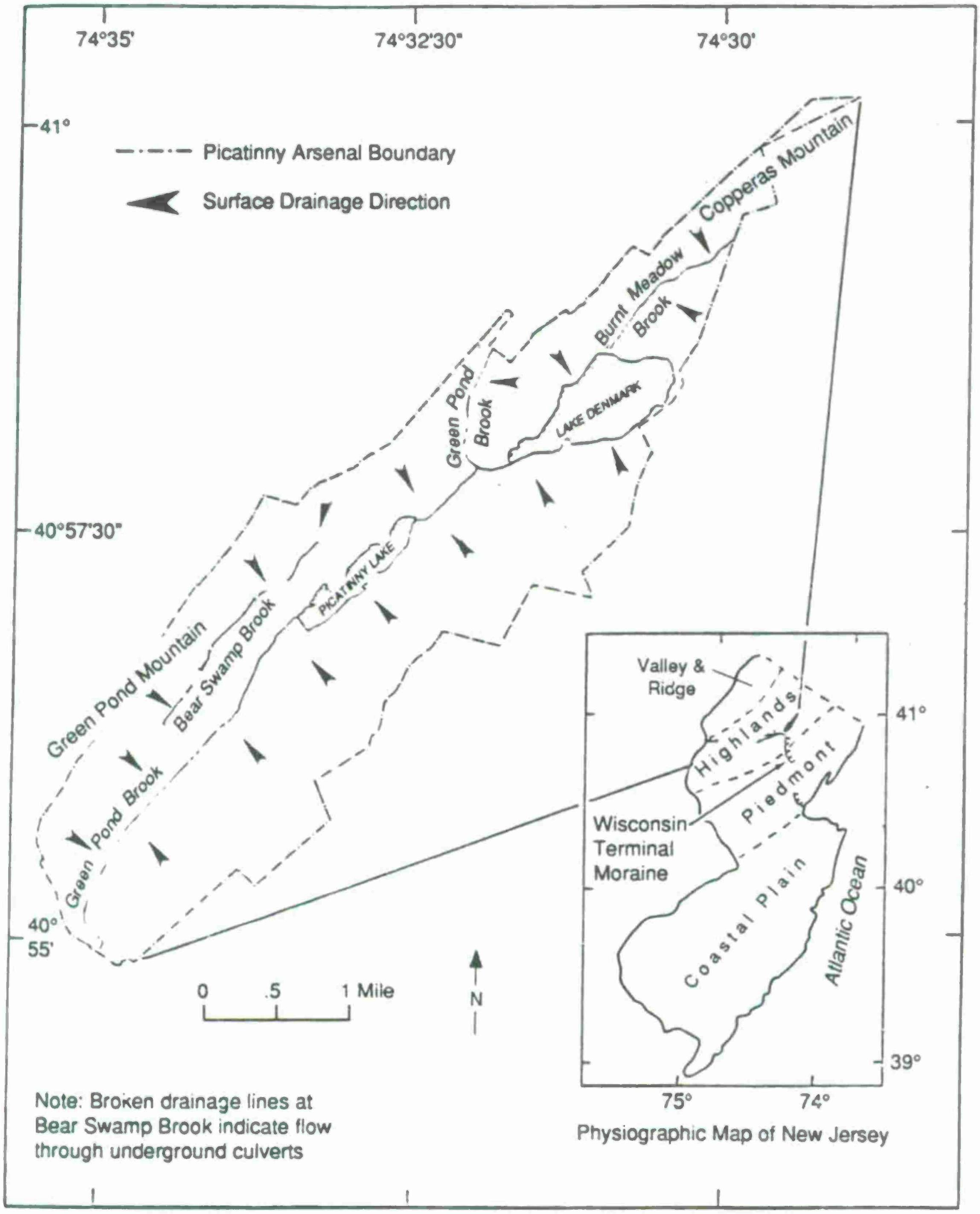


**FIGURE 2.6 Surface-Water Drainage Patterns at Picatinny Arsenal (Source: Adapted from Sargent 1988)**

the surrounding area (Wingfield 1976). There are two gaging stations on Green Pond Brook that have been in operation since November 1982. The mean daily discharges at the upper and lower gages were 38.4 and 68.2 $ft^3/s$, respectively, for the calendar years 1983 and 1984. Base flow discharge data collected on October 5, 1982, and September 10, 1984, indicate that Green Pond Brook is a gaining stream between the outlet at Picatinny Lake and the lower gaging station (Vowinkel et al. 1985).

Burnt Meadow Brook originates northeast of PTA, flows through a marsh near the base of Copperas Mountain, and discharges into Lake Denmark. Burnt Meadow Brook emerges from Lake Denmark and joins Green Pond Brook some 1,200 ft south of the lake (Wingfield 1976).

Several streams discharge into Green Pond Brook. The largest is Bear Swamp Brook, which originates from a spring near the top of Green Pond Mountain and flows through a series of culverts and underground piping systems before discharging into Green Pond Brook. Flow in Bear Swamp Brook is controlled by two weirs that create a pond where the stream makes a 90-degree bend in the direction of Green Pond Brook. To help control flooding, several drainage pipes discharge storm water into Bear Swamp Brook (Vowinkel et al. 1985). In addition, treated wastewater from Bldg. 24 was discharged into the brook. Base flow measurements indicate that the flow in Bear Swamp Brook is about 0.4 $ft^3/s$ just downstream from Bldg. 24. Water levels and base flow measurements indicate that Bear Swamp Brook is a losing stream in the area of Bldg. 24.

### 2.4.2 Groundwater

Three principal aquifers have been identified at PTA: an unconfined stratified drift or water table aquifer, a confined glacial aquifer, and a bedrock aquifer. The water table aquifer occupies unconsolidated deltaic silts, clays, sands, and gravels at the surface. The confined glacial aquifer is made of sublacustrine sand and gravel, which is separated from the water table aquifer by the lake bottom fine sand and silt. The lake bottom fine sand and silt layer acts as a leaky confining bed. Groundwater movement in the bedrock aquifer depends on the secondary porosity provided by solution channels and fractures. The leaky confining beds are not continuous, and all the aquifers are interrelated and act as one system (Vowinkel et al. 1985). Table 2.3 summarizes hydrologic characteristics of northeastern glacial-aquifer systems.

The USGS performed a detailed evaluation of groundwater conditions in the areas of Bldgs. 24 and 95 in 1985 (Vowinkel et al. 1985). As seen in the hydrogeologic sections of the area (Figs. 2.5, 2.7, and 2.8), the top of the water-table aquifer generally lies within 15 ft of the ground surface and occupies the upper 35 ft of the valley (Vowinkel et al. 1985). The water-table aquifer is continuous throughout most of the central PTA area and is separated from the confined aquifer by a leaky confining bed up to 150 ft thick (Fig. 2.8) (Vowinkel et al. 1985). Northwest of Bldg. 24, another leaky clay bed about 5-15 ft thick is found at a depth of 5 ft (Vowinkel et al. 1985). Figure 2.9 shows the approximate areal extent of the clay bed.

Water-level fluctuations at selected water-table wells were measured in 1983 and 1984 by Vowinkel et al. (1985) near Bldgs. 24 and 95 in areas located in the general

**TABLE 2.3 Selected Hydrologic Characteristics of Northeastern Glacial-Aquifer Systems**

| Characteristic | Range |
|---|---|
| Hydraulic conductivity | |
| Aquifer material | 1-13,300 ft/d |
| Silt and clay | 0.0001-1 ft/d |
| Till | 0.00001-30 ft/d |
| Streambed material | 0.03-120 ft/d |
| Fractured bedrock | <0.5-710 ft/d |
| Storage coefficient | |
| Confined sand and gravel | 0.0001-0.01 |
| Unconfined sand and gravel | 0.05-0.35 |
| Fractured bedrock | 0.00001-0.12 |
| Recharge from precipitation | 0.2-31 in./yr |
| Groundwater evapotranspiration | 1-9 in./yr |

Sources: Lyford et al. 1983; Vowinkel et al. 1985.

direction of flow from Green Pond Mountain toward Green Pond Brook. The water levels indicate significant seasonal fluctuations and suggest changes in hydraulic gradient. The magnitude of the water-level fluctuations depends on the distance of the well from the mountain slope and from surface water bodies such as Green Pond Brook or swampy areas. Water levels in wells in the vicinity of Bldg. 24 showed greater seasonal fluctuations than those in wells near Bldg. 95. Wells along the perimeter of the valley compared with wells in the center of the valley have much larger water-level fluctuations after rainfall events, which recharge the wells from the mountains (Vowinkel et al. 1985).

Groundwater flow within the water table and confined glacial aquifers is essentially horizontal, moving east toward 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. 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. (See Sec. 23.2 in Volume 2 for more discussion on the potentiometric surfaces of the water table, confined glacial, and bedrock aquifers in the central valley area.)

The confining bed separating the water-table aquifer and the middle aquifer is not continuous and appears to be thinner and leakier between wells 129 and 130. The confining bed increases in thickness from well 129 to well 246, as the thickness of the confined glacial aquifer decreases. The confining bed becomes finer grained and less

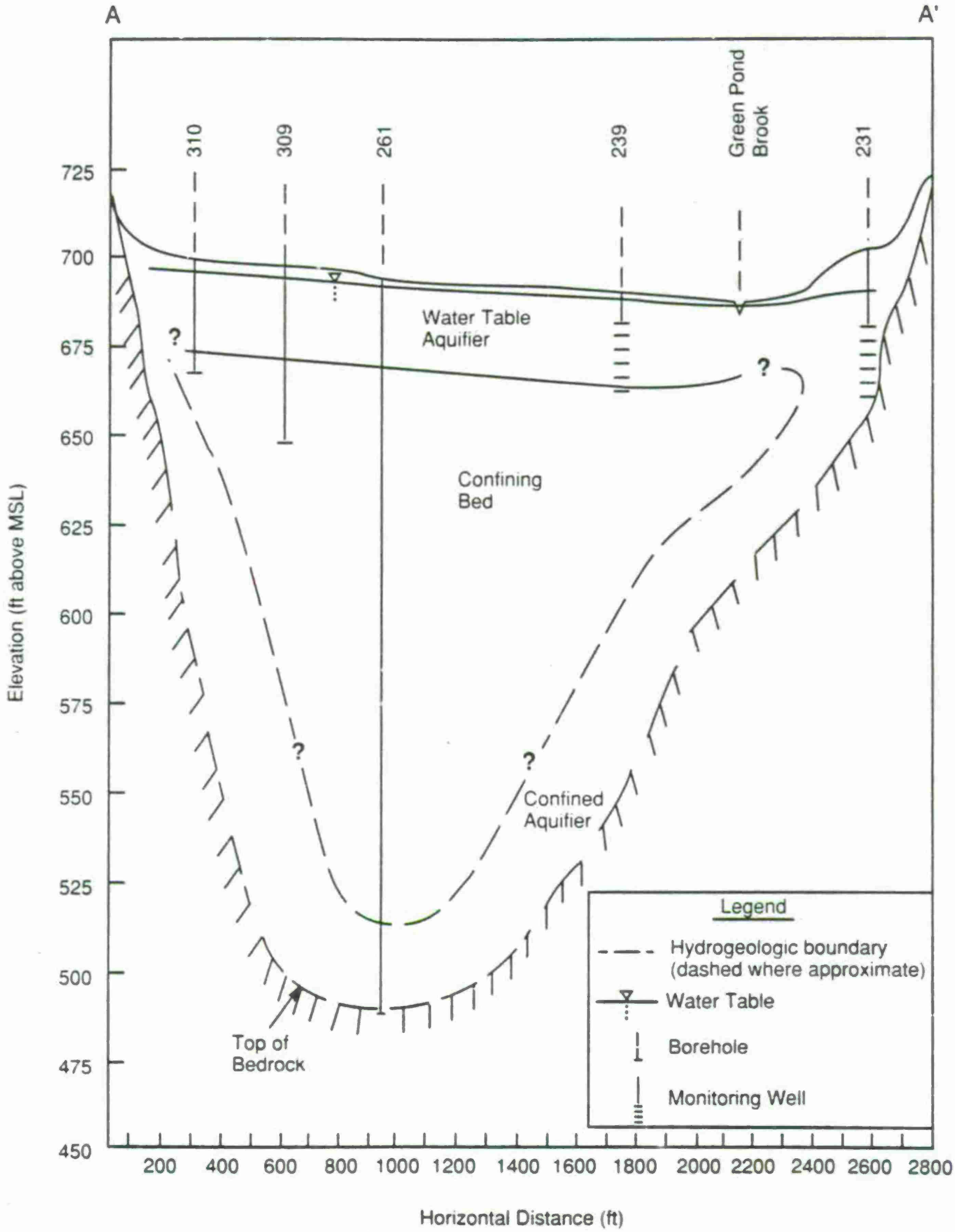


**FIGURE 2.7 Generalized Hydrogeologic Section A-A' (Source: Adapted from Vowinkel et al. 1985)**

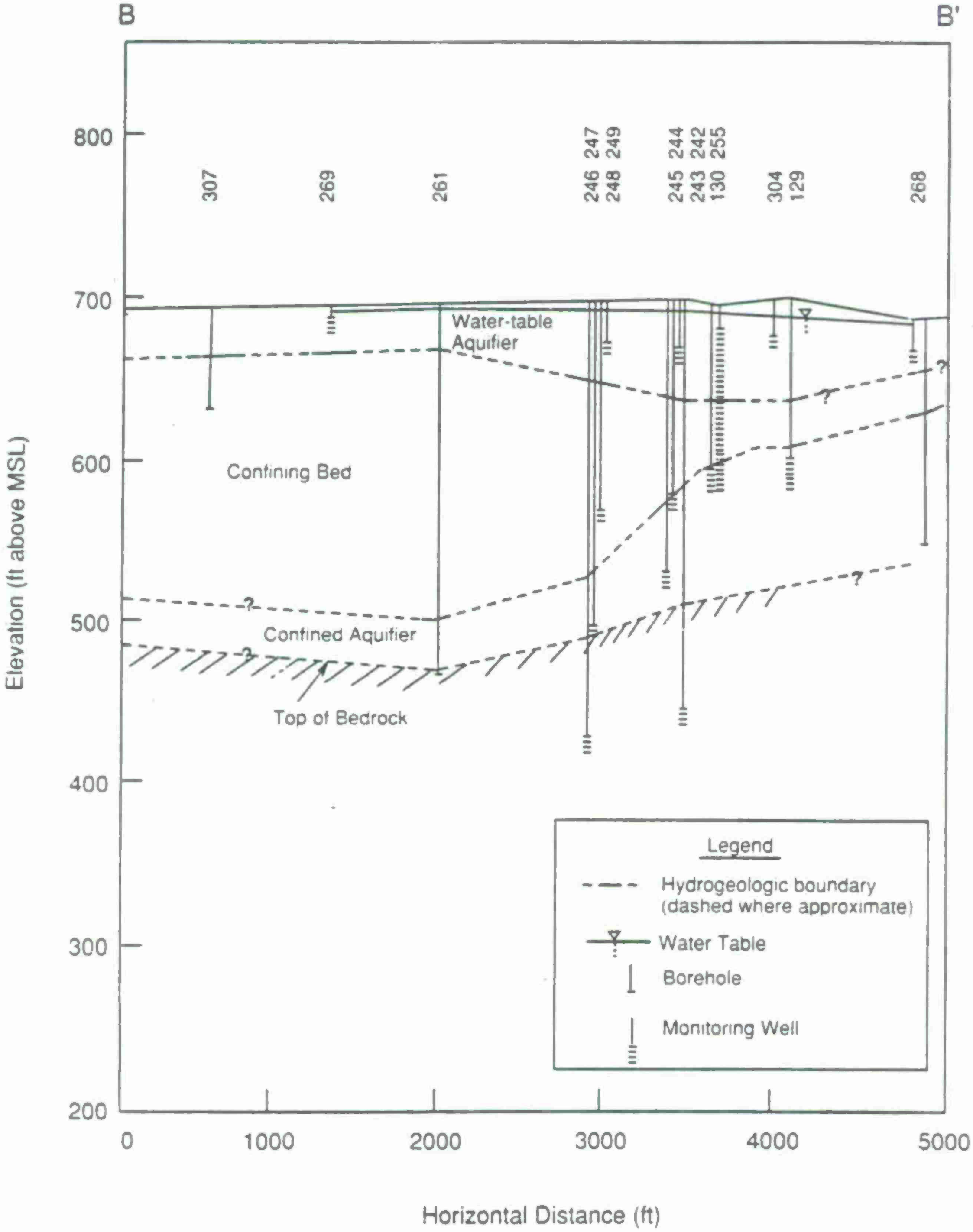


**FIGURE 2.8 Generalized Hydrogeologic Section B-B' (Source: Adapted from Vowinkei et al. 1985)**

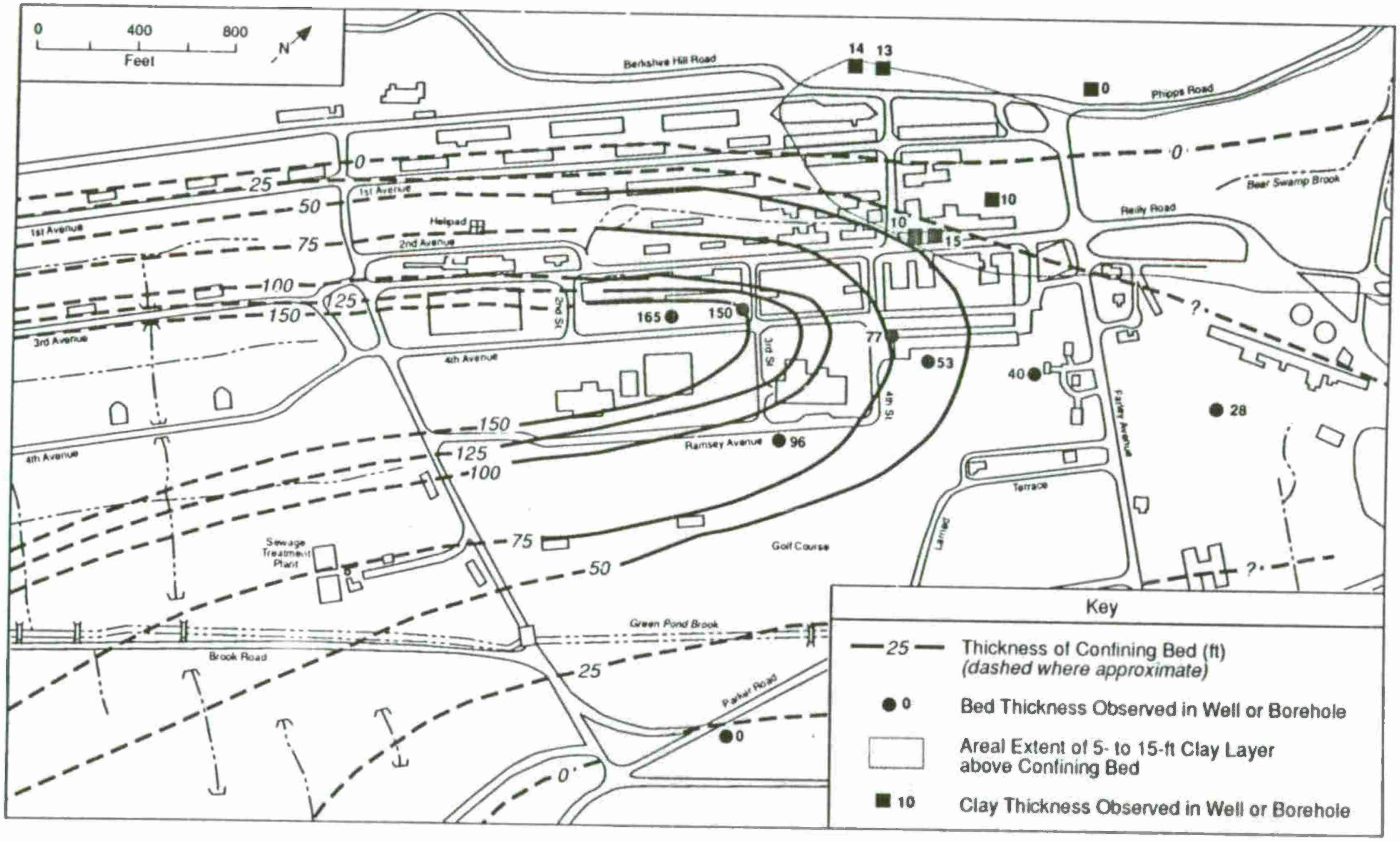


**FIGURE 2.9 Thickness of the Confining Bed and Areal Extent of a Shallow 5- to 15-ft Clay Bed in the Central PTA Area (Source: Adapted from Vowinkel et al. 1985)**

leaky toward the southwest. Analysis of a test hole and of aquifer test data indicate that the areal extent of the confining bed is limited (Vowinkel et al. 1985).

The confined glacial aquifer is the source of most PTA drinking water. Specific capacities of this aquifer vary depending on the location. Wells 129 and 130 are large-diameter wells with specific capacities of about 19 and 13 gal/min per foot of drawdown, respectively (Vowinkel et al. 1985). Aquifer tests indicate transmissivities in the confined aquifer range from about 7,600 $ft^2/d$ at well 243 to 6,600 $ft^2/d$ at well 130 (Vowinkel et al. 1985).

The detailed studies for the area of Bldgs. 24 and 95 generally reflect what is currently known about groundwater movement at the PTA. Vertical gradients in the unconsolidated deposits are generally downward on the sides of the valley and upward near Green Pond Brook. Minor flow variations appear to exist near Bear Swamp Brook, Robinson Run, and Ames Brook, but overall the flow is generally toward Green Pond Brook from both the east and west. Zones of the greatest vertical component of flow generally are upward, reflecting recharge from the hillsides. The range of measured head differences between the bedrock aquifer and the confined glacial aquifer is small, indicating that some limited flow exists between these aquifers (Sargent 1988).

Wells located outside 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 Quaternary aquifer of the Rockaway River Basin.

Hydrographs show that water levels in all the aquifers are influenced by natural hydrologic changes and by pumping (Vowinkel et al. 1985). Measurements made in wells at the cafeteria well cluster, wells 242-245 (Fig. 2.5), showed that water levels in the confined glacial and bedrock aquifers are significantly affected by pumping, whereas water levels in the water-table aquifer are less affected (Vowinkel et al. 1985). Water levels are low in the fall and high in the spring. Under stressed conditions, the natural heads in the aquifer indicate a downward component from the water table to the confined aquifers, but the head difference is generally less than 2 ft. During stressed conditions, drawdown in the confined glacial aquifer is about 5 ft at well 244. At the same time, the drawdown at well 243 is less than 0.25 ft, increasing the hydraulic gradient to over 6 ft. As a result, flow from the water-table aquifer to the confined aquifer has increased significantly because of pumping (Vowinkel et al. 1985).

A weathered bedrock zone separates the confined glacial aquifer from the bedrock aquifer and acts as a leaking confining bed. The maximum known thickness of weathered bedrock is 60 ft in the central PTA area (Vowinkel et al. 1985). Within the bedrock aquifer, water is available from fractures and solution cavities that have been enlarged by weathering (Vowinkel et al. 1985). The bedrock aquifer beneath the study area can potentially supply moderate quantities of water.

## 2.5 ARSENAL ACTIVITIES

### 2.5.1 Introduction

The history of PTA shows that many types of activities were carried out over a long period of time. These activities have included production, research, and development of many kinds of munitions, propellants, and explosives. Along with these activities are various support activities such as land management, building and roads upkeep and management, and provision of medical and fire-fighting services.

These activities, going back more than 100 years, are expected to have had some impact on the environment by contaminating soil and water at various locations in and around the Arsenal. Information on the types and amounts of chemical and nuclear materials used at the arsenal in various periods and at different locations gives some indication of the types and amounts of expected contaminants.

Sources of historical information for PTA include production and use records, waste-generation records, inventories, permit applications, and records of interviews with Arsenal personnel. The following sections offer a brief description of the Arsenal history, a listing of some of the chemicals used at the Arsenal, and a discussion of the use of nuclear materials. The discussion here is general and applies to the Arsenal as a whole; in later sections, the discussions become Site-specific within the Arsenal.

### 2.5.2 History

Picatinny Arsenal was established as a powder works in 1880, with the purchase by the U.S. government of 1,866 acres in the Denmark and Middle Forge tracts for $62,750. The facility was designated the Dover Powder Depot for four days; on September 10, 1880, the name was changed to the U.S. Powder Depot. The final name change, to Picatinny Arsenal, occurred in October 1907 (War Plans Division 1931).

The first building erected at the Depot was a 200-ft by 50-ft magazine with a 6-ft basement. The building, which was completed in 1881, was designed to store black powder. The use of this building was part of the original purpose of the powder depot, which was the storage, preparation, and issue of powder, projectiles, and explosives. In 1891, 315 acres of the Arsenal was transferred to the U.S. Navy for the construction of magazines. In 1897, cartridge bag manufacture and loading of charges was begun at the Arsenal. The first production activity at Picatinny, propellant charge loading, began a few years before the Spanish American War with the assembly of powder charges for cannon. By 1900, the need for a storage area for armor-piercing projectiles and high explosives became evident. Six projectile sheds were erected in 1903, followed in 1904 by the construction of a plant for filling projectiles with Explosive "D" (ammonium picrate). In 1906, buildings and machinery for the capping, grooving, tapping, and banding of fixed ammunition were installed. A building constructed for assembly of fixed ammunition was used temporarily as a chemical laboratory and later as a high-explosives plant (War Plans Division 1931; USATHAMA 1976).

A factory for the manufacture of powder for large munitions began operations in January 1908. The capacity of the plant was 3,000 lb of cannon powder per 24-h working day. Later in 1908, the factory was expanded to include manufacture of 30-caliber small arms powder, creating an additional capacity of 250-300 lb of powder per day. In 1909, the capacity of the factory was increased to 9,000 lb of powder per day -- or about 2,750,000 lb per year. A new factory with a capacity of 1,000 lb of Explosive "D" per day was built in 1913. At the beginning of WWI, Picatinny was producing all sizes of propellants, from 30-caliber ammunition for rifles to 16-in. shells for coastal artillery guns (War Plans Division 1931; USATHAMA 1976).

During the Arsenal's early period of operation, other activities were started. In 1911, a school for training in interior ballistics, chemistry, and explosives was established. Chemical and physical laboratories for the testing and control of manufacturing processes and equipment research were established in conjunction with manufacturing operations (War Plans Division 1931).

Shortly before the U.S. entered WWI, manufacture of smokeless powder was increased at Picatinny. During that war, the need for considerable storage space for powder, explosives, and other components became evident. Accordingly, 54 magazines were constructed at the Arsenal. At the end of the war, the manufacture of smokeless powder at PTA was discontinued because of the large quantities of powder on hand. New operations included the melt-l ading of projectiles and the manufacture of pyrotechnic signals and flares. Plants were also built for the experimental manufacture of modern propellants, high explosives, fuzes, and metal components. This activity included the study of raw materials, military pyrotechnics, and trench warfare materials; a plant for loading trinitrotoluene (TNT), and amatol into bombs and projectiles was also established. In 1921, the Arsenal took over all experimental work on fuses (War Plans Division 1931; USATHAMA 1976).

During a thunderstorm on Saturday afternoon, July 10, 1926, at about 5:15 PM, lightning struck in the Lake Denmark Naval Depot at or near a magazine containing more than 1,000,000 lb of cast TNT. A fire started in the magazine, which detonated about five minutes later. An adjoining magazine blew up five minutes later, blowing steel girders 5,000 ft away and wooden beams to a reported distance of up to 3.5 mi. A third explosion occurred at 5:45 PM with the detonation of a shellhouse. These explosions created three large craters, started many fires in other magazines and buildings, and destroyed many of the buildings at Picatinny. Eighteen people were killed. The total amount of explosives detonated in the three explosions was about 2,400,000 lb (War Plans Division 1931; Hatcher 1962).

Following the explosion, the Arsenal was rapidly cleaned up and rebuilt. In 1931, Picatinny Arsenal was the U.S. Army Ammunition Arsenal for the loading of bombs and projectiles, the manufacture and loading of all types of pyrotechnics and smokeless powder, the assembly of all fixed ammunition larger then 50 caliber, and the performance of chemical laboratory services for the ordnance department (War Plans Division 1931).

Before WWII, most of the pilot plant operations at Picatinny were enlarged to assembly line production. At the time of the Japanese attack on Pearl Harbor, PTA was the only facility in the United States capable of making large amounts of ordnance needed for the war. During the war, PTA production activities employed 7,000 personnel around the clock seven days a week. Large amounts of many different types of munitions and explosives were produced during the war, as shown in Table 2.4, which gives the amount of explosives produced in 1943, 1944, and later years (USATHAMA 1976; Gaven 1986, Attachment W [dated 1982]).

During the Korean War, the Arsenal employed 3,000 personnel. Large amounts of explosives (Table 2.4) were produced for the war effort. Some production of war materiel was carried out during the years between the Korean and Vietnamese wars. Production records for the calendar years 1957 to 1959 list many types of mines, shells, fuses, high-explosive castings and rockets, flash smokeheads for rockets, wafer bombs, and JATO units. Some nitroglycerin was also produced (Table 2.4). The Arsenal contributed to the development of some nuclear weapons such as artillery shells and the Davy Crockett in the 1950s. Design and development work on warheads for several army missiles such as the Nike family, the Hawk, Redstone, Corporal, Sergeant, Littlejohn, Honest John, SAM-D, Lance, and Safeguard was carried out at the Arsenal (USATHAMA 1976; Gaven 1986, Attachments A and W).

During the Vietnam War, production of nitroglycerin continued. as did the use of loading facilities that were essential for pilot plant production. The Arsenal contributed to the war by the development of Beehive ammunition of different calibers, mines that were dispersed from low-flying helicopters, and unique explosive systems for destroying tunnel networks. At the present time, research and development work on both nuclear and nonnuclear weapons is continuing at the Arsenal. The R&D applications include artillery, infantry, vehicle and aircraft weapons; demolition munitions; mines; bombs; grenades; pyrotechnic systems; rocket-assisted projectiles; flares; chemical systems/materials; and fuses (USATHAMA 1976; Foster Wheeler 1987a, Attachments A and W).

### 2.5.3 Chemicals Used at the Picatinny Arsenal

An exhaustive listing of all the chemicals used at the Arsenal throughout the 100-year period of active operations is impossible because appropriate records are not available for most of the years of operations. However, it is probably a reasonable assumption that a listing of chemicals used in recent years of operation includes most of the chemicals used in earlier operations. The pattern of growth and expansion in the chemical industry suggests that many chemicals used in earlier years were also used in recent operations. Also, the shift in emphasis at Picatinny from production to research and development in recent years implies that more types of chemicals would be used (in smaller amounts) than were used in the earlier production phase.

Lists of some of the chemicals used at PTA is given in App. A. The list has been generated from several sources such as pesticide inventories, hazardous-waste listings, recorded interviews with Picatinny personnel, information on production processes for explosives, and supporting documents for RCRA permit applications.

**TABLE 2.4 Annual Amounts of Explosives Produced at Picatinny Arsenal from 1943 to 1970 (lb/yr)[a]**

| Explosive Materials[b] | 1943 | 1944 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 |
|---|---|---|---|---|---|---|---|---|---|
| Smokeless powder | 7,920,000 | 6,150,000 | | 1,100,000 | 40,000 | 28,089 | | | |
| Tetryl | 1,536,000 | 1,080,000 | | | | | | | |
| EDNA | 12,000 | 10,000 | | | | | | | |
| Boosters | 2,820,000 | 1,400,000 | | | | | | | |
| Primers | 7,430,000 | 5,250,000 | | | | | | | |
| Detonators | 25,550,000 | 11,609,000 | | | | | | | |
| Demolition blocks | | | | 10,000 | | | | | |
| C-4 composition | | | | 800,000 | 600,000 | | | | |
| T-9 composition | | | 1,900,000 | 1,720,000 | | | | | |
| Igniters M-20 | | | 300,000 | 180,000 | 1,320,000 | 1,200,000 | | | |
| 60-mm mortar prop. powder | | | | | 120,000 | 120,000 | | | |
| Solvent powder | | | | | | | 140,000 | 138,000 | 240,000 |
| Nitroglycerin | | | | | 78,000 | 80,000 | 75,000 | 82,000 | 100,000 |
| Solventless powder | | | | | | | | | 1,800,000 |
| Other H.E. | | | | | 6,400 | 6,200 | 143,000 | 246,000 | 2,040,000 |
| P & E misc. | | | | | | | | | 28,000 |

| | 1956 | 1957 | 1958 | 1959-60 | 1961-62 | 1963-64 | 1965-66 | 1968-70 |
|---|---|---|---|---|---|---|---|---|
| Nitroglycerin | 98,000 | 102,000 | 95,000 | 90,000 | 92,000 | 95,000 | 88,000 | 80,000 |

[a]No production reported for 1945-1948.

[b]Only nitroglycerin produced during the period 1956 through 1970.

Source USATHAMA 1976.

### 2.5.4 Radioactive Materials at Picatinny Arsenal

Since the 1950s, research and development of nuclear weapons and other uses of radioactive materials have been carried out at several locations at PTA. In the past, some nuclear weapons components have also been manufactured at the Arsenal. Building 95 has been used for the manufacture of adaption kits for nuclear weapons components, and Bldg. 60 was the adaption kit laboratory. Effluent from etching and plating operations needed in the manufacture of nuclear weapons components was treated and discharged into a nearby stream. Cooling water was required for the operations carried out in Bldg. 60, which included the use of depleted uranium (DU) (USATHAMA 1976).

The Radiation Research Laboratory in Bldg. 3021 contains much of the radioactive material used at the arsenal. Materials stored or used there include several hundred curies (Ci) of tritium (H-3); more than 10,000 Ci of Co-60; several hundred pounds of U-238; curie amounts of Cs-137, Cf-252, and Pu-238; and smaller amounts of other radioactive materials. Other buildings containing multicurie amounts of radioactive materials include Bldg. 320 (H-3), Bldg. 64 (Pu-238), Bldg. 908 (Cf, Co-60), Bldg. 60 (H-3), Bldg. 3030 (H-3), Bldg. 221 (Co-60), Bldg. 620, (Cs-137), Bldg. 18 (H-3), and Bldg. 1090 (Co-60). Depleted uranium (DU or U-238) was used at many locations at the Arsenal. Uses included firing and detonation of DU-containing munitions; machining of DU-containing items; and research into mechanical, thermal, and corrosion properties of DU. A more complete list of past and present locations, uses, and quantities of radioactive materials used at PTA is given in App. B (USATHAMA 1976; Duncan 1990).

Much of the radioactive material is contained in sealed sources and containers. Some is kept in unsealed containers. All incoming shipments of radioactive material are received at the Bldg. 91 warehouse. Unwanted radioactive materials are sent to Bldg. 3018, sealed in drums, and removed in accordance with regulation AR 755-15 and 10 CFR 20. Radioactive waste is disposed of in compliance with Nuclear Regulatory Commission rules and regulations by the U.S. Army Materiel Command's central disposal authority, U.S. Army Armament, Munitions, and Chemical Command. Storage of radioactive waste in containers in a secure area of Bldg. 3021 and in Bldg. 84 was reported in a 1976 survey. There are no reported instances of radioactive material disposal on the Arsenal (USATHAMA 1976; USAEHA 1977; Ward 1988). Personnel from the PTA Safety Office reported during interviews in July 1976 that Bldg. 3018, which contains radwaste, and Bldg. 514, in which radwork occurred previously, may be contaminated (Gross et al. 1976).

Radioactive parameters proposed for analysis in the RI sampling plans include uranium at a few Sites where DU was used and gross alpha and gross beta at Sites for which there is a potential for radioactive contamination. Sites that show one or more samples with elevated gross alpha or gross beta contamination would require further analysis to determine which radionuclides are causing the contamination.

# 3 REGULATORY ASPECTS

## 3.1 BACKGROUND

The legal basis for applying both federal and state requirements or standards to remedial actions at federal facilities such as the Picatinny Arsenal resides in Secs. 120 and 121(d) of CERCLA, as amended by SARA. These sections require that remedial actions at federal facilities satisfy applicable or relevant and appropriate requirements (ARARs). For water, the ARARs are to be applied under the Safe Drinking Water Act (SDWA), Clean Water Act, and RCRA. For surface water or groundwater that is or may be used for drinking, the relevant and appropriate federal cleanup standards are the maximum contaminant levels (MCLs). If MCLs are not available for the chemical contaminants under consideration, then the EPA recommends use of the human health advisory levels. The EPA has determined that promulgated state cleanup standards are included in SARA as ARARs, even if they are more stringent than the federal standards (EPA 1987c).

Remedial actions at federal facilities are also covered by RCRA and HSWA. Sections 3004(u), 3004(v), and 3008(h) of HSWA give the EPA additional authority, beyond that provided by the RCRA, in carrying out corrective action programs. These programs apply to all closed, closing, or operating RCRA facilities. Also, the authority of the EPA to require corrective action for releases of hazardous constituents applies not only to groundwater releases from permitted units; its authority was extended to cover releases from all units to all environmental media. The current regulatory climate also encourages the use of other laws to obtain corrective action at federal facilities.

Sections 3004(u), 3004(v), and 3008(h) change the emphasis of the RCRA corrective action program from detection and correction of future releases from regulated units to cleanup problems resulting from past waste-management practices at RCRA facilities. Section 3004(u) stipulates that any permit issued after November 8, 1984, requires corrective actions for all releases from solid-waste management units at a facility. It also allows compliance schedules to be included in permits where corrective action cannot be finished before the permit is issued. Section 3004(v) directs the EPA to issue regulations requiring corrective action beyond a facility's boundaries whenever needed to protect human health and the environment. The necessary corrective action can be required before the regulations are promulgated. Section 3008(h) gives the EPA authority to issue enforcement orders to require corrective action or other response measures at interim status facilities (EPA 1986d).

Additional potentially relevant aspects of the HSWA and SARA are discussed, respectively, in Secs. 3.4 and 3.5 of this report. New Jersey soil action levels are discussed in Sec. 3.6.

## 3.2 WATER QUALITY CRITERIA

### 3.2.1 Federal

Table 3.1 gives the federal ambient water quality criteria for various chemicals. Sources for the table entries include EPA (1985, 1989) and 40 CFR 141. Some of the MCLs are included in the national primary drinking water standards (40 CFR 141), which are enforceable federal standards that are applicable to remedial action alternatives. Others are proposed or recommended values.

Recommended values that are not legally enforceable should also be considered in an analysis of remedial action alternatives. This includes the maximum contaminant level goals (MCLGs), which are included in SARA as potential ARARs. MCLGs are set at levels that cause no known or anticipated adverse health effects and allow for an adequate safety margin (EPA 1989). The MCLG is zero for all carcinogens. The Clean Water Act water quality criteria, which are also included in SARA as potential ARARs, are given for toxic effects and for carcinogenicity at a $10^{-6}$ lifetime-risk level. Criteria for different risk levels can be obtained as described in footnote e to Table 3.1. Organoleptic criteria are based on odor or taste, not on any health-based criteria. The 10-day and chronic health advisory criteria refer to exposure for a period of 10 days and continuous exposure, respectively.

The MCL values in Table 3.1 are supplied for only a few of the chemicals listed. This situation is expected to change in the next few years because amendments to the SDWA require that the EPA set MCL and MCLG values for 83 contaminants by June 1989. MCL values have been given (40 CFR 141) for some radionuclides, which were included in the list of 83 contaminants (EPA 1986b).

### 3.2.2 State of New Jersey

#### 3.2.2.1 Drinking Water

New Jersey has adopted the Federal National Primary Drinking Water regulations (given in the most current version of 40 CFR 141) as the New Jersey Primary and Secondary Drinking Water regulations. The adoption includes all requirements concerning siting, MCLs, monitoring, chemical analysis, reporting, public notification, and record keeping (New Jersey Administrative Code [NJAC] 7:10-5.1). MCLs for New Jersey are given separately in Table 3.2, as some of the regulated parameters and values are different from federal ones.

The national regulations allow the states discretionary authority to make certain changes in the regulations. Accordingly, New Jersey may allow a monthly average turbidity standard in MCL of up to 5 units at an entry to a water distribution system (a turbidity exception). The state also requires noncommunity water systems to perform nitrate measurements every three years or less. Community water systems (systems that serve at least 15 service connections that are used all year or serve at least 25 residents all year) using surface water sources must measure organic components every three years

**TABLE 3.1 Federal Ambient Water Quality Standards (μg/L except as noted otherwise) Based on Regulations and Other Criteria[a]**

| Chemical | Safe Drinking Water Act: Maximum Contaminant Level[b] | Safe Drinking Water Act: Health Advisories, 10-Day | Safe Drinking Water Act: Health Advisories, Chronic | Clean Water Act, Water Quality Criteria[c]: Maximum Contaminant Level Goal[d] | Human Health: Toxic Effect | Human Health: Carcinogen[e] ($10^{-6}$ risk) | Organoleptic[f] |
|---|---|---|---|---|---|---|---|
| Acenaphthene | - | - | - | - | - | - | 20 |
| Acrolein | - | - | - | - | - | - | 540 |
| Acrylonitrile | - | - | - | 0 | - | 0.063 | - |
| Aldrin | - | - | - | 0 | - | 0.0012 | - |
| Antimony | - | - | - | - | 146 | - | - |
| Arsenic | 50 | - | - | 0 | - | 0.0025 | - |
| Asbestos | - | - | - | 0 | - | 30,000 fibers/L | - |
| Barium | 1,000 | - | - | 5,000[g] | - | - | - |
| Benzene | 5 | 230 | 70 | 0 | - | 0.67 | - |
| Benzidine | - | - | - | 0 | - | 0.00015 | - |
| Beryllium | - | - | - | 0 | - | 0.0039 | - |
| Cadmium | 10 | - | - | 5[g] | 10 | - | - |
| Carbon tetrachloride | 5 | - | - | 0 | - | 0.42 | - |
| Chlordane | 2[g] | 62.5 | 7.5 | 0 | - | 0.022 | - |
| Chlorinated benzenes | | | | | | | |
| Hexachlorobenzene | - | - | - | 0 | - | 0.021 | - |
| 1,2,4,5-Tetrachlorobenzene | - | - | - | - | 180 | - | - |
| Pentachlorobenzene | - | - | - | - | 570 | - | - |
| o-Dichlorobenzene | 600[g] | - | - | 600[g] | - | - | - |
| p-Dichlorobenzene | 75 | - | - | 75[k] | - | - | - |
| Monochlorobenzene | - | - | - | 100[g] | 488 | - | - |
| Chlorinated ethanes | | | | | | | |
| 1,2-Dichloroethane | 5 | - | - | 0 | - | 0.94 | - |
| 1,1,1-Trichloroethane | 200 | - | 1,000 | 200 | 19,000 | - | - |
| 1,1,2-Trichloroethane | - | - | - | 0 | - | 0.6 | - |
| 1,1,[illegible]-Tetrachloroethane | - | - | - | 0 | - | 0.17 | - |
| Hexachloroethane | - | - | - | 0 | - | 2.4 | - |
| Chlorinated phenols | | | | | | | |
| 3-Chlorophenol | - | - | - | - | - | - | 0.1 |

TABLE 3.1 (Cont'd)

| Chemical | Safe Drinking Water Act | | | Clean Water Act, Water Quality Criteria[c] | | | |
|---|---|---|---|---|---|---|---|
| | Maximum Contaminant Level[b] | Health Advisories | | Maximum Contaminant Level Goal[d] | Human Health | | Organoleptic[f] |
| | | 10-Day | Chronic | | Toxic Effect | Carcinogen[e] ($10^{-6}$ risk) | |
| Chlorinated phenols (cont'd) | | | | | | | |
| 4-Chlorophenol | - | - | - | - | - | - | 0.1 |
| 2,3-Dichlorophenol | - | - | - | - | - | - | 0.04 |
| 2,5-Dichlorophenol | - | - | - | - | - | - | 0.5 |
| 2-Chlorophenol | - | - | - | - | - | - | 0.1 |
| 2,4-Dichlorophenol | - | - | - | - | 3.09 | - | - |
| 2,6-Dichlorophenol | - | - | - | - | - | - | 0.2 |
| 3,4-Dichlorophenol | - | - | - | - | - | - | 0.3 |
| 2,3,4,6-Tetrachlorophenol | - | - | - | - | - | - | 1 |
| 2,4,5-Trichlorophenol | - | - | - | - | 2,600 | - | - |
| 2,4,6-Trichlorophenol | - | - | - | 0 | - | 1.8 | - |
| 2-Methyl-4-chlorophenol | - | - | - | - | - | - | 1,800 |
| 3-Methyl-4-chlorophenol | - | - | - | - | - | - | 3,000 |
| 3-Methyl-6-chlorophenol | - | - | - | - | - | - | 20 |
| 1,2-Dichloropropane | - | - | - | 0[g] | - | - | - |
| Chlorophenoxys | | | | | | | |
| 2,4-Dichlorophenoxyacetic acid (2,4-D) | 100 | - | - | 70[g] | - | - | - |
| 2,4,5-Trichlorophenoxy-propionic acid (2,4,5-T) | 10 | - | - | 52[g] | - | - | - |
| Chloroalkyl ethers | | | | | | | |
| bis(Chloromethyl) ether | - | - | - | 0 | - | $3.9 \times 10^{-6}$ | - |
| bis(2-Chloroethyl) ether | - | - | - | 0 | - | 0.030 | - |
| bis(2-Chloroisopropyl) ether | - | - | - | - | 34.7 | - | - |
| Chloroform | 100[h] | - | - | 0 | - | 0.19 | - |
| Chromium (VI) | 50 | - | - | - | 50 | - | - |
| Chromium (III) | - | - | - | - | 179,000 | - | - |
| Copper | - | - | - | - | - | - | 1,000 |
| Cyanide | - | - | - | 200 | - | - | - |
| DDT | - | - | - | 0 | - | >0.0012 | - |
| Dibromochloropropane | 0.2[g] | - | - | 0[g] | - | - | - |

TABLE 3.1 (Cont'd)

| Chemical | Safe Drinking Water Act | | | Clean Water Act, Water Quality Criteria[c] | | | |
|---|---|---|---|---|---|---|---|
| | Maximum Contaminant Level[b] | Health Advisories | | Maximum Contaminant Level Goal[d] | Human Health | | Organoleptic[f] |
| | | 10-Day | Chronic | | Toxic Effect | Carcinogen[e] ($10^{-6}$ risk) | |
| Dichlorobenzenes | - | - | - | 470 | - | - | - |
| Dichlorobenzidines | - | - | - | 0 | - | 0.0207 | - |
| 1,1-Dichloroethylene | 7 | - | 70 | 7[k] | - | 0.033 | - |
| 1,2-Dichloroethylene (cis) | 70[k] | 400 | - | 70[g] | - | - | - |
| 1,2-Dichloroethylene (trans) | 100[g] | 270 | - | 100[g] | - | - | - |
| Dichloromethane | i | 1,300 | 150 | i | i | i | - |
| Dichloropropylenes | - | - | - | - | 87 | - | - |
| Dieldrin | - | - | - | 0 | - | 0.0011 | - |
| 2,4-Dimethylphenol | - | - | - | - | - | - | 400 |
| 2,4-Dinitrotoluene | - | - | - | 0 | - | 0.16[j] | - |
| 2,6-Dinitrotoluene | - | - | - | 0 | - | j | - |
| p-Dioxane | - | 568 | - | - | - | - | - |
| 1,2-Diphenylhydrazine | - | - | - | 0 | - | 0.046 | - |
| Endosulfan | - | - | - | - | 138 | - | - |
| Endrin | 0.2 | - | - | - | 1 | - | - |
| Ethylbenzene | - | - | - | 700[g] | 2,400 | - | - |
| Ethylene dibromide | 0.05[g] | - | - | 0 | - | - | - |
| Ethylene glycol | - | - | 5,500 | - | - | - | - |
| Formaldehyde | - | 30 | - | - | 30 | - | - |
| Fluoranthene | - | - | - | 188 | - | - | - |
| Fluoride | 4 | - | - | 4[k] | - | - | - |
| Halomethanes | - | - | - | 0 | - | 0.19 | - |
| Heptachlor | 0.4[g] | - | - | 0 | - | 0.011 | - |
| Hexachlorobutadiene | - | - | - | 0 | - | 0.45 | - |
| Hexachlorocyclohexanes | | | | | | | |
| α-Hexachlorocyclohexane | - | - | - | 0 | - | 0.013 | - |
| β-Hexachlorocyclohexane | - | - | - | 0 | - | 0.0232 | - |
| γ-Hexachlorocyclohexane (lindane) | 4 | - | - | 0.2[g] | - | 0.0264 | - |
| Hexachlorocyclopentadiene | - | - | - | - | 206 | - | - |
| n-Hexane | - | 4,000 | - | - | - | - | - |

TABLE 3.1 (Cont'd)

| Chemical | Safe Drinking Water Act: Maximum Contaminant Level[b] | Safe Drinking Water Act: Health Advisories 10-Day | Safe Drinking Water Act: Health Advisories Chronic | Clean Water Act, Water Quality Criteria[c]: Maximum Contaminant Level Goal[d] | Human Health: Toxic Effect | Human Health: Carcinogen[e] ($10^{-6}$ risk) | Organoleptic[f] |
|---|---|---|---|---|---|---|---|
| Isophorone | - | - | - | - | 5,200 | - | - |
| Kerosene/fuel oil No. 2 | - | 350[l] | - | - | - | - | - |
| Lead | 50 | - | - | 20[g] | 50 | - | - |
| Mercury | 2 | - | - | 2[g] | 10 | - | - |
| Methoxychlor | 400[g] | - | - | 400[g] | - | - | - |
| Methyl ethyl ketone | - | 7,500 | 750 | - | - | - | - |
| Nickel | - | - | - | - | 15.4 | - | - |
| Nitrate, as N | 10,000 | - | - | 10,000[g] | - | - | - |
| Nitrite, as N | 1,000[g] | - | - | 1,000[g] | - | - | - |
| Nitrobenzene | - | - | - | - | 19,800 | - | - |
| Nitrophenols | | | | | | | |
| 2,4-Dinitro-o-cresol | - | - | - | - | 13.6 | - | - |
| Dinitrophenol | - | - | - | - | 70 | - | - |
| Nitrosamines | | | | | | | |
| N-Nitrosodimethylamine | - | - | - | 0 | - | 0.0014 | - |
| N-Nitrosodiethylamine | - | - | - | 0 | - | 0.0008 | - |
| N-Nitrosodi-n-butylamine | - | - | - | 0 | - | 0.0064 | - |
| N-Nitrosodiphenylamine | - | - | - | 0 | - | 7.0 | - |
| N-Nitrosopyrrolidine | - | - | - | 0 | - | 0.016 | - |
| Pentachlorophenol | 200[g] | - | - | 200[g] | 1,010 | - | - |
| Phenol | - | - | - | - | 3,500 | - | - |
| Phthalate esters | | | | | | | |
| Dimethyl phthalate | - | - | - | - | 350,000 | - | - |
| Diethyl phthalate | - | - | - | - | 434,000 | - | - |
| Dibutyl phthalate | - | - | - | - | 44,000 | - | - |
| bis(2-Ethylhexyl) phthalate | - | - | - | - | 21,000 | - | - |
| Polychlorinated biphenyls (PCBs) | 0.5[g] | 12.5 | - | 0 | - | >0.0126 | - |
| Polynuclear aromatic hydrocarbons | - | - | - | 0 | - | 0.0031 | - |
| RDX | - | - | - | - | 33.7[m] | - | - |
| Selenium | 10 | - | - | 50[g] | 10 | - | - |

TABLE 3.1 (Cont'd)

| Chemical | Safe Drinking Water Act: Maximum Contaminant Level[b] | Safe Drinking Water Act: Health Advisories 10-Day | Safe Drinking Water Act: Health Advisories Chronic | Clean Water Act, Water Quality Criteria[c]: Maximum Contaminant Level Goal[d] | Clean Water Act, Water Quality Criteria[c]: Human Health Toxic Effect | Clean Water Act, Water Quality Criteria[c]: Human Health Carcinogen[e] ($10^{-6}$ risk) | Clean Water Act, Water Quality Criteria[c]: Organoleptic[f] |
|---|---|---|---|---|---|---|---|
| Silver | 50 | - | - | - | 50 | - | - |
| 2,3,7,8-TCDD (dioxin) | - | - | - | 0 | - | $1.8 \times 10^{-7}$ | - |
| Tetrachloroethylene | 5[g] | 175 | 20 | 0 | - | 0.88 | - |
| Thallium | - | - | - | - | 17.8 | - | - |
| Toluene | 2,000[g] | 2,200 | 340 | 2,000[g] | 15,000 | - | - |
| Toxaphene | 5 | - | - | 0 | - | 25,800 | - |
| Trichloroethylene | 5 | 200 | 75 | 0 | - | 2.8 | - |
| Trihalomethanes | 100[h] | - | - | - | - | - | - |
| Trinitroglycerin | - | - | - | - | - | 1.4[n] | - |
| Trinitrotoluene (TNT) | - | - | - | - | 44[m] | - | - |
| Vinyl chloride | 2 | - | - | 0 | - | 2 | - |
| Xylenes | 10,000[g] | 1,200 | 620 | 10,000[g] | - | - | - |
| Zinc | - | - | - | - | - | - | 5,000 |

[a]Sources: EPA 1985, EPA 1989, and 40 CFR 141, unless otherwise noted. A hyphen denotes the absence of a regulation or criterion.

[b]These standards are part of the national primary drinking water regulations (40 CFR 141).

[c]These criteria are recommended but not legally enforceable.

[d]MCLGs are nonenforceable health goals that are set at a level at which no known or anticipated adverse health effect occurs and that allows an adequate safety margin. The MCLG for all carcinogens is zero.

[e]To obtain criteria for risks at $10^{-4}$, $10^{-5}$, and $10^{-7}$, multiply the criteria by factors of 100, 10, and 0.1, respectively. Values are for ingestion of water only and do not include ingestion of fish.

[f]Organoleptic criteria are based on odor and taste; health-based criteria are not available.

**TABLE 3.1 (Cont'd)**

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[g]Proposed value (see EPA 1989).

[h]The summed concentration of the four trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane, and bromoform) must be less than 100 µg/L.

[i]See halomethane criteria.

[j]Source: Etnier 1987. Insufficient data are available to estimate a water quality criterion for 2,6-DNT. However, existing data show that this isomer is a more potent carcinogen than the 2,4 isomer.

[k]Values given in the National Primary Drinking Water regulations, 40 CFR 141.

[l]Seven-day health advisory for benzene and benzo(a)pyrene in kerosene, respectively.

[m]Source: Erickson 1980.

[n]Source: Smith 1986.

**TABLE 3.2 Drinking Water MCLs for the State of New Jersey[a]**

| Chemical | MCL (µg/L) |
|---|---|
| Arsenic | 50 |
| Barium | 1,000 |
| Benzene | 1 |
| Cadmium | 10 |
| Carbon tetrachloride | 2 |
| Chlordane | 0.5 |
| Chlorobenzene | 4 |
| Chromium (hexavalent) | 50 |
| m-Dichlorobenzene | 600 |
| o-Dichlorobenzene | 600 |
| p-Dichlorobenzene | 6 |
| 1,2-Dichloroethane | 2 |
| 1,1-Dichloroethylene | 2 |
| 1,2-Dichloroethylene (trans) | 10 |
| 2,4-D | 100 |
| Endrin | 0.2 |
| Lead | 50 |
| Lindane | 4 |
| Mercury | 2 |
| Methoxychlor | 100 |
| Methylene chloride | 2 |
| Nickel | 13.4 |
| Nitrate (as N) | 10,000 |
| PCBs | 0.5 |
| Selenium | 10 |
| Silver | 50 |
| 2,4,5-TP (Silvex) | 10 |
| Tetrachloroethylene | 1 |
| Toxaphene | 5 |
| Trichlorobenzene | 8 |
| 1,1,1-Trichloroethane | 26 |
| Trichloroethylene | 1 |
| Vinyl chloride | 2 |
| Zinc | 44 |

[a]NJAC 7:10-16.7a; New Jersey Safe Drinking Water Act and A-280 Amendments.

Source: Adapted from York 1990a.

or more often. Other state requirements are given in the New Jersey Administrative Code (NJAC 7:10-5.2).

Secondary drinking water regulations apply to any substance in drinking water that may adversely affect the taste, odor, or appearance of water or that may adversely affect the public welfare. The state secondary drinking water regulations are given in Table 3.3. The listed concentrations apply to water at the free-flowing outlet of the ultimate user of a public or nonpublic water system (NJAC 7:10-7.1). The recommended upper limits in the table are values that should not be exceeded. The recommended lower limits are concentration levels that should be equaled or exceeded (NJAC 7:10-7.2).

**TABLE 3.3 New Jersey Secondary Drinking Water Standards**

| Parameter | Recommended Upper Limit | Recommended Lower Limit |
|---|---|---|
| Color | 10 color units | -[a] |
| Corrosivity | Within ±1.0 of optimum pH | - |
| Odor | 3 (threshold odor number) | - |
| Taste | No objectionable taste | - |
| ABS/LAS[b] | 0.5 mg/L | - |
| Chloride | 250 mg/L | - |
| Copper | 1.0 mg/L | - |
| Fluoride[c] | - | 1.0 mg/L |
| Hardness, as $CaCO_3$ | 250 mg/L | 50 mg/L |
| Iron | 0.3 mg/L | - |
| Manganese[d] | 0.05 mg/L | - |
| Sodium[e] | 50 mg/L | - |
| Sulfate | 250 mg/L | - |
| Total dissolved solids | 500 mg/L | - |
| Zinc | 5.0 mg/L | - |

[a] value given.

[b] Alkyl-benzene-sulfonate and linear-alkyl-sulfonate, or similar methylene-blue reactive substances contained in synthetic detergents.

[c] An MCL for fluoride is included in the state primary drinking water regulations. The recommended lower limit applies only to those water supplies in which the fluoride concentration is artificially adjusted.

[d] The limits for iron and manganese may be raised to 0.6 mg/L and 0.1 mg/L, respectively, if a sequestering treatment is provided. Whenever either of these limits is exceeded in the raw water of a public community water system, the water must be treated to reduce the concentrations to below 0.3 mg/L (iron) and 0.05 mg/L (manganese).

[e] Significant only for consumers requiring a low-sodium diet.

### 3.2.2.2 Surface Water

The state of New Jersey has promulgated surface water quality standards for several types of surface waters. For FW2 waters,* which appear to be the type in the lakes and streams on the PTA grounds, the standards are expressed as concentration levels in the receiving waters that must not be exceeded as a result of any discharge into the waters (water-quality-based effluent limitations). The surface water quality standards for FW2 waters are given in Table 3.4. For any parameter for which the quality in the receiving surface water is below that in the table because of natural causes, the background value is to be used as the standard (NJAC 7:9-4.1 through 7:9-4.14).

Some concentration limits apply to surface water discharges that are allowed by a New Jersey Pollutant Discharge Elimination System (NJPDES) permit when the discharges come from a manufacturing or research facility. In essence, the NJDEP must be notified if discharges occur or will occur that would result in the release of toxic pollutants not specifically covered in the permit at concentrations of 100 µg/L or more. Some specific pollutants have higher notification limits: 200 µg/L for acrolein and acrylonitrile; 500 µg/L for 2,4-dinitropnenol and 2-methyl-4,6-dinitrophenol; and 1 mg/L for antimony (NJAC 7:14A-3.11 as reported in Bureau of National Affairs 1988).

### 3.2.2.3 Groundwater

The state of New Jersey has also promulgated groundwater quality standards for protection of different types of groundwater. For types GW2 and GW3‡ groundwater, the state has established criteria that must not be exceeded by human activities. If discharges to groundwater result in the criteria being exceeded, the NJDEP may require dischargers to restore and upgrade the groundwater or contain the contamination within boundaries established by the NJDEP (NJAC 7:9-6.5).

Groundwater quality criteria for GW2 and GW3 waters are given in Table 3.5. The primary standards cannot be exceeded except as a result of natural conditions. The NJDEP may establish conditions in a permit that allow the secondary standards to be exceeded only if there is no adverse effect on the designated uses of the groundwater (NJAC 7:9-6.6).

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*FW2 waters are general surface waters not designated as FW1 or Pinelands waters. FW1 waters are waters that originate in and are wholly contained in federal or state parks, forests, fish and wildlife lands, and other holdings; they are maintained in their natural state and are not subject to man-made discharges. Pinelands waters are all non-FW1 waters within the Pinelands Area (NJAC 7:9-4.4).

‡Class GW2 groundwater contains a natural total dissolved solids (TDS) concentration of less than 500 mg/L. It is suitable for potable, industrial, or agricultural water supply after conventional water treatment, if necessary, or for surface water replenishment. GW3 groundwater has a natural TDS concentration between 500 and 10,000 mg/L. It is suitable for conversion to fresh potable water or other beneficial uses (NJAC 7:9-6.5)

**TABLE 3.4 Surface Water Quality Criteria for FW2 Waters[a]**

| Parameter | Criteria |
|---|---|
| Fecal coliform | 200 counts/100 mL |
| Chloride | 250 mg/L |
| Dissolved oxygen | At least 5.0 mg/L (24-h average)<br>At least 4.0 mg/L at all times |
| Floating solids, petroleum hydrocarbons, oils and grease | None noticeable |
| Acidity | 6.5-8.5 pH units |
| Total phosphorous | 0.05 mg/L in lakes, 0.1 mg/L in streams |
| Radioactivity | Prevailing regulations[b] |
| Suspended solids | 40.0 mg/L |
| Sulfate | 250 mg/L |
| Organoleptic substances | None offensive to humans |
| Temperature | <2.8°C change from ambient in streams, <1.7°C change from ambient in lakes |
| Toxic substances (general) | Concentrations below levels that affect humans or are detrimental to aquatic life |
| Nonpersistent toxic substances | Concentrations no greater than 0.05 of acute definitive $LC_{50}$ or $EC_{50}$ values ($EC_{50}$ is the concentration having a specified adverse effect on 50% of a test population; see page 3-18 for definition of $LC_{50}$) |
| Persistent toxic substances | Concentrations no greater than 0.01 of acute definitive $LC_{50}$ or $EC_{50}$ values |
| Specific toxic substances (μg/L) | |
| Aldrin/Dieldrin | 0.0019 |
| Ammonia (un-ionized) | 50 (24-h average) |
| Total arsenic | 50 |
| Total barium | 1,000 |
| Benzidine | 0.1 |
| Total cadmium | 10 |
| Chlordane | 0.0043 |
| Chlorine, total residual | 3.0 |
| Total chromium | 50 |
| DDT and metabolites | 0.0010 |
| Endosulfan | 0.056 |
| Endrin | 0.023 |
| Heptachlor | 0.038 |
| Total lead | 50 |

**TABLE 3.4 (Cont'd)**

| Parameter | Criteria |
|---|---|
| Specific toxic substances (µg/L) (Cont'd) | |
| Lindane | 0.080 |
| Total mercury | 2 |
| PCBs | 0.014 |
| Total selenium | 10 |
| Total silver | 50 |
| Toxaphene | 0.013 |
| Turbidity (NTU units) | 15 NTU (30-d average)<br>50 NTU maximum at any time |

[a]See footnote in Sec. 3.2.2.2 for definition of FW2 waters.

[b]Refers to prevailing regulations adopted by the EPA pursuant to Secs. 1412, 1445, and 1450 or the Public Health Services Act as amended by the SDWA (PL 93-123).

Source: NJAC 7:9-4.14(c).

## 3.3 HAZARDOUS WASTE

### 3.3.1 Federal

Solid wastes are divided into two types: hazardous and nonhazardous. According to the EPA (40 CFR 261), for regulatory purposes solid wastes are hazardous if they are listed as hazardous, have at least one of four characteristics of hazardous waste, or contain sufficiently high concentrations of one or more of a long list of hazardous constituents. Some of the hazardous wastes listed are produced by the manufacture of explosives. These consist of the wastes K044 (wastewater-treatment sludges from the manufacturing and processing of explosives); K045 (spent carbon from the treatment of wastewater containing explosives); K046 (wastewater-treatment sludges from the manufacture, formulation, and loading of lead-based initiating compounds); and K047 (pink-red water from TNT operations). Another type of hazardous waste consists of residues and contaminated soil resulting from the cleanup of spills of hazardous or toxic chemicals; such chemicals appear in two long federal lists. Sulfuric acid (including oleum) and nitric acid are not included on the lists (40 CFR 261, Subpart D).

Wastes that are not specifically listed, such as contaminated soils, are hazardous if they are ignitable, corrosive, reactive, or toxic. The reactivity characteristic includes explosivity. In particular, a solid waste is reactive if it is capable of (1) detonation or explosive reaction when subjected to a strong initiating source or heated under confinement or (2) detonation or explosive decomposition at standard temperature and pressure. Also, materials classified as forbidden, Class A explosives, or Class B explosives by the U.S. Department of Transportation are reactive (49 CFR 173.51,

**TABLE 3.5 Groundwater Quality Criteria for GW2 and GW3 Waters[a]**

| Parameter | Criteria |
|---|---|
| Primary Standards | |
| Aldrin/Dieldrin | 0.003 µg/L |
| Arsenic and compounds | 0.05 mg/L |
| Barium | 1.0 mg/L |
| Benzidine | 0.0001 mg/L |
| Cadmium and compounds | 0.01 mg/L |
| Chromium (+6) and compounds | 0.05 mg/L |
| Cyanide | 0.02 mg/L |
| DDT and metabolites | 0.001 µg/L |
| Endrin | 0.004 µg/L |
| Lead and compounds | 0.05 mg/L |
| Mercury and compounds | 0.002 mg/L |
| Nitrate (as N) | 10 mg/L |
| Phenol | 3.5 mg/L |
| PCBs | 0.001 µg/L |
| Radionuclides | Prevailing EPA regulations |
| Selenium and compounds | 0.01 mg/L |
| Silver and compounds | 0.05 mg/L |
| Toxaphene | 0.005 µg/L |
| Secondary Standards | |
| Ammonia | 0.5 mg/L |
| Chloride | 250 mg/L[b] |
| Coliform bacteria | See NJAC 7:9-6.6 |
| Color | None Noticeable |
| Copper | 1.0 mg/L |
| Fluoride | 2.0 mg/L |
| Foaming agents | 0.5 mg/L |
| Iron | 0.3 mg/L |
| Manganese | 0.05 mg/L |
| Odor and taste | None noticeable |
| Oil, grease, and petroleum hydrocarbons | None noticeable |
| pH | 5-9 (standard units) |
| Phenol | 0.3 mg/L |
| Sodium | 50 mg/L[b] |
| Sulfate | 250 mg/L[b] |
| TDS | 500 mg/L[b] |
| Zinc and compounds | 5 mg/L |

[a]See footnote in Sec. 3.2.2.3 for definitions of GW2 and GW3 groundwater.

[b]For GW3 groundwaters, these are replaced by natural background concentrations.

Source: NJAC 7:9-6.6.

173.53, 173.88). Forbidden explosives include compounds or mixtures that ignite spontaneously or decompose when heated to 75°C (167°F) for 48 consecutive hours, new explosive compounds, explosive mixtures or devices containing chlorate and either an ammonium salt or an acidic metal salt, liquid explosives such as nitroglycerin, and others. Class A explosives are detonating explosives, and Class B explosives are rapidly burning explosives such as propellants. Class A explosives include initiators and priming explosives, such as lead azide and mercury fulminate, and high explosives, such as TNT, dynamite (with or without a liquid explosive), tetryl, and black powder.

The characteristic of toxicity for a solid waste is determined by use of the toxicity characteristic leaching procedure (TCLP). The TCLP consists of tests performed on solid waste to determine the leachability of 40 chemical parameters that are toxic constituents of concern. The new rule, which replaces the old EP toxicity tests and parameter lists with those for the TCLP, was promulgated in March 1990 (Fed. Reg. 55(61):11,798-11,877, Thursday March 29), and became effective on September 25, 1990. The new TCLP contaminants and corresponding regulatory levels are listed in Table 3.6.

The determination of whether a material such as contaminated soil or waste is hazardous is the responsibility of the generator. If the solid waste is not specifically excluded from regulation, then the listings of Subpart D in 40 CFR 261 are checked to see if the wastes are specifically listed. If the waste is not listed and not ignitable, reactive, corrosive, or toxic (these characteristics apply to the contaminated material and not to the pure contaminant) (40 CFR 261, Subpart C), it can still be hazardous. In particular, a solid waste is hazardous if it contains at least one of a long list of toxic constituents listed in App. VIII of 40 CFR 261.11, unless the waste "is not capable of posing a substantial presence or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed." This determination is based on consideration of several factors, including the nature, concentration, and degradation rate and products of the constituent -- and the potential for the constituent or its degradation products to migrate into the environment under different but plausible types of improper management (40 CFR 261.11).

### 3.3.2 State of New Jersey

New Jersey definitions of hazardous waste are similar to those of the federal government. A solid waste is hazardous if it is not one of the wastes specifically excluded in NJAC 7:26-8.2 and if it meets any one of the following criteria (NJAC 7:26-8.1(a), 8.7, and 8.8):

- It is a listed hazardous waste.

- It contains a hazardous waste constituent listed in NJAC 7:26-8.16 and, after consideration of several factors, the NJDEP concludes that the waste is capable of posing a substantial threat or potential hazard to public health or the environment when improperly stored, treated, disposed of, or otherwise managed. These hazardous wastes are designated as toxic wastes.

**TABLE 3.6 Toxicity-Characteristic Contaminants and Regulatory Levels**

| Contaminant | EPA Hazardous Waste Number | Chemical Abstracts Service Number | Regulatory Level (mg/L) |
|---|---|---|---|
| Arsenic | D004 | 7440-38-2 | 5.0 |
| Barium | D005 | 7440-39-3 | 100.0 |
| Benzene | D018 | 71-43-2 | 0.5 |
| Cadmium | D006 | 7440-43-9 | 1.0 |
| Carbon tetrachloride | D019 | 56-23-5 | 0.5 |
| Chlordane | D020 | 57-74-9 | 0.03 |
| Chlorobenzene | D021 | 108-90-7 | 100.0 |
| Chloroform | D022 | 67-66-3 | 6.0 |
| Chromium | D007 | 7440-47-3 | 5.0 |
| o-Cresol[a] | D023 | 95-48-7 | 200.0 |
| m-Cresol[a] | D024 | 108-39-4 | 200.0 |
| p-Cresol[a] | D025 | 106-44-5 | 200.0 |
| 2,4-D | D016 | 94-75-7 | 10.0 |
| 1,4-Dichlorobenzene | D027 | 106-46-7 | 7.5 |
| 1,2-Dichloroethane | D028 | 107-06-2 | 0.5 |
| 1,1-Dichloroethylene | D029 | 75-35-4 | 0.7 |
| 2,4-Dinitrotoluene[b] | D030 | 121-14-2 | 0.13 |
| Endrin | D012 | 72-20-8 | 0.02 |
| Heptachlor (and its hydroxide) | D031 | 76-44-8 | 0.008 |
| Hexachlorobenzene[b] | D032 | 118-74-1 | 0.13 |
| Hexachlorobutadiene | D033 | 87-68-3 | 0.5 |
| Hexachloroethane | D034 | 67-72-1 | 3.0 |
| Lead | D008 | 7439-92-1 | 5.0 |
| Lindane | D013 | 58-89-9 | 0.4 |
| Mercury | D009 | 7439-97-6 | 0.2 |
| Methoxychlor | D014 | 72-43-5 | 10.0 |
| Methyl ethyl ketone | D035 | 78-93-3 | 200.0 |
| Nitrobenzene | D036 | 98-95-3 | 2.0 |
| Pentachlorophenol | D037 | 87-86-5 | 100.0 |
| Pyridine[b] | D038 | 110-86-1 | 5.0 |
| Selenium | D010 | 7782-49-2 | 1.0 |
| Silver | D011 | 7440-22-4 | 5.0 |
| Tetrachloroethylene | D039 | 127-18-4 | 0.7 |
| Toxaphene | D015 | 8001-35-2 | 0.5 |
| Trichloroethylene | D040 | 79-01-6 | 0.5 |
| 2,4,5-Trichlorophenol | D041 | 95-95-4 | 400.0 |
| 2,4,6-Trichlorophenol | D042 | 88-06-2 | 2.0 |
| 2,4,5-TP (Silvex) | D017 | 93-72-1 | 1 0 |
| Vinyl chloride | D043 | 75-01-4 | 0.2 |

[a]If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration and corresponding regulatory level of 200 mg/L are used.

[b]Regulatory value is also equal to the quantitation limit.

Source: Federal Register, Vol. 55, pp. 11798-11877, March 29, 1990.

- It is a mixture of a solid waste and a listed hazardous waste (some exclusions apply).

- It is corrosive, reactive, ignitable, or extraction procedure (EP) toxic.

- It is listed in 40 CFR 261 Subpart D (including all future additions or supplements).

A solid waste that is not excluded from regulation under NJAC 7:26-8.2 becomes hazardous [NJAC7:26-8.1(b)]:

- When the solid waste first becomes a listed hazardous waste.

- If a hazardous waste is mixed with the solid waste.

- When the solid waste becomes reactive, ignitable, corrosive, or EP toxic.

- If the waste is unlisted and is not reactive, ignitable, corrosive, or EP toxic, when the NJDEP makes a final determination that the waste is hazardous.

- If the waste is listed in 40 CFR 261 Subpart D, when the waste first meets the listing description.

- When a hazardous waste is recycled and the recycled material has been stored, buried, land-disposed, or processed before becoming a commonly traded commercial product.

A solid waste generated from the treatment, storage, or disposal of a hazardous waste -- including sludge, spill residue, ash, emission control dust, or leachate (but excluding precipitation runoff) -- is a hazardous waste unless it is shown not to be hazardous according to several criteria in NJAC 7:26-8.6(d).

There are 21 specific wastes excluded from regulation as hazardous wastes. The specifically excluded wastes that may be relevant to PTA include (NJAC 7:26-8.2):

- Domestic sewage.

- Any mixture of domestic sewage and other wastes passing through a sewer system to a publicly owned treatment works for treatment.

- Industrial wastewater discharges that are point-source discharges subject to regulation under Section 402 of the Clean Water Act as amended (33 USC 125 et seq.).

- Source, special nuclear, or by-product materials as defined in the 1954 Atomic Energy Act as amended (42 USC 2011 et seq.).
- Household waste.
- Samples of solid waste or air, water, or soil collected for testing (this exemption applies only when the samples are being shipped or stored temporarily before or after testing).
- Used batteries awaiting reclamation, provided that the batteries are not stored for more than 90 days.
- Materials recycled on-site to the original production process that generated them (provided that certain requirements are met).

Listed hazardous wastes are any wastes listed in NJAC 7:26-8.13 (hazardous wastes from nonspecific sources); NJAC 7:28-8.14 (hazardous wastes from specific sources); and NJAC 7:26-8.15 (discarded commercial chemical products, off-specification species, containers, and spill residues thereof). Each of these lists appears to be quite similar to the federal lists in 40 CFR 261.31, 261.32, and 261.33. Also, the state uses the EPA hazardous waste numbers for the listed wastes. However, the state list of wastes from nonspecific sources has several wastes not on the federal list (Table 3.7).

Listed hazardous wastes from specific sources that are of special relevance to PTA are the explosive wastes. These wastes have the same definitions and classifications as those given by the EPA (Sec. 3.3.1 and NJAC 7:26-8.14).

New Jersey classifies hazardous wastes according to whether they have the characteristics of ignitability, corrosivity, reactivity, EP toxicity, and toxicity or whether they are acutely hazardous. A waste is acutely hazardous if (1) it is fatal to humans in low doses; (2) in the absence of data for humans, it has been shown to produce an oral $LD_{50}$* toxicity in rats at doses of <50 mg/kg, an inhalation $LC_{50}$* toxicity in rats at concentrations of <2 mg/L, or a dermal $LD_{50}$ toxicity in rabbits at doses of <200 mg/kg; or (3) it is otherwise capable of causing or significantly contributing to an increase in serious irreversible or incapacitating reversible illness (NJAC 7:26-8.8). The definitions of these characteristics of hazardous wastes are essentially the same as those given in the federal regulations in 40 CFR 261.

## 3.4 THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

The HSWA of 1984, which amended RCRA, contain prohibitions on land disposal of certain hazardous wastes. In particular, land disposal (except deep-well injection) of hazardous solvent wastes (EPA numbers F001-F005) is banned as of November 8, 1986.

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*$LD_{50}$ is the dose of a substance that is lethal to 50% of a test population, and $LC_{50}$ is the concentration that is lethal to 50% of a test population.

**TABLE 3.7 Hazardous Wastes from Nonspecific Sources Listed in NJAC 7:26-8.13, but not Listed in 40 CFR 261.31**

| Waste Number | Waste Description |
|---|---|
| X721 | Waste automotive crankcase and lubrications oils from automotive service and gasoline stations, truck terminals, and garages |
| X722 | Waste oil and bottom sludge generated from tank cleanouts from residential/commercial fuel oil tanks |
| X723 | Waste oil and bottom sludge generated by gasoline stations when gasoline and oil tanks are tested, cleaned, or replaced |
| X724 | Waste petroleum oil generated when tank trucks or other vehicles or mobile vessels are cleaned, including, but not limited to, oily ballast water from product transport units of boats, barges, ships, or other vessels |
| X725 | Oil spill cleanup residue that is either contaminated beyond saturation or the generator fails to demonstrate that the spill material was not one of the listed hazardous waste oils |
| X726 | The following used and unused waste oils: metal-working oils, turbine lubricating oils, diesel lubricating oils, and quenching oils |
| X727 | Waste oil from the draining, cleaning, or disposal of electrical transformers |
| X728 | Bottom sludge generated from the processing, blending, and treatment of waste oil in waste oil processing facilities |

Source: NJAC 7:26-8.13.

Land disposal of wastes containing dioxins, chlorinated dibenzofurans, and some chlorinated phenols (EPA numbers F020-F023 and F026-F028) is banned as of November 8, 1988. However, solvent-contaminated soils (from non-CERCLA or RCRA corrective actions) containing less than 1% by weight total F001-F005 solvent constituents listed in Table 3.8, or soils or debris that are contaminated with any of the constituents listed in Table 3.8 and are generated in response actions taken under CERCLA or RCRA, are exempt from the ban until November 8, 1988. Until November 8, 1988, landfill disposal of the hazardous wastes is permitted only in a facility that is in compliance with the requirements specified in 40 CFR 268.5(h)(2). Extension of the November 8, 1988, deadline may be granted by the EPA on a case-by-case basis.

After November 8, 1988, wastes containing solvents or dioxins may be disposed of on land without treatment only if the waste or a liquid extract from the waste obtained by the TCLP satisfies the regulatory limits given in Tables 3.8 and 3.9. If the wastes do not meet the TCLP limits, they must be treated to meet the limits before they can satisfy the land-disposal standard. Although the choice of the method of treatment is up to the generator, dilution is not allowed. Between November 8, 1986, and

**TABLE 3.8 Treatment Standards for Wastes Contaminated with F001-F005 Solvents (mg/L)**

| F001-F005 Solvent Constituents | Wastewaters Containing Spent Solvents | All Other Spent Solvent Wastes |
|---|---|---|
| Acetone | 0.05 | 0.59 |
| n-Butyl alcohol | 5.0 | 5.0 |
| Carbon disulfide | 1.05 | 4.81 |
| Carbon tetrachloride | 0.05 | 0.96 |
| Chlorobenzene | 0.15 | 0.05 |
| Cresols (and cresylic acid) | 2.82 | 0.75 |
| Cyclohexanone | 0.125 | 0.75 |
| 1,2-Dichlorobenzene | 0.65 | 0.125 |
| Ethyl acetate | 0.05 | 0.75 |
| Ethyl benzene | 0.05 | 0.053 |
| Ethyl ether | 0.05 | 0.75 |
| Isobutanol | 5.0 | 5.0 |
| Methanol | 0.25 | 0.75 |
| Methylene chloride | 0.20 | 0.96 |
| Methylene chloride[a] | 12.7 | 0.96 |
| Methyl ethyl ketone | 0.05 | 0.75 |
| Methyl isobutyl ketone | 0.05 | 0.33 |
| Nitrobenzene | 0.66 | 0.125 |
| Pyridine | 1.12 | 0.33 |
| Tetrachloroethylene | 0.079 | 0.05 |
| Toluene | 1.12 | 0.33 |
| 1,1,1-Trichloroethane | 1.05 | 0.41 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | 1.05 | 0.96 |
| Trichloroethylene | 0.062 | 0.091 |
| Trichlorofluoromethane | 0.05 | 0.96 |
| Xylene | 0.05 | 0.15 |

[a]From the pharmaceutical industry.

Source: EPA 1986c.

November 8, 1988, the TCLP limits apply only to solvent wastes not exempted from the 1986 ban.

The TCLP standards given in Table 3.8 do not apply to soils or debris contaminated with solvents because the limits are determined by applying the best demonstrated available technology (BDAT) to the wastes, which is incineration for nonaqueous wastes. The EPA has not yet determined a BDAT applicable to contaminated soils and debris.

According to the EPA (1986c), land disposal under the HSWA is defined to include placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or bed formation, underground mine or cave, or concrete vault or bunker. However, neither open burning nor detonation constitutes land disposal; thus, they are not prohibited unless the residues resulting from the open detonation or burning of explosives are hazardous wastes.

The land-disposal restrictions are considered to be prospective; that is, they apply to wastes disposed of after the effective date of the prohibition. Wastes disposed of on land or placed in storage prior to the applicable effective date of prohibition do not have to be exhumed or removed for treatment. However, any hazardous wastes that are removed from a land-disposal or storage unit after the effective date of prohibition are subject to the disposal restrictions and treatment provisions (EPA 1986c; 40 CFR 268.2).

**TABLE 3.9 Treatment Standards for Dioxin Wastes**

| Dioxin | Concentration |
|---|---|
| Hexachlorodibenzo-p-dioxins | <1 ppb |
| Hexachlorodibenzofurans | <1 ppb |
| Pentachlorodibenzo-p-dioxins | <1 ppb |
| Pentachlorodibenzofurans | <1 ppb |
| Tetrachlorodibenzo-p-dioxins | <1 ppb |
| Tetrachlorodibenzofurans | <1 ppb |
| 2,4,5-Trichlorophenol | <0.05 ppm |
| 2,4,6-Trichlorophenol | <0.05 ppm |
| 2,3,4,6-Tetrachlorophenol | <0.10 ppm |
| Pentachlorophenol | <0.01 ppm |

Source: EPA 1986c.

Additional hazardous wastes, e.g., those included in the "California list," are included among those the HSWA bans from the possibility of land disposal. A proposed rule bans these wastes from land disposal (except deep-well injection) as of July 8, 1987. Soil and debris that are contaminated with these wastes, and are generated as a result of response actions taken under CERCLA or RCRA authority, were exempt from the ban until November 8, 1988. Details on the proposed rule are given in the Federal Register (EPA 1987b).

## 3.5 SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986

SARA, enacted on January 21, 1986, includes provisions on federal facilities, cleanup standards, and an environmental restoration program to be carried out at U.S. Department of Defense (DOD) facilities. The federal facilities provisions (Sec. 120 of SARA) state that all federal facilities are subject to the same guidelines, rules, regulations, and criteria regarding hazardous substances that are applicable to any nonfederal facility. This applies in particular to preliminary assessments or remedial actions, evaluations under the National Contingency Plan, or inclusion in the National Priorities List (NPL). Also, as far as the NPL is concerned, a preliminary assessment of any federal facility must be started by July 21, 1987. A remedial investigation/feasibility study (RI/FS) must be started within six months of listing on the NPL. If the facility was on the list on or before January 21, 1986, then an RI/FS must be started by January 21, 1987. Also, response actions at DOD or U.S. Department of Energy facilities may be modified as necessary to protect national security interests.

The SARA cleanup standards (Sec. 121) state that remedial actions in which the volume, mobility, or toxicity of hazardous substances or contaminants is permanently and significantly reduced by treatment are preferred to passive actions, such as land disposal without treatment. Off-site transport and disposal without such treatment should be the least-preferred action if practicable treatment technologies are available. Any off-site transfer of hazardous substances must be to an approved facility. The unit receiving the hazardous substances must not be releasing any hazardous waste or constituent into the groundwater, surface water, or soil.

Remedial actions must be selected to attain a degree of cleanup that ensures protection of human health and the environment. Pollutants or hazardous substances remaining after completion of the remedial action are subject to all legally applicable or relevant and appropriate requirements. For a given site, these requirements are either "applicable," or they are "relevant and appropriate" -- but they are not both. Applicable requirements relate to cleanup or control standards or environmental limitations that specifically address a hazardous substance, remedial action, location, or circumstance at a CERCLA site. Relevant and appropriate requirements relate to cleanup or control standards or environmental limitations that address site situations sufficiently similar to those encountered at a CERCLA site so that the use of ARARs is well suited to the site under consideration. One type of ARAR consists of ambient or chemical-specific requirements, such as the MCLs (Table 3.1) or the National Ambient Air Quality Standards.

Section 121(d)(2) of CERCLA, as amended by SARA, states that remedial actions should satisfy ARARs under the SDWA, Clean Water Act, and RCRA. It also specifically requires that MCLGs and federal water-quality criteria (Table 3.1) should be satisfied where they are relevant and appropriate for the actual or potential release (EPA 1987c).

Section 211 of SARA describes an environmental restoration program for DOD facilities such as the PTA. The program is to be carried out in consultation with the EPA, and it is subject to the requirements given in Sec. 120 (federal facilities) of CERCLA. Goals of the program include the following:

1. Identification, investigation, research and development, and cleanup of contamination from hazardous substances, pollutants, and contaminants.

2. Correction of other environmental damage (such as detection and disposal of unexploded ordnance) that creates an imminent and substantial threat to the public health or welfare or to the environment.

3. Demolition and removal of unsafe buildings and structures, including buildings and structures at sites formerly used by the DOD or under the jurisdiction of the Secretary of Defense.

## 3.6 SOIL ACTION LEVELS

Interim soil action levels (ISALs), as established by the state of New Jersey, have been in existence for several years. ISALs are soil concentrations of chemical parameters, which are used to determine the presence of contamination. If soil concentrations exceed the ISALs then there is a need for soil sampling and other RI activity to determine the extent and level of contamination. ISALs are not cleanup objectives, although they may be so used. The numerical values of the ISALs are based on background concentrations for some chemical parameters and on health-based risk assessments for others. Table 3.10 lists the ISALs published by New Jersey (NJDEP 1990; Kurisko 1991).

At present the ISALs are to be used as guidance only as they have not yet been promulgated. However, a task force is working on developing rules and regulations that are expected to be out for public comment in the near future (Kurisko 1991).

**TABLE 3.10 NJDEP Interim Soil Action Levels**

| Chemical Parameters | ISAL (ppm) |
|---|---|
| Inorganic | |
| Antimony | 10 |
| Arsenic | 20 |
| Barium | 400 |
| Beryllium | 1 |
| Cadmium | 3 |
| Chromium | 100 |
| Copper | 170 |
| Lead | 250-1,000 |
| Nickel | 100 |
| Mercury | 1 |
| Molybdenum | 1 |
| Selenium | 4 |
| Silver | 5 |
| Thallium | 1 |
| Vanadium | 100 |
| Zinc | 350 |
| Pesticides and PCBs | |
| DDT | 1-10 |
| Chlordane | 1 |
| PCBs | 1-5 |
| Other pesticides | Case-by-case |
| Surrogate Levels | |
| Total petroleum hydrocarbons | 100[a] |
| Acid extractables | Case-by-case |
| Base neutral extractables | 10[a] |
| Volatile organics | 1[a] |

[a]Values refer to total concentrations in each group and not concentrations of individual chemicals.

Source: Adapted from NJDEP 1990.

# 4 REMEDIAL INVESTIGATION SITES AND AREAS AT PICATINNY ARSENAL

Picatinny Arsenal is a large and complex installation that has been operating for more than 100 years. It would be expected to have many areas containing hazardous materials or disposed of hazardous waste. Some RI Sites were first identified in an installation report prepared in 1976 (USATHAMA 1976). In 1980, the list was expanded by EPA, which identified and evaluated 25 potentially hazardous Sites (Sites 1-25). Four additional Sites (Sites 26-29) were added during preparation of an application for a RCRA Part B permit to store and treat hazardous waste at PTA. Twenty-five additional Sites (Sites 30-54) were added as a result of an analysis of Sites in the RCRA facility assessment (Gaven 1986). PTA added Bldg. 255 to the list of Sites (as Site 55) in 1988.

In 1989, after ANL had begun to evaluate the original 55 Sites, USATHAMA and PTA decided to expand the scope of the investigation to include additional Sites. The expansion was based on the fact that many Sites exempted from the RCRA Part B permit application may have stored hazardous wastes in the past for more than 90 days or for unknown periods of time. Also, information provided by PTA employees raised the possibility that past practices may have led to contamination at several Sites.

To obtain information on past activities and possible contamination at PTA Sites, ANL staff interviewed former and current employees of the Arsenal during 1988 and 1989. All relevant information provided by the interviewees is included in this report and is explicitly noted as provided by interviews. To protect the individuals providing information and to encourage them to speak freely, the names of all interviewees are confidential.

Based on information obtained during the interviews and provided by PTA (which included lists of Sites generating and storing hazardous waste, the status of closure plans for various buildings, and similar materials), ANL staff prepared a master list of additional candidate Sites to be evaluated for their contamination potential. A building or area was included in the list if one or more employees reported that materials that are now considered hazardous were used or disposed of at the Site. The master list also included all information obtained during the interviews and provided by PTA.

ANL staff then evaluated the master list to create a shorter list of Sites having a potential for contamination due to activities at each Site. Selection criteria included reports of spills of hazardous material, reports of the handling of hazardous material in a manner that could contaminate the environment (e.g., burial of wastes or uncontrolled wastewater discharge), and storage of appreciable amounts of hazardous material. Some of the buildings and areas on the list were added to 11 of the original 55 Sites.

In July 1989, ANL sent the shorter list and supporting information to PTA and USATHAMA for review. PTA and USATHAMA approved the list with minor changes. In November 1989, PTA included four other Sites and finalized the list of 105 additional Sites. In May 1990, two Sites were deleted from the list. Three additional Sites were deleted in December 1990. Thus, this study evaluates a total of 156 Sites at PTA. A map of the Arsenal showing the locations of most of the Sites is provided in Plate 1.1

(USACE 1984a). (Sites 177 and 178, the sewer lines and buildings in the Toxic Energetics Cleanup Program [TECUP], respectively, were omitted from the map for clarity.)

To avoid confusion with earlier lists of Sites, there are gaps in the numbering sequence for some Sites. For example, an early list was prepared by PTA (known as "Major Riley's list"). Numbers assigned by Riley were used for those Sites on the Riley list selected for evaluation here. ANL staff did not reuse numbers assigned to Sites on the Riley list that were not selected for further evaluation (e.g., since Riley's Site 56 was not selected, the number 56 was not assigned to an RI Site).

An examination of the Sites shows that, based on the locations and type of activities at the Sites, they can be divided into several different groups or Areas. The Sites in each Area are all fairly close to one another and should have quite similar physical environmental characteristics. In general, the same type of activities were carried out at all the Sites in an Area. Consequently the potential environmental contaminants should be similar for all Sites in an Area. For the purposes of this RI Concept Plan, it is also easier to consider a smaller number of Areas of similar Sites than to consider each of the 156 Sites separately.

The specific grouping of the 156 Sites into 16 different Areas was chosen by USATHAMA and PTA and has been approved by the U.S. EPA Region II and the NJDEP. The grouping is shown in Table 4.1, which also gives a summary description of each of the 156 Sites at PTA. Within each Area the Sites are ordered according to increasing Site number. The Areas are shown on Plate 1.1 as solid lines enclosing the Sites within the Areas. The Area boundaries in Plate 1.1 are drawn to indicate which Sites are included in each of the Areas. They are not meant to assign an exact extent to the Areas.

In general, the Site names given are intended to briefly describe the environmentally significant activities at the Site. As shown in Table 4.1, 80 Sites are still in use and 73 are inactive; for three Sites (two lakes and a reservoir), such a description of status is inapplicable. The "comments" column describes the activities that provided the basis for considering each building or area as a Site. Activities referred to as "reported" generally were learned during interviews; other information was obtained during 1988 and 1989 visits to the Arsenal by ANL staff or was provided by PTA (e.g., lists of satellite, 90-day, interim, and special waste storage areas as well as other data). Each Site is characterized in greater detail in Volume 2 of this report.

Some of the Sites at PTA are currently managed under state or federal regulations. Hazardous waste storage or treatment activities at five Sites (Nos. 36, 38, 39, 42, and 43) are managed in accordance with RCRA requirements. Wastewater discharges at three Sites are included in an NJPDES permit (No. NJ0002500): Sites 37 and 40 discharge treated wastewater and Site 63 discharges noncontact cooling water and floor drain effluent. Activities at another Site (No. 34) are covered by a New Jersey open burning permit, which is renewed every six months. Also, for more than 52 Sites, part or all of each will be closed under RCRA; closure plans have been prepared for these Sites.

**TABLE 4.1 Summary Descriptions of the 156 Remedial Investigation Sites at Picatinny Arsenal**

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| **Area A: Burning Grounds** | | | | |
| 34 | Along S. Brook Road | Lower burning ground and open detonation area | Active | Open burning and detonation of explosive wastes, including lead azide; N.J. open burning permit renewed every 6 months |
| **Area B: Southern Boundary, West of Green Pond Brook** | | | | |
| 20 | Within Site 24 | Pyrotechnic testing range | Active | Developmental test firing of pyrotechnic munitions |
| 24 | Between S. Brook and Phipps Roads | Sanitary landfill | Inactive | Disposal until 1972 of sanitary waste and possibly fly ash, ordnance, industrial waste, and treatment plant sludge |
| **Area C: Southern Boundary, East of Green Pond Brook** | | | | |
| 19 | Near S. Brook and Shinkle Roads | Pyrotechnic demonstration area | Inactive | Developmental test firing of pyrotechnic munitions |
| 23 | Near Bldg. 1150 | Post farm landfill | Inactive | Disposal of industrial and municipal wastes and fly ash until 1979; drums disposed of near the Site |
| 25 | Along Spicer Avenue | Sanitary landfill | Inactive | Disposal of industrial waste and possibly treated sewage sludge and unexploded ordnance (UXO) until 1972 |
| 26 | Within Site 25 | Dredge disposal pile | Inactive | Pile of 12,000 $yd^3$ of sludge from Green Pond Brook; scheduled for sampling and closure |
| 163 | Near main entrance and Spicer Road | Baseball fields | Active | Reported to have been an open burning area and disposal area for material dredged from the brook |
| 180 | South of Site 19 and east of Site 34 | Waste burial area | Inactive | Waste, such as railroad ties, railroad cars, telephone poles, and concrete, was reportedly dumped into wetlands |
| **Area D: Central Manufacturing Valley** | | | | |
| 21 | Bldg. 24 | Metal plating facility | Inactive | Plating operations produced hazardous components in wastewater. RCRA postclosure investigation based on documented groundwater contamination |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 37 | Next to Bldg. 24 | Surface impoundments for metal plating wastewater treatment | Inactive | Treats wastewater from metal plating activity; water and sludge disposed of off-post; facility and waste disposal regulated under RCRA |
| 29 | Bldg. 31 yard | Drum storage area | Inactive | Storage of waste oils in drums and 10,000-gal underground storage tank (UST); unauthorized dumping in 1984; documented soil contamination |
| 39 | Bldg. 31 | Vehicle maintenance wastewater treatment facility | Active | Treats wastewater in oil/water separator; waste oil stored in 1,000-gal underground tank; facility regulated under RCRA |
| 45 | Bldg. 33 | 90-day waste accumulation area | Active | Less than 90-day storage of small amounts of waste oil from vehicle maintenance |
| 49 | Bldgs. 19 and 19A | 90-day waste accumulation areas | Active | Less than 90-day storage of small amounts of soldering wastes from soldering facility |
| 69 | Bldg. 92 | Surveillance laboratory | Active | Storage of waste oil generated from maintenance |
| 86 | Bldg. 12 | Photoprocessing facility | Active | Storage of photographic waste |
| 117 | Bldg. 22 | Precision machine shop | Inactive | Used in the 1960s to machine metals and DU; possible oil spills |
| 118 | Bldg. 41 | Pesticide storage area and oil/water separator pond | Active | Storage of pestides; nearby pond was used as an oil/water separator |
| 122 | Bldg. 60 | Satellite waste accumulation area | Active | Storage of oily rags and waste oil generated from hydraulic vibrator; storage of nuclear materials |
| 123 | Bldg. 64 | Metal plating shop | Inactive | Assembly and disassembly area for objects containing Be and DU; Bear Swamp Brook was reportedly discolored by activities at the Site |
| 182 | Bldg. 5 | Arsenal reproduction and training offices | Active | Building contains photoprocessing unit; waste from unit is stored in building |
| 183 | Bldg. 58 | Graphic reproduction and training | Active | Photoprocessing operations; storage of waste from photoprocessing |
| Area E: Building 95 Area | | | | |
| 22 | Near Bldg. 95 | Waste impoundments for plating and etching facility | Inactive | Received wastewater from Bldg. 95 until 1981; RCRA postclosure investigation based on documented groundwater contamination |
| 28 | Bldg. 80 | Sewage treatment plant sludge beds | Inactive | Received treated sewage sludge and wastewater before mid-1960s |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status$^a$ | Comments |
|---|---|---|---|---|
| 38 | Bldg. 95 | Plating and etching wastewater treatment facility | Active | Treats wastewater from plating and etching activities, closure scheduled for three underground tanks; wastewater and sludge disposed of off-post; facility regulated under RCRA |
| 44 | Bldg. 39 | Golf Course Maintenance Shop | Active | Less than 90-day storage of small amounts of oil and pesticide wastes |
| Area F: Propellant Area | | | | |
| 60 | Bldg. 163 | Photoprocessing laboratory | Active | Storage of waste generated from photographic development; UST scheduled for closure |
| 61 | Near Bldgs. 171 and 176 | Waste dumps | Inactive | Possible disposal of propellants behind Bldg. 171; swamp area near Bldg. 176 may contain trash and other waste material |
| 104 | Bldgs. 161 and 162 | Chemical laboratories | Active | Reports of chemicals dumped into sinks and propellants dumped behind Bldg. 162; possible mercury contamination |
| 106 | Bldg. 1010 | Propellant plant | Inactive | Acid recovery area; leakage of storage tanks and transformers, building burned down in TECUP |
| 111 | Bldgs. 454 and 455 | Propellant bag filling area | Active | Spills of propellant dust and grains on floor |
| 124 | Bldg. 166 | Propellant testing building | Active | Used for propellant surveillance tests and propellant storage |
| 125 | Bldgs. 172 and 183 | Office building and lubricant testing area | Active | Storage in Bldg. 183 of lubricant waste, adhesive, solvent, and acid from lubricant testing; Bldg. 172 has been used as an office building |
| 126 | Bldg. 197 | Propellant testing building | Active | Storage of waste propellant generated from propellant testing |
| 138 | Bldgs. 404, 407, and 408 | Chemical laboratory and propellant processing plants | Active | Bldgs. 404 and 407 were chemical laboratories used to research laboratory manufacture and burn propellants; Bldg. 408 used for chemical synthesis and melt casting of explosives; wastewater may be discharged to a nearby swamp; presently used for the storage of chemicals used in past operations |
| 139 | Bldg. 424 | Propellant processing plant | Inactive | Storage of wastewater in a large tank in 1960s; slurry pipeline and decontamination pits may still be present |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 140 | Bldgs. 427 and 427B | Propellant processing areas | Active | Powder extrusion presses; mixing of nitrocellulose, nitroglycerin, and HMX; currently used for storage of rags, alcohol, acetone, ethyl acetate or ether, and scrap and excess propellant from propellant processing; pits and catch tank may still be present |
| 141 | Bldg. 429 | Propellant crushing area | Inactive | Catch tank present |
| 142 | Bldg. 435 | Propellant solvent mixing area | Active | Building houses four to six large solvent mixers; possible solvent spills |
| 143 | Bldg. 436 | Propellant processing area | Active | Waste generated from propellant mixing included 25 lb/yr contaminated rags and 25 gal/yr contaminated solvents |
| 144 | Bldg. 462 | Propellant finishing plant | Inactive | R&D for energetics generated contaminated paper towels, rubber gloves, and plastic hardware; scrap propellant; explosives; and solvents |
| 145 | Bldg. 477 | Explosive and propellant mixing area | Active | Mixing and drying of explosives and propellants and mixing of pyrotechnics |
| 146 | Bldg. 497 | Powder pressing | Active | Reported powder pressing operations |
| Area G: DRMO Yard and Surroundings | | | | |
| 31 | Bldgs. 314 and 314B-314E | Defense Reutilization and Marketing Office | Active | Storage of used lead-acid batteries |
| 52 | Bldgs. 305 and 336 | Petroleum leak area and Bldg. 336 | Inactive | Estimated 400-gal leak of petroleum products; three diesel fuel tanks are in the area |
| 95 | Bldg. 336 | Former laundry facility | Inactive | Wastewater from laundry contained explosives, fire retardants, and detergent and was discharged to swamp; operations closed in the late 1970s or early 1980s; building was demolished |
| 96 | Bldgs. 301 and 301A | Waste oil storage area | Inactive | Storage of oil and paint stripper; apparent leakage |
| 101 | Bldgs. 311 and 319 | Gasoline station and storage area | Active | Bldg. 311 was a gas station; 10,000-gal underground tank may have leaked since it was designed for aboveground installation |
| 134 | Bldg. 302 | Service shops | Inactive | Former laundry that reportedly discharged wastewater containing explosives, fire retardants, and detergent into a swamp; reported disposal pit is now now paved over |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 135 | Bldg. 315 | Metallurgy laboratory | Active | Storage of oily rags and metal cuttings |
| 136 | Bldg. 355 | Metallurgy laboratory | Active | Storage of waste from metallographic etching |
| Area H: Munitions Assembly | | | | |
| 55 | Bldgs. 221, 223, and 225 | Explosives machining facility | Active | Treats wastewater from melt loading of projectiles |
| 62 | Bldg. 210 | Satellite waste accumulation area | Inactive | Temporary storage of hazardous chemicals, black powder, and hydraulic oil in 1960s; area was previously used as an explosives manufacturing area |
| 64 | Bldg. 241 | Press loading and disassembly plant | Active | Initially built as an explosive D loading plant, then used for demilling and disassembly; used as electrical equipment storehouse since 1981 |
| 98 | Bldg. 268 | Mine assembly facility | Inactive | Manufactured antipersonnel mines |
| 100 | Bldg. 276 | Explosives loading facility | Inactive | Used for loading explosives; possible soil contamination with explosives and waste oil; possible disposal into Bear Swamp; building burned down in TECUP |
| 127 | Bldg. 230 | Explosives melt-casting and machining | Active | Storage of composition B and octol from melt casting operations |
| 128 | Bldgs. 235 and 236 | Explosives pressing plants | Inactive | Bldg. 236 is active; scrap explosive generated |
| 129 | Bldg. 240 | Changing house and dispatch center | Active | Reportedly, dioxin was stored in building about 25 years ago |
| 130 | Bldg. 252 | Powder pressing and pelleting facility | Inactive | Wash water probably was discharged into swamp |
| 131 | Bldg. 266 | Ordnance manufacturing facility | Inactive | Storage of waste oil and solvents |
| 132 | Bldgs. 271 and 271I-271N | Loading facility for detonators and initiators | Inactive | Used for producing detonators and initiators containing lead azide and tetryl; wash water containing explosives reportedly discharged onto ground |
| 151 | Bldg. 600 | Change house | Inactive | Reported testing of hand grenades, rockets, and mines until about 1978 |
| Area I: Around Picatinny Lake | | | | |
| 16 | | Guncotton line | Inactive | Abandoned pipeline that may contain dried nitrocellulose (guncotton) |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 30 | Bldg. 3045 | Fluorochemicals storage | Inactive | Storage of cylinders of fluorochemicals; Site was closed in 1982 without submission of closure plans or NJDEP approval |
| 32 | Bldg. 553 | Storage tanks | Inactive | Storage of alcohol, spent alcohol, ether, diesel fuel, etc., in 11 aboveground tanks |
| 33 | Bldg. 527A | Storage tanks | Inactive | Storage of spent alcohol in two tanks (5,200 and 1,075 gal); scheduled for decontamination and closure |
| 40 | Bldgs. 809 and 810 | Explosives manufacturing wastewater treatment facility | Active | Treats wastewater from explosives processing |
| 46 | Bldg. 507 | 90-day waste accumulation area | Active | Less than 90-day storage of small amounts of waste oil from train engine maintenance |
| 47 | Bldgs. 3005 and 3006 | 90-day waste accumulation areas | Active | Less than 90-day storage of small amounts of waste oil from equipment maintenance |
| 50 | Bldgs. 519 and 519A | Hazardous waste tank storage areas | Inactive | Storage of spent alcohol in one 3,800-gal tank; scheduled for decontamination and closure |
| 53 | Approximate center of PTA | Picatinny Lake | - | Probably contains defective ordnance, containers of explosives, and UXO from 1926 explosion |
| 63/65 | Bldg. 506 | Steam and power plant | Active | Coal pile runoff entered nearby Picatinny Lake; storage of waste oil and material strained from waste oil; waste storage area and waste burning system scheduled for decontamination and closure |
| 70 | Bldgs. 3028 and 3029 | R&D laboratory and general purpose warehouse | Active | Storage of waste explosives and contaminated solvents from R&D of propellants and explosives |
| 71 | Bldg. 910 | General purpose laboratory | Inactive | Storage of propellants; ammunition testing lab scheduled for closure |
| 79 | Bldg. 3013 | High-pressure boiler | Active | Waste oil storage area scheduled for closure; facility is used infrequently |
| 82 | Bldg. 908 | X-ray photoprocessing laboratory | Active | Storage of waste oil and fixer solution generated from operation and maintenance of X-ray machine |
| 83 | Bldg. 3022 | Physical analysis laboratory for energetics | Active | Storage of energetic material samples, and spent solvents generated from lab and R&D experiments |
| 90 | Bldg. 329 | Electromagnetic gun test shed | Active | Storage of waste motor oil, acetone, ethyl alcohol, and oil rags generated from R&D of EM gun |
| 93 | Bldgs. 800 and 807 | Ammunition demolition facility and ordnance facility | Inactive | Assembly, loading, and packing of aerial grenades |
| 97 | Bldg. 501 | Post Engineer maintenance shop | Inactive | Pump repair shop; suspected mercury contamination |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 102 | Bldg. 3050 | Enlisted mens' barracks | Active | Car rack behind building used for vehicle maintenance; waste oil reportedly dumped onto the ground |
| 105 | Bldg. 511 | Propellant plant | Inactive | PCB leakage from transformers; transformers removed about two years ago; building burned down in TECUP |
| 108 | Bldgs. 717, 722, and 732 | Ordnance facilities | Inactive | Used to burn flares; pyrotechnics manufacturing; a flare fire reportedly occurred behind Bldg. 717; possible heavy metal contamination of soil |
| 109 | Bldg. 445 | Pyrotechnic plant | Inactive | Manufactured flares; flare ingredients reportedly were washed into soils; nitro compounds in sump near building |
| 110 | Southeast of Picatinny Lake | 500 area | Active | Explosives reportedly fell off of a train along the narrow-gauge railroad track |
| 113 | Bldg. 561 | Propellant plant | Inactive | Possible soil contamination; building burned down in TECUP |
| 137 | Bldg. 382 | Administrative building | Active | Reportedly, disposal pits near the building were used during the early 1940s-1950s; waste included paper products, ammo. boxes, tubes, and material dredged from Picatinny Lake |
| 147 | Bldg. 520 | Poaching house | Inactive | Storage of nitrocellulose-water slurry mix in vats; waste disposed of in pits in basement; building burned down in TECUP |
| 148 | Bldg. 527 | Change house | Inactive | Nitrocellulose processing; smokeless powder factory scheduled for closure |
| 149 | Bldg. 541 | Propellant plant | Inactive | Storage of single-base powder grains in solvents; reported vat leak; building burned down in TECUP |
| 150 | Bldg. 555 | Propellant plant | Inactive | Nitrocellulose chunks and water from powder operations were reportedly found in drainpipe; |
| 156 | Bldgs. 813, 816, and 816B | Ordnance facilities | Inactive | Reported assembly area where explosives were loaded and packed; high production before 1957; Picatinny Lake reportedly received discarded objects and discharged wash water |
| 157 | Bldgs. 820 and 823 | Ordnance facilities | Inactive | Reportedly, shells were packed and sealed for shipping; shells steamed and washed out in buildings; washout water discharged into Picatinny Lake |
| 158 | Bldg. 926 | High-explosives magazine | Inactive | Reported storage of lead azide and styphnates; they were removed in 1985 |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 159 | Bldg. 975 | Samples and services administration building | Inactive | Reported storage of packed shells and other explosives prior to shipping; lead azide may have been buried behind building in 1983 |
| 178 | | TECUP buildings | Inactive | Buildings in program were destroyed by spraying them with diesel fuel and igniting it; drain lines possibly containing explosives were not removed; some buildings were washed |
| 184 | Bldg. 523 | Refrigeration and inert gas plant | Inactive | Used for manufacturing refrigeration and inert gases; three underground tanks containing gasoline are located just outside the southeast wall of the building, which has been inactive since 1976 |
| Area J: Around Snakehill Road | | | | |
| 1 | G-2 Road | Reaction Motors/rocket fuel test area (G-2 area) | Inactive | Testing of rocket fuel and explosives containers; possible dump on east or southeast side of Site |
| 2 | 3500 series bldgs. | Reaction Motors/rocket fuel test area (G-1 area) | Inactive | Testing of rocket motors; storage of liquid fuels |
| 4 | 3600 series bldgs. | Reaction Motors/rocket fuel test area | Inactive | Testing of rocket motors |
| 175 | Bldg. 3801 | Helicopter building | Active | Floor drains in shop area reportedly drain to swamp |
| Area K: Navy Hill | | | | |
| 3 | 1500 series bldgs. | Reaction Motors/rocket fuel test area | Active | Testing of rocket motors and munitions; documented beryllium contamination in soil |
| 48 | Bldgs. 3314 and 3315 | 90-day waste accumulation areas | Active | Less than 90-day storage of small amounts of waste oil from equipment maintenance |
| 172 | Bldg. 3328 | Parking lot near calibration facility | Active | Reportedly, oil, possibly containing PCBs, was spilled onto the paved parking lot |
| 173 | Bldg. 3404 | Administration and supplies building | Active | Previously used as a solid propellants chemical laboratory; storage of chemical waste |
| 174 | Bldg. 3420 | Old sewage plant | Inactive | Former holding ponds and beds for sewage sludge |
| Area L: Explosives Manufacturing | | | | |
| 5 | Near Bldg. 3150 | Shell burial area | Inactive | Burial of explosive devices during 1926-1945 |
| 6 | Near Bldg. 3100 | Shell burial area | Inactive | Burial of explosive devices during 1926-1945 |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 17 | Near Bldg. 1095 | Northern tetryl pit | Inactive | Disposal of waste from tetryl manufacture until 1945 |
| 18 | Near Bldg. 1031 | Southern tetryl pit | Inactive | Disposal of waste from tetryl manufacture until 1945 |
| 35 | Near Bldgs. 1361A, 1363A, 1364, and 1365 | Nytroglycerin processing area | Inactive | Storage of spent nitric and sulfuric acids in tanks; tanks scheduled for decontamination and closure; Site also includes catch basin and stagnant water near buildings |
| 36 | Bldg. 3100 | Hazardous and nonhazardous waste storage area | Active | Storage of waste oil; storage capacity is 772 drums; Site is being renovated and is RCRA regulated |
| 41 | Bldg. 1094 | Lab-pack repacking and storage facility | Active | Storage of toxic chemical wastes and spent reagents; facility regulated under RCRA |
| 42 | Bldg. 3114 | PCB storage area | Active | Storage of PCB-contaminated waste oil, capacitors, and leaky transformers; RCRA-regulated facility |
| 43 | Bldg. 3157 | Pesticides storage area | Active | Storage and mixing of pesticides; cleaning of contaminated application equipment; facility regulated under RCRA |
| 51 | Bldg. 1380 | Hazardous waste tank storage area | Inactive | Storage of spent nitric and sulfuric acids in two 3,000-gal tanks; scheduled for decontamination and closure |
| 77 | Bldg. 3150 | Machine shop and waste storage area | Active | Building houses gym and machine shop for metal and plastic; basement storage area and underground tanks scheduled for closure |
| 91 | Bldg. 1301 | Rocket motor assembly | Active | Storage of small amounts of waste solvents and energetic wastes |
| 103 | Near Bldg. 3159 | Reservoir | - | May contain UXO |
| 114 | Bldg. 1033 | Filling plant for cast high explosives | Inactive | Used for loading explosives; filtered pink/red water reportedly was discharged into stream |
| 160 | Bldg. 1029 | Ordnanace facility | Active | Analysis activities generate waste propellant, nitrocellulose, and tetrahydrofuran; satellite accumulation of wastes on concrete floor |
| 161 | Bldg. 1031 | Nitration building | Active | TNT, HMX, and RDX plant; building scheduled for decontamination and closure |
| 162 | Bldgs. 1070, 1071, and 1071C | Explosives manufacturing and storage facilities | Active | Used for chemical storage prior to 1986; flammable materials currently stored in Bldg. 1071C; explosives wastewater leaching field may be present |
| 166 | Bldgs. 1354, 1357, and 1359 | Propellant buildings | Inactive | Reported spills of nitroglycerin inside buildings |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 167 | Bldgs. 1373 and 1374 | Ordnance facility and propellant plant | Inactive | Used to blend nitroglycerin/nitrocellulose slurries; contaminated sumps in Bldg. 1373 |
| 168 | Bldgs. 1400, 1402, and 1403 | Propellant plants and press house | Active | In Bldgs. 1400 and 1402, scrap propellant generated from sheet propellant production is stored on floor; Bldg. 1400 sump contains water but has not been used since 198i<br>In Bldg. 1403 (press house), scrap propellant and contaminated rags and solvents generated from mixing and propellant extrusion are stored on floor; possible spills; two sumps in use |
| 169 | Bldgs. 1408, 1408A-1408C, 1409, and 1411 | Propellant plants | Inactive | Water containing HMX, RDX, TNT, and nitroglycerin discharged into swamp between Bldgs. 1408A and 1408B; waste solvents and rags from propellant mixing stored on floor in Bldgs. 1408 and 1408C; scrap energetic material stored on floor in Bldg. 1409; a catch basin at the Site is possibly contaminated |
| 170 | Bldgs. 1462, 1463, and 1464 | Explosives plants | Inactive | Reportedly used for pilot plant R&D until 1980 or 1981; storage of potassium perchlorate and unknown chemicals; wastewater discharged outside; possible contamination includes TNT, comp. B, phosphate esters, and hydraulic fluid |
| 171 | Bldgs. 3106, 3109 and 3111 | Ordnance facility | Active | Testing of munitions; machinery repairs and leaks generate waste oil, which is stored in the buildings on concrete floors |
| 176 | Near Walsh and Schrader Roads | Little League baseball field | Active | Reportedly used as a burning ground; possible contamination from dredge materials reportedly applied to field in 1983 |
| 177 | | Sanitary sewer lines breaks/leaks | Active | Possible leakage of clay sewer pipes; chemical labs, photo shops, and other operations reportedly dumped chemicals into sewers |
| Area M: 600 Buildings Area | | | | |
| 15 | Bldgs. 616 and 654 | Munitions test area | Active | Developmental testing of munitions |
| 115 | Bldg. 611 | Ordnance facility | Active | Storage of aerosol cans; reported red seepage in soil from 528 area |

**TABLE 4.1 (Cont'd)**

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 152 | Bldgs. 604 and 604C, tanks 604C-T1 and 604C-T2 | Ordnance facility | Active | Explosives-contaminated water stored in underground storage tank; underground catch basin and tanks T1 and T2 are scheduled for closure |
| 153 | Bldg. 606 | Ordnance facility | Active | Storage outside of building of X-ray fixer and developer waste generated from X-ray developing |
| 154 | Bldg. 617 | Munitions and explosives testing | Inactive | Reported testing of munitions and explosives |
| | Bldg. 617G | Ordnance facility | Active | Storage of waste inside machine shop generated from fabricating test fixtures and modifying ammunition |
| 155 | Bldgs. 520 and 620B | Ordnance facilities | Active | Inside storage of waste from testing, including 111-trichoroethane, propellants, and explosives |
| Area N: Firing and Test Ranges | | | | |
| 7 | Bldg. 1242 | Munitions and propellants test area | Inactive | Developmental testing of munitions and propellants |
| 8 | Bldg. 1222 | Munitions and propellants test area | Active | Developmental testing of munitions and propellants |
| 9 | Bldgs. 670, 673, and 674 | Munitions and propellants test area | Active | Developmental testing of munitions and propellants |
| 10 | Along Berkshire Trail | Chemical burial pit | Inactive | Disposal of toxic chemical wastes, including cyanides and fluoroacetates |
| 11 | Bldgs. 647, 649, and 650 | Munitions test range | Active | Developmental testing of munitions |
| 12 | Bldg. 656 | Munitions waste pit | Active | Disposal of armament components |
| 13 | Bldg. 640 | Munitions and pyrotechnics test area | Active | Developmental testing of munitions and pyrotechnics |
| 14 | Bldg. 636 | Munitions test area | Active | Developmental testing of munitions |
| Area O: Lake Denmark | | | | |
| 54 | Northeast end of PTA | Lake Denmark | - | Used as impact area for mortars and other munitions; probably contains UXO from 1926 explosion |
| 164 | Bldg. 1217 | General purpose magazine | Active | Storage of propellant material; propellant materials reportedly opened outside |
| Area P: Miscellaneous Storage | | | | |
| 27 | Near Shinkle and S. Brook Roads | Former salt storage area | Inactive | Storage of road salts in building; building will be removed |
| 78 | Bldg. 91 | Optics prototype processing facility | Active | Storage of waste solvent, oil, and acid |

TABLE 4.1 (Cont'd)

| Site Number | Site Location | Site Name | Current Status[a] | Comments |
|---|---|---|---|---|
| 94 | Bldgs. 1600, 1601, 1604, 1609, and 1610 | Ordnance facilities | Inactive | Test firing of pyrotechnics; nuclear materials and atomic cannon developed at Site; storage of waste generated from photographic development |
| 119 | Bldgs. 46-48 | Propellant storage area | Active | Storage of propellant |
| 120 | Bldg. 50 | Propellant storage area | Inactive | Storage of propellant; small quantities of material may have spilled onto ground |
| 121 | Bldg. 57 | Chemical storage area | Active | Storage of chemicals, gas, nitrogen, and oxygen; possible leakage |

[a]Current status is as of May 1989. Active and inactive do not refer to the RCRA definition of these terms.

Each of the 16 Areas listed in Table 4.1 has been prioritized by USATHAMA and PTA with respect to the need for RI activity. The prioritization, which has been approved by the U.S. EPA and the NJDEP, is based on the potential for adverse effects on public health and the environment.

The results of the ranking are given in Table 4.1 in that the Areas are listed in the table in the order of their ranking; that is, Area A has the highest rank and is presented first in the table, Area B has the next highest rank and is presented next, and so on down to Area P, which has the lowest rank and is presented last in the table. The ordering of Areas and of Sites within each Area shown in Table 4.1 is preserved throughout this document. In particular, this is the case for Chapter 5 of Volume 1 and all of Volume 2.

The ranking shown in Table 4.1 is based on such factors as location with respect to water movement off PTA, the documented existence and extent of soil, surface water, or groundwater contamination, the status of required regulatory action on sites, etc. Area A, Burning Grounds, is assigned the highest ranking because a RCRA Subpart X permit application has already been filed for operating Site 34, the Burning Grounds. Since it is hoped to obtain the permit in 1992, it is important that the work needed to bring the Site into RCRA compliance be expedited and completed in time to obtain the permit.

Areas B and C, Southern Boundary, West and East of Green Pond Brook, respectively, are ranked next because of the potential for contamination to move off the southern boundary of the arsenal and affect the downgradient communities. The assignment of a higher rank to Area B than to Area C is arbitrary.

Area D, the Central Manufacturing Valley, is next in the ranking because Sites in the Area have the most extensive documented contamination in the Arsenal. Groundwater contamination originating from activities in Bldg. 24 is the main reason PTA was listed on the NPL. Interim remedial activities are also underway in the Area.

Area E, the Building 95 Area, is ranked next because of documented groundwater contamination and the contribution of Sites in the Area to the listing of PTA on the NPL. Area F, the Propellant Area, is next because it contains drinking water wells that are known to be contaminated.

Areas G and H, the respective Defense Reutilization and Marketing Office (DRMO) Yard and Munitions Assembly Areas, are next because of the potential to contaminate Green Pond Brook. Area G is known to be contaminated and is next to Green Pond Brook. Area H includes Bear Swamp Brook, which is a tributary to Green Pond Brook. Regulatory agencies are also interested in investigations of Bear Swamp Brook.

Area I, Around Picatinny Lake, is ranked next because the lake is an alternate water supply for the Arsenal. The next, Area J, Around Snakehill Road, includes the headwaters for Ames Creek, which flows off the Arsenal. This Area is ranked below those around Green Pond Brook because of the much lower potential for contamination of Ames Brook.

The ranking of the last six Areas is somewhat arbitrary. Area K, the Navy Hill Area, was the site of the 1926 explosion. There is a potential for explosives contamination of soil and water in Area L, the Explosives Manufacturing Area. Area M, the 600 Buildings Area, is part of the headwaters of Bear Swamp Brook, and Area N, Firing and Test Ranges, has some potential for generating contamination, some of which might ultimately end up in Picatinny Lake. Lake Denmark (in Area O), which should have less potential for contamination than Picatinny Lake, is used for recreation. Area P, Miscellaneous Storage, contains Sites that have been used for storage of wastes, chemicals, propellants, and road salt.

# 5 SUMMARY OF PROPOSED RI PLANS

## 5.1 INTRODUCTION

This section provides summaries of the proposed RI plans for each of the 156 Sites grouped into 16 Areas; Sec. 5.2 briefly describes the proposed activities for each Site, and Sec. 5.3 tabulates the sampling and survey activities. Details and other Site information are given in Volume 2. Types of activities proposed in the RI sampling plans include, but are not limited to, collecting surface soil samples and surface water samples; conducting soil gas and geophysical surveys; drilling soil borings to collect subsurface soil samples; and installing wells to monitor groundwater quality.

The proposed sampling plans for each Site are fairly detailed and compose, in essence, a summary work plan. Details, such as sampling depths and intervals, are given for many sampling activities. Unless explicitly stated otherwise, some procedures are the same for all Sites. All soil borings should be drilled to bedrock or the water table, whichever comes first. Water elevations should be measured in monitoring wells at the time samples are collected. Also, where a plan calls for the "disposal of" contaminated materials, such materials should be disposed of in an appropriate manner.

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) in turn are contingent on the results of Phase II. The only exception is for Phase I sampling activities that depend on the results of field 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 be different for different parameters, will be those selected as mutually agreeable to the U.S. Army, the EPA, and New Jersey.

Analytic 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, TCLP metals or TCLP leachabiality, explosives, propellants, herbicides, pesticides, macroparameters, and others. The specific chemical parameters in each of the categories used in this report are given in separate tables in App. C.

Analyses for pesticides or herbicides are recommended in the RI sampling plans for several Sites. This is done 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 that are representative of true background conditions may be difficult because Picatinny Arsenal has been active for such a long time, 100 years or more. The problem is that it is difficult to be sure that concentrations of metal or inorganic parameters measured at an assumed background location are naturally occurring, as 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 the quality assurance and quality control procedures given by USATHAMA (1987a, 1987b). These procedures are incorporated here by reference. Appropriate health and safety procedures must also be carried out during all proposed RI activities.

Brief summaries of 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 in the past at the Site for more than 90 days; 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), Solecki (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. Proposed activities will be carried out independently of implementation of the closure plan. All the closures are scheduled to be clean closures, that is, decontamination to the extent that the regulatory agency (e.g., the 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.

## 5.2 SITE-SPECIFIC PLANS

This section summarizes the proposed RI sampling plans for the Site in each of the 16 Areas. The order of presentation of the Areas and of the Sites within each Area is the same as that used in Table 4.1 and Volume 2. Additional discussion for each Site, as well as Site maps showing proposed sampling locations, can be found in Volume 2 of this report.

### 5.2.1 Area A: Burning Grounds

#### 5.2.1.1 Site 34 — Lower Burning Ground

- Conduct a geophysical survey to locate any buried shells and areas of contamination. Conduct a ground-penetrating radar survey to investigate the subsurface geology.
- Collect continuous core samples to characterize the particle size distribution, porosity, and hydraulic conductivity of soils in the area.
- Conduct an RI/FS in accordance with Task Order Number 20, issued by USATHAMA in January 1990.

### 5.2.2 Area B: Southern Boundary, West of Green Pond Brook

#### 5.2.2.1 Site 20 — Pyrotechnic Testing Range

- Collect four surface soil samples near the edges of the Site.
- Analyze the samples for TCLP leachability.
- See the recommendations for Site 24 for other activities for this area.

#### 5.2.2.2 Site 24 — Sanitary Landfill

Phase I

- Install three monitoring wells west and southwest of the Site. Because of mounding and the shallow water table in this area, place the wells far enough away from the landfill so the well screens can straddle the water table. Distance depends on the depth to water and on best field judgment. Collect groundwater samples and measure water levels.

- Analyze samples for all TCL compounds, explosives, and uranium. After the initial sampling, sample the wells quarterly for significant contaminants.

- Collect two sediment and two surface water samples from the southern drainage ditch upgradient and outside of the boundary of the study area. Collect the same number of sediment and surface water samples from the northern drainage ditch between the pond and brook.

- Analyze the surface water and sediment samples for TCL parameters, explosives, TCLP leachability (sediment samples only), and uranium.

**Phase II**

Install additional monitoring wells and drill soil borings if warranted by the results of the Phase I sampling program.

### 5.2.3 Area C: Southern Boundary, East of Green Pond Brook

#### 5.2.3.1 Site 19 — Pyrotechnic Demonstration Area

- Collect groundwater samples for two quarters from monitoring wells DM19-1, DM19-2, and DM19-3.

- Analyze the samples for volatile organics and metals.

#### 5.2.3.2 Site 23 — Post Farm Landfill

**Phase I**

- Sample the contents of, and the soil near, each drum in the wooded area southwest of the landfill. Analyze the samples for TCL volatiles, TCL semivolatiles, TCL metals, PCBs, pesticides, explosives, and propellants.

- Excavate and properly dispose of these drums and contaminated soil if contamination is confirmed.

- Install two new water-table wells, one west and one south of the southern part of the landfill.

semivolatiles, explosives, propellants, pesticides, PCBs, TCL metals, nitrite, nitrates, ammonia, gross alpha, gross beta, and macroparameters.

- Conduct slug tests for the two new wells and wells DM23-1 and DM23-2; measure static water levels in all wells quarterly for one year; and assess the groundwater flow regime.

**Phase II**

- Continue the monitoring program if warranted by the new data on groundwater flow and quality.

- Determine the need for additional soil sampling and monitoring wells.

**5.2.3.3 Site 25 — Landfill near South Boundary**

**Phase I**

- Sample surface water and sediments quarterly for one year at locations SW25-1 and SW25-2 on Green Pond Brook. Analyze samples for all TCL parameters, explosives, gross alpha, gross beta, nitrite, nitrate, macroparameters, and TCLP leachability (sediment samples only).

- Install three new water-table monitoring wells in the area between the landfill and the Arsenal boundary and install two new water-table wells northeast of the landfill.

- Collect groundwater samples from all existing wells, including the ten wells on Site 25 (DM25-1 through -5; MW-16 and MW-17; and LF-1, LF-2, and LF-3) and the nine wells in the three well clusters (i.e., SB1, SB2, and SB3) recently established near the PTA southwest boundary, and the five proposed new wells (24 wells altogether). Sample the wells for two quarters.

- Analyze all water samples for all TCL parameters (except for PCBs and pesticides), explosives, nitrite, nitrate, gross alpha, gross beta, and macroparameters.

- Conduct aquifer slug tests for selected wells (suggested wells are DM25-3, DM25-5, and LF-1), measure static water levels in all wells quarterly for one year, and assess the groundwater flow regime in the area.

- Determine whether the glacial aquifers at PTA are hydraulically connected to the Quaternary aquifer in the Rockaway River Basin area.

**Phase II**

Review the surface water and groundwater sampling results after the respective Phase I sampling programs are completed.

#### 5.2.3.4 Site 26 — Dredge Disposal Pile

**Closure Plan**

The revised RCRA closure plan for the dredge disposal pile includes the following:

- Random sampling methods will be used to collect 10 dredge samples composited from the pile surface to the interface between the pile and natural soil. Six samples will be analyzed for all EP toxicity parameters, reactivity (including reactive cyanide and sulfide), total petroleum hydrocarbons, and PCBs. Four samples will be retained as spare samples.

- Further sampling will be required only if the dredge pile is classified as hazardous waste by the NJDEP. Samples from 0 to 6 in. deep will be collected and analyzed for the same parameters listed above. The number of samples to be taken will be determined by NJDEP and ARDEC when the hazardous nature of the pile is determined.

**Proposed RI Plan**

**Phase I**

Monitor the groundwater with the existing well network in the area. Coordinate the monitoring for Site 26 with that for Site 25.

**Phase II**

If clean closure of the dredge pile is not possible, develop additional sampling.

#### 5.2.3.5 Site 163 — Baseball Fields

**Phase I**

- Use groundwater data from Site 25 to determine the groundwater flow direction and quality.
- Conduct a geophysical survey on the Site to locate potential contamination areas and the reported disposal pits.
- Drill one soil boring in each area of a located geophysical anomaly, and collect soil samples from the top, depth of pit bottom or anomaly, and bottom of each boring.
- Analyze the soil samples for furans, dioxins, PCBs, cyanide, TCL volatiles, TCL semivolatiles, TCL metals, propellants, and explosives.

**Phase II**

Determine the need for additional monitoring wells and soil and groundwater samples based on the results of Phase I.

#### 5.2.3.6 Site 180 — Waste Burial Area near Sites 19 and 34

**Phase I**

- Inspect all areas near the Site for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface water sample and one sediment sample from three locations in the swampy area. Determine locations by field inspection.
- If possible, conduct a geophysical survey to locate the disposal area.
- If the disposal area is found, a grid should be established and samples should be obtained from a depth of 0.6 m (2 ft) using a hand auger. If the disposal area cannot be found, collect 10 soil samples at random from a depth of 0.6 m across the Site area.
- Analyze all samples for all TCL parameters except dioxin.

**Phase II**

- Drill one soil boring in each area of significant soil contamination identified during Phase I. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the Phase I soil samples.
- Determine the need for monitoring wells based on the results of the soil boring analyses. Coordinate any well placement with the placement of new wells for Site 34 and the existing wells at Site 19.
- Analyze groundwater samples from any new wells for the parameters present at elevated concentrations in the soil boring samples.

### 5.2.4 Area D: Central Manufacturing Valley

#### 5.2.4.1 Sites 21 and 37 — Building 24, Metal Plating Facility and Surface Impoundments

- Collect groundwater samples for two quarters from all 33 wells installed in this area in 1987 by the USGS.
- Analyze the groundwater samples for TCL volatiles, TCL metals, radon-220, and radon-222.
- Upon approval by the NJDEP, close the lagoons at Site 37 according to the closure plan developed in accordance with NJAC 7:26-10.6(h).

#### 5.2.4.2 Site 29 — Building 31 Yard, Drum Storage Area

**Closure Plan**

Revised RCRA closure plans for the Bldg. 31 Yard, Drum Storage Area include the emptying and excavation of the 10,000-gal UST and piping from the storage area. Soil samples will be collected from three soil borings drilled in the area. Stained soil will be excavated and drummed. A composite soil sample will be collected of the drummed stained soil. All samples will be analyzed for priority pollutant metals, VOCs, PCBs, and if needed, EP toxicity (metals).

**Proposed RI Plan**

The proposed action for Site 29 is to complete the closure plan.

### 5.2.4.3 Site 39 — Building 31, Vehicle Maintenance Wastewater Treatment Facility

Upon approval of the closure plan by NJDEP, remove the 1,000-gal UST.

### 5.2.4.4 Site 45 — Building 33, 90-Day Waste Accumulation Area

**Phase I**

- Inspect the exterior of the building for visible contamination, spills, and leaks.
- Collect surface soil samples to a depth of 0.15 m (6 in.) outside the access doors and in any areas with visible contamination.
- Analyze the samples for TCL volatiles and TCL semivolatiles.

**Phase II**

If warranted by the results of the soil sampling, excavate and dispose of the contaminated soil and conduct confirmation sampling.

### 5.2.4.5 Site 49 — Buildings 19 and 19A, 90-Day Waste Accumulation Area

**Closure Plan**

The revised RCRA closure plan includes removing wastes; washing and rinsing both buildings; and collecting two wash water samples from each of the two buildings, four chip samples from Bldg. 19, and two chip samples from Bldg. 19A. The wash water and chip samples will be analyzed for priority pollutant metals. If the floor of Bldg. 19A is cracked, one soil sample will be collected through the crack and analyzed for VOCs, priority pollutant metals, and, if necessary, EP toxicity for metals.

If an area is found contaminated, additional surface and subsurface soil samples will be collected to delineate the extent of contamination.

**Proposed RI Plan**

No activities in addition to those in the closure plan are proposed unless the soils are contaminated, in which case surface water and groundwater should be sampled and monitored.

### 5.2.4.6 Site 69 — Building 92

**Closure Plan**

Revised RCRA closure plans include sampling and disposing of the containers of stored chemicals and high pressure water cleaning of the laboratory table tops in Room 18, a storage cabinet, and a paint locker storage bin. Two rinsate samples will be collected along with two chip samples from each cleaned area and analyzed for priority pollutant metals.

**Proposed RI Plan**

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area. Collect one soil sample each to a depth of 0.6 m (2 ft) from three locations around the underground tank.
- Collect two surface water and sediment samples from the location of the former outfall at Bear Swamp Brook.
- Analyze all samples for TCL volatiles, TCL semivolatiles, TCL metals, nitrate, sulfate, and cyanide.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination.
- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of soil boring analyses.

**5.2.4.7 Site 86 — Building 12**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways. In the absence of visible contamination, no further action is required.
- Determine the need for additional sampling based on the field inspection.

**5.2.4.8 Site 117 — Building 22**

**Phase I**

- Inspect the Site and surrounding area for visible contamination.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.
- Collect three surface water and sediment samples 30 m (100 ft) apart along Bear Swamp Brook (one upstream, one at the Site, and one downstream).
- Analyze all soil, surface water, and sediment samples for TCL volatiles, TCL semivolatiles, uranium, and TCL metals.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.4.9 Site 118 — Building 41 (Pesticide Storage) and Oil-Water Separator Pond

**Phase I**

- Collect one sediment sample from the brook at the outlet of the underground pipe and collect two sediment samples and two water samples from the oil-water separator pond.
- Analyze the sediment and water samples for TCL volatiles, TCL semivolatiles, TCL metals, cyanide, PCBs, pesticides, and herbicides.

**Phase II**

- If significant contamination is found in the Phase I samples in the pond, install at least one shallow well between the pond and the brook to monitor groundwater flow and quality.
- Analyze the groundwater samples for the chemicals found in Phase I analysis.

### 5.2.4.10 Site 122 — Building 60

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from thee locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.
- Collect three surface water and sediment samples 30 m (100 ft) apart along Bear Swamp Brook (one upstream, one at the Site, and one downstream).
- Analyze all samples for TCL volatiles, TCL semivolatiles, and explosives.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

**5.2.4.11 Site 123 — Building 64**

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.
- Collect three surface water and sediment samples 30 m (100 ft) apart along Bear Swamp Brook (one upstream, one at the Site, and one downstream).
- Analyze all soil, surface water, and sediment samples for TCL metals, uranium, nitrate, sulfate, and cyanide.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.4.12 Site 182 — Building 5

#### Closure Plan

Revised RCRA closure plans for Bldg. 5 include removing hazardous waste and any contaminated floor tiles and washing the building with detergent. Two wash water or rinsate grab samples and two chip samples will be collected and analyzed for priority pollutant metals.

#### Proposed RI Plan

#### Phase I

- Inspect the area around Bldg. 5 for signs of contamination or staining Do nothing further if the area appears to be clean.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) in the center of each visibly contaminated area.
- Analyze the samples for cyanide and TCL metals.

#### Phase II

- If the surface soil samples contain significant silver concentrations, drill one soil boring at the center of each contaminated area. Collect samples from each boring.
- Analyze the samples for cyanide and TCL metals.

#### Phase III

Determine the need for monitoring wells based on the results of the soil boring program.

### 5.2.4.13 Site 183 — Building 58

#### Closure Plan

The revised RCRA closure plan for Bldg. 58 includes decontaminating the photoprocessing facility. Two wash water or rinsate grab samples and two chips will be collected and analyzed for priority pollutant metals.

**Proposed RI Plan**

**Phase I**

- Inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each visibly contaminated area outside the building.
- Analyze the soil samples for cyanide, and TCL metals.

**Phase II**

- Drill one soil boring in each area of significant soil contamination and collect samples from each boring.
- Analyze the samples for the contaminants found in the Phase I samples.

### 5.2.5 Area E: Building 95 Area

#### 5.2.5.1 Site 22 — Impoundments near Building 95

**Closure Plan**

The revised RCRA closure plan includes the following proposed actions:

- Test holes will be drilled through the center of the closed old sludge drying basin and two sand filter lagoons and into the upper aquifer; composite soil samples will be collected over 0.6-m (2-ft) intervals. In addition, two core samples will be taken from the locations outside and downgradient from the lagoon, and eight snallow soil samples will be collected to a depth of 0.3 m (1 ft) from random locations downgradient from the lagoon.
- The soil samples (a total of about 25) will be analyzed for pH, total organic carbon (TOC), total organic hydrocarbons (TOH), conductivity, and priority pollutant metals. If TOC and TOH concentrations exceed background levels, then the soil will be tested for the volatile organic portion of the priority pollutants analysis.

- 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 soil samples indicate that soils below and downgradient of these impoundments are still contaminated, the contaminated soil will be excavated until clean soil is reached. The contaminated soil will be disposed of at permitted facilities, and the excavation pits will be backfilled with clean fill, resurfaced with top soil, and seeded.

- The exact location of underground pipelines on the Site will be determined by using appropriate, commercially available pipe location techniques. Four soil samples will be randomly collected from locations under the pipes and analyzed for pH, TOC, total organic halogens (TOX), conductivity, and priority pollutant metals. If the soil under the pipelines is contaminated, then both the piping and soil will be removed by excavation and disposed of properly. Excavation of soil will continue until clean soil is reached. The excavation will then be restored to prevent soil erosion. If the soil under the pipelines is not contaminated, these pipelines will be cleaned and then capped.

- An ongoing groundwater monitoring program by USGS will be continued for this area. The new monitoring wells drilled in summer 1989, which are completed in the unconfined glacial aquifer, and all other wells at the Site will be sampled for analysis of trace metals, common constituents, explosive compounds, and VOCs. In addition, about 15% of the wells will be sampled for analysis of base/neutral and acid extractable compounds, pesticides, and PCBs. Water levels will be measured in all wells to develop maps of the water table elevation.

**Proposed RI Plan**

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

**5.2.5.2 Site 28 — Sewage Treatment Plant Sludge Beds**

**Phase I**

- Check the units in the sewage treatment plant for subsurface leakage.

- Collect sewage samples and sludge samples (from the secondary settling tanks in the existing plant).

- Analyze the samples to determine whether they contain excessive levels of contaminants generally not present in sewage, including TCL metals, TCL volatiles, TCL semivolatiles, and PCBs.

**Phase II**

- Install a well cluster between the sewage treatment plant and Green Pond Brook.

- Include the new well cluster in the groundwater monitoring program for Site 22.

### 5.2.5.3 Site 38 — Building 95, Plating and Etching Wastewater Treatment System

Closure Plan

The revised closure plan calls for the interim closure of unused underground tanks T-1, T-2, and T-7 by removing the contents, washing the tanks with water, flushing and removing all associated piping, etc., and closing the tanks in place by filling them with an inert material. Two rinsate samples will be collected per tank; one concrete core sample and one underlying soil sample will be collected from underneath each of the tanks. The rinsate and core samples will be analyzed for priority pollutant metals, and the soil samples will be analyzed for priority pollutant metals, halogenated VOCs, and, if necessary, EP toxicity for metals.

**Proposed RI Plan**

**Phase I**

- Close tanks T-3 through T-6, T-8, and T-9 as soon as possible. Implement the sampling specified in the closure plan for tanks T-1, T-2, and T-7 and collect additional samples as described below.

- Collect six grab samples from the tanks and six soil samples from beneath the tanks.

- Analyze the grab and soil samples for all TCL parameters, cyanide, and TCLP leachability.

### Phase II

If the soil samples are found to be contaminated, collect additional soil and groundwater samples.

### 5.2.5.4 Site 44 — Building 39, Golf Course Maintenance Shop

### Closure Plan

Revised RCRA closure plans include inspection of the building and surrounding areas, and collection of one soil sample from under the pallet storage area. The sample will be analyzed for petroleum hydrocarbons, VOCs, priority pollutant metals, herbicides, pesticides, and, if necessary, EP toxicity for metals. If the sample shows contamination, one soil boring will be drilled in the area.

### Proposed RI Plan

### Phase I

- Inspect the underground gasoline tank next to the building. If the tank leaks, collect two soil samples from underneath the tank and analyze them for TCL volatiles and TCL semivolatiles.

- Collect six air quality samples in the area around the building.

- Analyze the air samples for TCL volatiles, TCL semivolatiles, TCL metals, pesticides, herbicides, and asbestos.

### Phase II

- Collect subsurface soil samples at the locations known to be contaminated with pesticides to delineate the extent of contamination.

- Develop a cleanup plan.

## 5.2.6 Area F: Propellant Area

### 5.2.6.1 Site 60 — Building 163, Photography Laboratory

**Closure Plan**

The revised RCRA closure plan for the underground storage tank near the building includes collecting one sample of the tank contents and analyzing it for priority pollutant metals, VOCs, and cyanide. The tank and piping will be emptied, cleaned, and removed. Six soil samples will be collected and analyzed for priority pollutant metals, VOCs, cyanide, and EP toxicity for metals. One or two condensate or rinsate grab samples and two chip samples will be collected and analyzed for priority pollutant metals.

**Proposed RI Plan**

**Phase I**

- Inspect the building and area around it for signs of contamination. Do nothing further if the area is clean.
- Collect one surface soil sample from each area of stained soil.
- Analyze the soil and chip samples for cyanide and TCL metals.

**Phase II**

Drill one soil boring in each area of soil contamination identified by the Phase I results. Additional soil and water samples may be needed to determine the extent of contamination, if any, found by the Phase I results.

### 5.2.6.2 Site 61 — Buildings 171 and 176, Photographic and Propellant Processing

**Closure Plan**

The revised closure plan includes decontaminating the building and equipment. Two wash water or rinsate samples and two chip samples will be collected and analyzed for priority pollutant metals. Six soil samples will be collected and analyzed for priority pollutant metals, VOCs, cyanide, and, if necessary, EP toxicity for metals.

**Proposed RI Plan**

**Phase I**

- Inspect the areas around the buildings to locate areas of visible contamination or dumping. Inspect the photographic chemical containers stored in the shed behind Bldg. 176 for signs of leakage.
- Collect one surface soil sample from the center of each visibly contaminated area outside the buildings.
- Collect four surface soil samples behind Bldg. 171.
- Collect one sediment sample from each drain outfall from Bldg. 171, and collect two surface water samples and two sediment samples from the creek south of Bldg. 171.
- Analyze the above soil, water, and sediment samples for cyanide, propellants, and TCL metals.
- Collect one surface soil sample from each side of Bldg. 176.
- Analyze the Bldg. 176 surface soil samples for cyanide and TCL metals.
- Collect four surface water samples and four sediment samples to a depth of 0.6 m (2 ft) from the swamp between Bldgs. 176 and S406.
- Analyze the surface water and swamp sediment samples for TCL metals, propellants, and explosives.

**Phase II**

- Drill one soil boring in the center of each contaminated area identified by the Phase I surface soil analyses. Samples should be analyzed for parameters found at significant contamination levels in the Phase I results.
- Collect additional sediment and soil samples and install monitoring wells if warranted by the Phase I analyses and soil boring results.

### 5.2.6.3 Site 104 — Buildings 161 and 162, Chemical Laboratories

**Phase I**

- Conduct a field inspection in the areas around the buildings to locate propellant dumping areas and the lime pit. If the lime pit cannot be located, conduct a geophysical survey to locate the pit. Visually inspect the swamp, creek, and building interiors for signs of contamination.

- Collect surface soil samples to a depth of 0.6 m (2 ft):

  - One sample from each area outside the buildings with signs of contamination.

  - One sample from each identified propellant or chemical dump.

  - One sample from each side of each building (eight samples).

- If the lime pit is located, drill one soil boring in its center and collect soil samples from the top, pit bottom, and bottom of the boring.

- Collect surface water and sediment samples to a depth of 0.3 m (1 ft):

  - Three water and three sediment samples from the swamp behind Bldg. 162.

  - One water and one sediment sample from the creek downgradient from the buildings.

  - One sediment sample from each outfall of building drain.

- Analyze all the samples for TCL volatiles, TCL semivolatiles, TCL metals, propellants, explosives, nitrates, and sulfates.

**Phase II**

- Drill one soil boring from the surface to the water table in the center of each area of significant contamination identified by the Phase I analyses. Collect soil samples over 0.6-m (2-ft) intervals from each boring.

- Analyze the soil boring samples for contaminants with elevated concentrations in the Phase I samples.

- Install at least one monitoring well downgradient from the lime pit site, if the surface soil samples and soil boring samples show contamination.

**Phase III**

Collect additional soil, sediment, and water samples to delineate the extent of the contamination, depending on the Phase II results.

**5.2.6.4 Site 106 — Building 1010, Propellant Plant**

**Phase I**

- Visually inspect the location of Bldg. 1010 (which was destroyed under TECUP) and the transformer storage area for signs of contamination.

- Collect one surface soil sample over a depth of 0.15-0.3 m (6-12 in.) from each side of the building's former location and transformer storage area (a total of eight samples) and from the center of each visibly contaminated area.

- Analyze the samples for propellants, PCBs, and nitrates.

**Phase II**

- Collect additional surface soil samples if warranted by the results of the Phase I analyses.

- Drill one soil boring in the center of each significantly contaminated area identified during Phase I. (Avoid the asbestos burial area.) Collect at least two soil samples from each boring.

**5.2.6.5 Site 111 -- Buildings 454 and 455, Propellant Bag Filling Area**

**Phase I**

- Inspect the areas around the buildings for signs of contamination and drain outfalls.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each area with visible contamination.

- Collect two surface soil samples to a depth of 0.6 m (2 ft) from the Bldg. 454 loading areas and collect one surface soil sample (to the same depth) from each side of Bldgs. 455 and 454 (eight samples).
- Collect one sediment sample to a depth of 0.6 m (2 ft) from the outfall of each building drain located during the inspection.
- Analyze all samples for propellants.

**Phase II**

Collect additional surface soil samples and drill soil borings if areas of significant contamination are identified by the Phase I results.

**5.2.6.6 Site 124 — Building 166, Propellant Testing**

**Phase I**

- Inspect the area around the building for signs of contamination. Do nothing further if the area is clean.
- Collect one soil sample from each visibly contaminated area outside the building.
- Analyze all samples for propellants and explosives.
- Prepare a composite sample from three soil samples taken from three areas near the PCB transformer at the building.
- Analyze the composite sample for PCBs.

**Phase II**

- Drill one soil boring to the water table at each contaminated aree and collect soil samples from each boring.
- Analyze the boring samples for propellants and explosives.

### 5.2.6.7 Site 125 — Buildings 172 and 183, Office Building and Lubricant Testing

**Phase I**

- Inspect the areas around the buildings for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the buildings and collect one soil sample from each side of the two buildings (at least eight samples altogether).
- Analyze all samples for TCL semivolatiles, TCL metals, nitrates, and sulfates.
- Prepare two composite samples, each from three soil samples (to a depth of 0.15 m) collected in areas near each of the two PCB transformers of Bldg. 183.
- Analyze the composite samples for PCBs.

**Phase II**

Determine the need for additional sampling based on the Phase I analyses.

### 5.2.6.8 Site 126 — Building 197, Propellant Testing

**Phase I**

- Inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the building.
- Analyze all samples for propellants.

**Phase II**

- If contamination is found in the surface soil samples, drill one soil boring in the center of each contaminated area and collect samples from each boring.

- Analyze the boring samples for the contaminants found in the Phase I samples.

**5.2.6.9 Site 138 — Buildings 404, 407, and 408, Chemical Laboratory and Propellant Plants**

**Phase I**

- Inspect drains, drain outfalls, and the areas around the buildings for signs of contamination.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the buildings and collect one surface soil sample to a depth of 0.6 m (2 ft) from each side of each building (12 samples).

- Collect sediment and surface water samples:

  - One sediment sample at the outfall of each drain from the buildings.

  - One sediment sample from each settling tank of Bldg. 408.

  - Two surface water and two sediment samples from the nearby swamp.

- Collect two drive-point water samples from each of three different areas (a total of six samples) downgradient of the buildings.

- Analyze the soil, water, and sediment samples for nitrates, TCL metals, TCL volatiles. TCL semivolatiles, explosives, and propellants.

- Prepare a composite sample from either three soil samples (to a depth of 0.15 m) or chip samples in three areas near the PCB transformers of Bldg. 404.

- Analyze the composite sample for PCBs.

**Phase II**

- Collect surface water samples and additional soil samples if significant contamination is indicated by the Phase I analyses.

- Install two shallow monitoring wells downgradient to monitor groundwater if warranted by the soil, sediment, and surface water analyses.

- Analyze the groundwater samples for TCL metals, TCL volatiles, explosives, and propellants.

### 5.2.6.10 Site 139 — Building 424, Propellant Processing

**Phase I**

- Conduct a field inspection to locate the reported decontamination pits and slurry pipeline. Use geophysical methods if necessary.

- Collect soil samples from each pit located by the inspection:

  - If the pit bottoms are visible, collect one soil sample from the bottom of each.

  - If the pits are covered, drill one soil boring to a depth at least 1.8 m (6 ft) below the bottom of each pit. Collect samples from the top, pit bottom, and bottom of each boring.

- Collect two sediment samples to a depth of 0.3 m (1 ft) from the swamp behind the building.

- Analyze all samples for propellants.

**Phase II**

- If contamination is indicated by the Phase I analyses, drill one soil boring in each area of contaminated soil or sediment sampling. Collect samples from each boring and analyze for contaminants found in the Phase I samples.

- Additional groundwater sampling may be needed to determine the extent of contamination.

### 5.2.6.11 Site 140 — Buildings 427 and 427B, Propellant Processing

**Phase I**

- Inspect the areas around the buildings for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the buildings and collect one surface soil sample from each side of Bldg. 427.
- Collect two sediment samples to a depth of 0.3 m (1 ft) in the open drain around the buildings, two sediment samples from any two inlets of the open drain, and one sediment sample from the concrete pit of Bldg. 427B.
- Analyze all samples for propellants and explosives.
- Collect one grab sample from each catch tank in Bldg. 427.
- Analyze the grab sample for TCL volatiles, TCL semivolatiles, acetone, ethyl acetate, propellants, and explosives.

**Phase II**

If contamination is indicated by the Phase I analyses, collect additional groundwater and soil samples.

### 5.2.6.12 Site 141 — Building 429, Propellant Crushing

**Phase I**

- Inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area.
- Analyze the surface soil samples for propellants.
- Collect one sediment sample from the catch tank in Bldg. 429.
- Analyze the sediment sample for TCL metals, TCL volatiles, TCL semivolatiles, and propellants.

Phase II

Collect additional samples if contamination is indicated by the Phase I analyses.

**5.2.6.13 Site 142 — Building 435, Propellant Solvent Mixing**

**Closure Plan**

The revised RCRA closure plan includes removal of hazardous wastes and decontamination of the building and equipment. Two chip samples and two wash water or condensate samples will be collected and analyzed for priority pollutant metals. After decontamination, equipment will be removed and disposed of and the building will be demolished.

**Proposed RI Plan**

**Phase I**

- Inspect the area around the building for visible contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each area with signs of contamination.
- Collect one sediment sample from the outfall of each building drain outlet located during the inspection.
- Analyze the soil and sediment samples for propellants, nitrates, chlorides, ethyl acetate, and acetone.

**Phase II**

Collect additional samples if contamination is indicated by the Phase I analyses. Determine sampling media and locations based on the Phase I results.

**5.2.6.14 Site 143 — Building 436, Propellant Processing**

**Phase I**

- Inspect the area around the building for signs of contamination.

- Collect one surface soil sample to depth of 0.3 m (1 ft) from each visibly contaminated area.
- Collect one sediment sample to a depth of 0.3 m (1 ft) from the outfall of each drain located during the inspection.
- Analyze all samples for propellants.

**Phase II**

Collect additional samples if contamination is indicated by the Phase analyses. Determine sampling media and locations based on the Phase I results.

### 5.2.6.15 Site 144 — Building 462, Propellant Processing

**Phase I**

- Conduct a field inspection to locate signs of contamination outside the building, to locate drains and drain outfalls, and to inspect any waste cans for leaks.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area outside the building.
- Collect one sediment sample from each located drain or drain outfall.
- Analyze the soil and sediment samples for explosives and propellants.

**Phase II**

- If contamination is found in the outfalls of any drains, install two monitoring wells in two different areas downgradient from the building. Sample the well for two quarters.
- If contamination is found in the soil samples, determine the need for additional surface or subsurface soil samples.

### 5.2.6.16 Site 145 — Building 477, Explosive and Propellant Mixing

**Phase I**

- Conduct a field inspection around the building to locate areas with signs of contamination, the reported sand filter, drains, drain outfalls and any of the reported waste dumping areas.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) in the center of any located area of waste dumping and each area with signs of contamination. Collect one surface soil sample to a depth of 0.6 m (2 ft) from each side of the building.

- Collect two sediment samples from the bottom of the sand filter (if it is located) and collect two sediment samples to a depth of 0.3 m (1 ft) from each drainage receiving filter effluent.

- Collect one sediment sample from each building drain outfall located by the inspection.

- Analyze all soil and sediment samples for TCL metals, propellants, and explosives.

**Phase II**

- If any of the sediment samples collected from filter effluent areas or drains contain significant contamination, install one well between the building and brook.

- Collect water samples for two quarters and analyze for contaminants found in the Phase I samples.

- If the soil samples contain significant contamination, determine the need for additional surface and subsurface soil sampling.

### 5.2.6.17 Site 146 — Building 497, Powder Pressing

**Phase I**

- Conduct a field inspection to locate signs of contamination.

- Collect four surface soil samples to a depth of 0.15 m (6 in.), one from each side of the building. If possible, collect one soil sample from each of two locations under the building.

- Collect one sediment sample from each ditch or drain outfall around the building (if any exist) and from any drainage receiving effluent from the building.

- Analyze the soil and sediment samples for propellants.

**Phase II**

Collect additional samples if contamination is indicated by the Phase I analyses. Determine sampling media and locations based on the Phase I results.

### 5.2.7 Area G: DRMO Yard and Surroundings

#### 5.2.7.1 Site 31 — Buildings 314 and 314B-314E, Defense Reutilization Marketing Office

**Phase I**

- Inspect area surrounding Bldgs. 314B, 314C, 314D, and 314E for visible contamination. Collect surface soil samples from each stained area and one from each loading and handling area.

- Analyze the surface soil samples for TCL compounds.

- Drill eight soil borings to the water table, one each at the soil sampling locations SS31-1 through SS31-6, SS31-8, and SS31-10.

- Analyze the soil boring samples for all TCL parameters.

**Phase II**

Install groundwater monitoring wells if warranted by the results of the soil boring program.

### 5.2.7.2 Sites 52 and 95 — Petroleum Leak Area (near Building 305) and Building 336

**Brook Area**

**Phase I**

- Collect 10 surface soil samples at depths of 0.15-0.3 m (6-12 in.) in an even distribution across the brook area.
- Analyze the samples for all TCL parameters except dioxin.

**Phase II**

Drill soil borings if warranted by the results of the soil sampling.

**Swampy Area**

**Phase I**

- Drill soil borings to 3 m (10 ft) or groundwater in (1) the location of Bldg. 336 and (2) all areas where previous surface soil samples contained elevated contaminant concentrations. Collect samples from the top, middle, and bottom of each core.
- Analyze the boring samples for TCL volatiles, TCL semivolatiles, TCL metals, and explosives.

**Phase II**

Install upgradient and downgradient monitoring wells if warranted by the results of the soil boring program.

**Former Pond Bed**

**Phase I**

- Drill soil borings to 3 m (10 ft) or groundwater in all areas where previous surface soil samples contained elevated contaminant concentrations. Collect samples from the top, middle, and bottom of each core.

- Analyze the samples for all TCL volatiles, TCL semivolatiles, TCL metals, and explosives.

**Phase II**

Install upgradient and downgradient monitoring wells, if warranted by the results of the soil boring program.

**5.2.7.3 Site 96 — Buildings 301 and 301A**

**Phase I**

- Inspect the Site and surrounding areas for visible contamination. Locate drains and other migration pathways.

- Collect one soil sample from each stained area.

- Collect one surface soil sample from each side of each building and one sample from three locations in each storage area. Collect the samples between 0.15 and 0.3 m (6 and 12 in.) deep. If storage areas are paved, drill through the pavement to obtain samples.

- Analyze all samples for TCL volatiles, TCL semivolatiles, and PCBs.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.7.4 Site 101 — Buildings 311 and 319

**Phase I**

- Inspect the Site and surrounding areas for visible contamination. Locate drains and other migration pathways. Inspect the area around Bldg. 311 for signs of disposal activities. Carry out a geophysical survey to locate disposal pits (if any).
- If disposal pits are found, collect six or more surface soil samples between 0.15 and 0.3 m (6 and 12 in.) deep from the pit area.
- Collect one surface soil sample from ten locations between 0.15 and 0.3 m (6 and 12 in.) deep in the reported burning ground area.
- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, and TCL metals.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.7.5 Site 134 — Building 302

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Conduct a geophysical survey around building to locate the disposal pit.
- If the pit is found, collect three hand-auger samples to a depth of 0.6 m (2 ft) in the pit area. If the pit is paved over, drill through the pavement to obtain samples.

- Collect one soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each storage area. Drill through pavement if necessary.
- Analyze all samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrate, and nitrite.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

**5.2.7.6 Site 135 — Building 315**

**Phase I**

- Inspect the Site and surrounding area for visible contamination.
- Collect one surface soil sample from each stained area.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.
- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, and sulfate.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

#### 5.2.7.7 Site 136 — Building 355

**Phase I**

- Inspect the Site and surrounding area for visible contamination.
- Collect one surface soil sample from each area.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.
- Analyze all samples for TCL volatiles, TCL semivolatiles, TCL metals, nitrate, and sulfate.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.8 Area H: Munitions Assembly

#### 5.2.8.1 Site 55 — Building 225, Explosives Machining Facility

**Phase I**

- Collect soil samples at four locations: (1) underneath the raised flow trough between Bldgs. 225 and 232 at 3-m (10-ft) intervals, (2) around the perimeters of Bldgs. 221, 223, and 225 (two samples from each side of each building [24 total]), (3) around the holding tank in Bldg. 225 if possible, and (4) under the discharge point in Bear Swamp Brook at each corner and in the center of a 4.6- by 6-m (15- by 20-ft) area.

- Analyze all samples for TCL volatiles, TCL semivolatiles, nitrate, nitrite, and explosives.

**Phase II**

Install groundwater monitoring wells if warranted by the results of the soil sampling program.

### 5.2.8.2 Site 62 — Building 210

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate any drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.
- Collect two surface water and sediment samples from the former outfall location in Bear Swamp Brook.
- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant soil contamination.
- Analyze the samples for parameters found to have elevated concentrations by the Phase I analyses.
- Install one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.8.3 Site 64 — Building 241

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Collect one surface soil sample from each area of stained soil.
- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.
- Collect two surface water and sediment samples from the location of the former outfall in Bear Swamp Brook.
- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

Phase II

- Drill one soil boring to the shallower of the water table or 3.0 m (10 ft) in each area of significant surface soil contamination.
- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring program.

#### 5.2.8.4 Site 98 — Building 268

Phase I

- Inspect the building and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.
- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, and nitrite.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table, whichever comes first, in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated levels in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.8.5 Site 100 — Building 276

Phase I

- Review DEH records to find the former location of Bldg. 276 (which was destroyed under TECUP) and determine the positions of loading docks and doors. Inspect these areas for visible contamination and signs of disposal.

- Collect one surface soil sample from each visibly contaminated area.

- Collect one surface soil sample from ten locations between 0.15 and 0.3 m (6 and 12 in.) deep at the building's former location. Use building plans to locate samples.

- Collect two surface water and sediment samples from Bear Swamp. Sampling locations should be in areas near the building.

- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, and PCBs.

Phase II

- Drill one soil boring 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

#### 5.2.8.6 Site 127 — Building 230

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area. Collect one surface soil sample from each side of the building.
- Analyze all samples for explosives, nitrate, and nitrite.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

#### 5.2.8.7 Site 128 — Buildings 235 and 236

**Phase I**

- Inspect the Site and surrounding areas for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area. Collect one surface soil sample from each side of each building (eight perimeter samples altogether).
- Analyze all samples for explosives, nitrate, and nitrite.

**Phase II**

- Drill one soil boring to the water table or 3 m (10 ft) in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

**5.2.8.8 Site 129 — Building 240**

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways. Search PTA records and interview knowledgeable personnel about past uses of Bldg. 240.

- Develop and implement a sampling plan if warranted by the results of the inspection and records search.

**Phase II**

Determine the need for further action if sampling shows the presence of contamination.

**5.2.8.9 Site 130 — Building 252**

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Collect one surface soil sample from each area of stained soil.

- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area. Collect one surface soil sample from each side of the building.

- Analyze all samples for explosives, propellants, nitrate, and nitrite.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

**5.2.8.10 Site 131 — Building 266**

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area.
- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, nitrate, nitrite, sulfate, and PCBs.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.8.11 Site 132 — Buildings 271 and 271I-271N

#### Closure Plan

The revised RCRA closure plan for Bldg. 271I includes analyzing one grab sample from each container for the parameters listed in the closure plan. Also, seven chip samples and two grab samples of wash water or condensate will be analyzed for priority pollutant metals.

#### Proposed RI Plan

#### Phase I

- Inspect the Site and surrounding areas for visible contamination. Locate drains and other migration pathways.
- Collect one surface soil sample from each area of stained soil.
- Collect one surface soil sample from three locations from a depth of 0.15-0.3 m (6-12 in.) in each loading and handling area. Collect four surface soil samples from the perimeter (one from each side) of each building.
- Analyze all samples for TCL metals, explosives, propellants, nitrate, and nitrite.

#### Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.
- Analyze the boring samples for the parameters present at elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

#### 5.2.8.12 Site 151 — Building 600

**Phase I**

- Visually inspect the area around the building for signs of contamination.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from each side of the building and from the center of each area of visible contamination.
- Analyze the samples for propellants and explosives.

**Phase II**

- If significant contamination is found, drill one soil boring in the center of each contaminated area. Collect samples from each boring.
- Analyze the boring samples for the contaminants found in the Phase I samples.

### 5.2.9 Area I: Around Picatinny Lake

#### 5.2.9.1 Site 16 — Guncotton Line

- Consult knowledgeable personnel of ARDEC before characterizing the line or making decisions about its disposition.
- The location of 80% of the length of the guncotton line is known. Use dye tracer tests to locate the remainder of the line. Assess the integrity of the line.
- Assess the feasibility of removing the line based on the explosives removal methods developed by the Army.
- During any excavation of the line or associated portions, collect samples of surrounding soil and analyze them for explosives.

### 5.2.9.2 Site 30 — Building 3045, Fluorochemicals Storage

**Closure Plan**

Revised RCRA closure plans for Bldg. 3045 include collecting two rinsate samples and two chip samples from the cleaned floor and analyzing them for priority pollutant metals.

**Proposed RI Plan**

**Phase I**

- Collect four surface soil samples to a depth of 0.15 m (6 in.) at the following locations: one sample by the building doorway, one sample along each of the two sides of the building, and one sample from the roof near the vent (only if soil is present).
- Analyze the samples for TCL metals, TCL volatiles, TCL semivolatiles, herbicides, chloride, fluoride, bromide, nitrate, and nitrite.

**Phase II**

- Collect additional soil samples if significant contamination is found in the surface soil samples. Drill soil borings if they are needed to determine the depth of contamination.
- Install two monitoring wells (one upgradient and one downgradient of the building) if warranted by the results of the surface soil sampling in Phase I.

### 5.2.9.3 Site 32 — Storage Tanks at Building 553

**Closure Plan**

Revised RCRA closure plans for the 11 tanks include air bomb or liquid sampling of each tank, followed by water flushing and steam cleaning. One steam condensate grab sample will be collected for each tank. The samples will be analyzed for nitrates, VOCs (liquid samples only), and priority pollutant metals (condensate samples only).

**Proposed RI Plan**

**Phase I**

- Collect 14 surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.), one under each filling or discharge point for each tank (11 samples altogether) and three along the northwest side of Bldg. 553 and by the pipeline.

- Collect three or more surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.) under the pipeline at points of soil staining or under joints and valves if no staining is present.

- Analyze the samples for TCL volatiles, TCL semivolatiles, nitrocellulose, nitrate, and nitrite.

**Phase II**

Collect additional surface soil samples and/or drill soil borings if warranted by the Phase I results.

**5.2.9.4 Site 33 — Storage Tanks at Building 527A**

**Closure Plan**

Revised RCRA closure plans for the Site include collecting air bomb and liquid samples of the tank contents followed by flushing out the tanks with water and then steam cleaning. Two steam condensate samples will be collected from the tanks and 16 soil samples will be collected at two depths (0-0.15 m and 0.15-0.3 m [0-6 in. and 6-12 in.]) at 8 locations from the area under the two tanks. The samples will be analyzed for nitrates (0-6 in. soil and liquid samples only), VOCs (6-12 in. soil and liquid tank samples only), priority pollutant metals (0-6 in. soil and condensate samples only), and, if necessary, EP toxicity for metals (soil samples only).

**Proposed RI Plan**

**Phase I**

- Collect two surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.) from locations half-way between the building and Picatinny Lake.

- Analyze samples for TCL volatiles and explosives.

#### Phase II

Collect additional surface soil samples, drill soil borings, and/or install monitoring wells if warranted by the Phase I results.

### 5.2.9.5 Site 40 — Buildings 809 and 810, Explosives Manufacturing Wastewater Treatment Facility

#### Closure Plan

Revised RCRA closure plans for Bldg. 809 include collecting wipe samples from the cleaned floor and analyzing them for nitrates and EP toxicity (metals). Surface soil samples will be collected from five locations and analyzed for priority pollutant metals, nitrate, and EP toxicity for metals. Subsurface soil samples will be collected from the same locations and analyzed for VOCs.

Revised closure plans for the holding tank outside Bldg. 810 include collecting surface and subsurface soil samples at four locations around the tank pad and analyzing them for priority pollutant metals, nitrates, and EP toxicity for metals. Subsurface samples will be collected from the same locations and analyzed for VOCs.

#### Proposed RI Plan

#### Phase I

- Collect six surface soil samples to a depth of 0.15 m (6 in.) as follows: three from the drainage ditch, two along the lake shore, and one from sediments in the drainage pipe.
- Collect surface soil samples from areas of soil disturbance, soil staining, or possible spills. Examine the area between Bldgs. 809 and 810, where the possible existence of a pit was reported.
- Analyze all surface soil and sediment samples for herbicides, explosives, TCL metals, nitrate, and nitrite.

#### Phase II

Collect additional surface soil samples and drill soil borings if warranted by the results of the Phase I surface soil and sediment sampling programs.

### 5.2.9.6 Site 46 — Building 507, 90-Day Waste Accumulation Area

#### Closure Plan

The revised RCRA closure plan includes removal of hazardous wastes and steam cleaning the building and shed. Two chip samples and two wash water or condensate grab samples will be collected and analyzed for priority pollutant metals. Three soil samples will be collected and analyzed for priority pollutant metals, VOCs, total petroleum hydrocarbons (TPH), and if necessary EP toxicity for metals. Soil borings will be drilled and additional surface and subsurface soil samples collected to delineate the extent of contamination if it is found.

#### Proposed RI Plan

No additional activities are proposed unless the soils are contaminated, in which case surface water and groundwater monitoring would be needed.

### 5.2.9.7 Site 47 — Buildings 3005 and 3006, 90-Day and Satellite Waste Accumulation Areas

#### Closure Plan

Revised RCRA closure plans for Bldg. 3005 include collecting soil samples from two different depths (0-0.15 m and 0.15-0.3 m [0-6 in. and 6-12 in.]) from one location under the pallet storage area. The shallow sample will be analyzed for priority pollutant metals, and the deeper sample will be analyzed for VOCs, TPH, and EP toxicity for metals.

#### Proposed RI Plan

##### Phase I

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.
- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each area of obvious soil discoloration, disturbance, or other indicators of contamination.
- If no visible contamination is found, collect at least three samples from around the edge of the storage area behind Bldg. 3005.

- Analyze all samples for PCBs, oil and grease, TCL volatiles, and TCL semivolatiles.

**Phase II**

Collect additional soil samples if warranted by the Phase I results.

### 5.2.9.8 Site 50 -- Buildings 519 and 519A, Still House and Alcohol Storage

**Closure Plan**

Revised RCRA closure plans have been prepared for Bldg. 519A. Since the tanks, which stored alcohol, have already been removed, activities are limited to collecting 12 soil samples at two depths (0-0.15 m and 0.15-0.3 m [0-6 in. and 6-12 in.]) from six locations in the area where the tank was located. The shallow samples will be analyzed for priority pollutant metals, nitrates, and, if necessary, EP toxicity for metals, and the deeper samples for VOCs.

**Proposed RI Plan**

**Phase I**

- Inspect the area around Bldgs. 519 and 519A for soil staining or other signs of visible contamination. Locate any sumps or weirs inside or outside either building.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) in the center of each visibly contaminated area. Collect one surface soil sample from each side of Bldg. 519 (four samples). This is in addition to the samples collected in the closure sampling plan.

- Collect one sediment sample from each sump or weir located during the inspection.

- Analyze all samples for explosives, TCL volatiles, TCL metals, and TCL semivolatiles.

**Phase II**

- Collect additional surface soil samples and/or drill soil borings if warranted by the Phase I results.

- Install groundwater monitoring wells if warranted by the soil boring results.

### 5.2.9.9 Site 53 — Picatinny Lake

**Phase I**

- Collect soil samples from the island in the lake to a depth of 0.15 m (6 in.) at locations on a regular 30-m (100-ft) grid and in any areas of soil staining, in areas of little or no vegetative growth, and around building exits.
- Analyze the soil samples for TCL volatiles, TCL semivolatiles, TCL metals, and explosives.
- Make a strong effort to locate UXO, containers of explosives, and other dangerous items on the lake bottom. Use techniques such as geophysical surveying, scanning with underwater television cameras, and those available to explosive ordnance demolition (EOD) teams (including classified methods).
- Remove or mark (with buoys) any dangerous items that are located.
- Give consideration to *slow* drainage of the lake to expose the bottom for sampling, cleanup, and removal of dangerous items.
- Collect water and sediment samples from 10 or more locations in Picatinny Lake. The water samples should be averages over the water column and the sediment samples should be core samples to a depth of 0.3 m (1 ft) in the lake bottom.
- Analyze the water and sediment samples for TCL metals, TCL volatiles, TCL semivolatiles, explosives, pesticides, PCBs, Mirex, herbicides, fluoride, cyanide, nitrate, nitrite, gross alpha, gross beta, and macroparameters (water samples only).

**Phase II**

- Drill soil borings and install monitoring wells on the island if warranted by the results of the surface soil sampling program.
- Collect additional surface water and sediment samples from Picatinny Lake if warranted by the results of the Phase I sampling program. If elevated gross alpha or gross beta activities are found

in the Phase I samples, analyze additional samples to identify the radionuclides responsible for the activity.

- Quarterly monitor surface water at locations near any dangerous items that are located but not removed (and presumably marked with buoys). Parameters to monitor are explosives, TCL metals, TCL volatiles, nitrate, nitrite, fluoride, and any other parameter detected in the water or possibly present in the nearby dangerous item. Monitoring for the same parameters is also needed near any drinking water intakes.

### 5.2.9.10 Site 63/65 — Building 506

#### Closure Plan

Revised RCRA closure plans for Bldg. 506 include collecting two chip samples, two condensate grab samples, and three soil samples each from the storage and burning system pads. All samples will be analyzed for priority pollutant metals; the condensate and soil samples will be analyzed for EP toxicity for metals: and the soil samples will be analyzed for VOCs, TPH, and PCBs.

#### Proposed RI Plan

#### Phase I

- Visually inspect the waste oil storage pad and surrounding area to locate signs of contamination.

- Drill one soil boring in the center of each visibly contaminated area near the pad to a depth of 0.9-1.5 m (3-5 ft). Also drill one boring between the pad and Picatinny Lake, 16 m (50 ft) away from the pad.

- Analyze the samples for TCL volatiles, TCL semivolatiles, TCL metals, oil and grease, and PCBs.

#### Phase II

Determine the need for additional sampling based on the results of the Phase I sampling.

#### 5.2.9.11 Site 70 — Buildings 3028 and 3029

**Phase I**

- Inspect the exteriors and areas around the buildings for signs of contamination. Also inspect areas near the acid treatment pit and sewage lift station at Bldg. 3028. Do nothing further if the areas appear to be clean.
- Collect one surface soil sample at a depth of 0.3 m (1 ft) from the center of each visibly contaminated area.
- Analyze the samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase II**

- If significant contamination is found in the surface soil samples, drill one soil boring near each contaminated area and collect samples.
- Analyze the boring samples for explosives, TCL metals, TCL volatiles, and TCL semivolatiles.

**Phase III**

Determine the need for monitoring wells based on the results of the soil boring sampling program.

#### 5.2.9.12 Site 71 — Building 910

**Closure Plan**

The revised RCRA closure plans for Bldg. 910 include sealing off the building, washing and removing equipment, and steam cleaning the building. Two grab wash water or rinsate samples and four chip samples will be collected and analyzed for priority pollutant metals.

### Proposed RI Plan

#### Phase I

- Inspect the perimeter of the building for signs of soil staining, spills, or waste disposal.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each area identified by the inspection.
- Analyze the samples for propellants, explosives, and TCL metals.

#### Phase II

- If significant contamination is found in the surface soil samples, drill at least two soil borings between Bldg. 910 and Picatinny Lake and near the contaminated area and collect samples from each boring.
- Analyze the boring samples for propellants, explosives, and TCL metals.

#### Phase III

- If subsurface soils are significantly contaminated, collect two sediment samples to a depth of 0.3 m (1 ft) from the shore of Picatinny Lake near each contaminated boring.
- Analyze the sediment samples for the contaminants found in the soil boring samples.

### 5.2.9.13 Site 79 — Building 3013

#### Closure Plan

Revised RCRA closure plans for Bldg. 3013 include sealing off and steam cleaning the building and collecting two rinsate grab samples and two chip samples. The samples will be analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the building perimeter for any areas of visible contamination.

- Collect three surface soil samples to a depth of 0.3 m (1 ft) near the southwest corner of the building and from any visibly contaminated areas located by the inspection.

- Analyze the samples for TCL volatiles and TCL semivolatiles.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring near each contaminated area and collect samples from each boring.

- Analyze the boring samples for TCL volatiles and TCL semivolatiles.

Phase III

Determine the need for monitoring wells based on the results of the soil boring program.

5.2.9.14 Site 82 – Building 908

Phase I

- Locate the original outflow line and outfall point for the silver recovery unit. Use a visual inspection, detailed maps, or geophysical techniques as necessary.

- If the outflow line is located, collect three surface soil samples to a depth of 0.3 m (1 ft), two along the path of the line and one from the discharge point.

- Analyze the samples for silver and TCL semivolatiles.

Phase II

- If significant silver concentrations are found in the samples, collect two sediment samples to a depth of 0.3 m (1 ft) from the shore of Picatinny Lake near the contaminated sampling locations.

- Analyze the sediments for silver and TCL semivolatiles.

### 5.2.9.15 Site 83 — Building 3022

Closure Plan

The revised RCRA closure plan for Bldg. 3022 includes sealing off and steam cleaning the building and equipment. Two rinsate grab samples and 36 chip samples (two from each lab) will be collected and analyzed for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the area around the building for soil and surface contamination and to locate the acid pit and drain lines. Geophysical methods may be needed.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each stained area.

- Analyze the samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

- If the pit is exposed, collect surface soil samples to a depth of 0.3 m (1 ft) from the drain outfall and pit bottom. If the pit is covered, drill one soil boring in the center of the pit and collect samples at 0.6-m (2-ft) intervals from the top, through the pit bottom, and down to the bottom of the boring.

- Analyze pit samples for explosives, propellants, TCL metals, nitrate, nitrite, and sulfate.

Phase II

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area and collect samples from each boring.
- Analyze the boring samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

Phase III

Install monitoring wells if significant subsurface contamination is found in the boring samples. Determine the number and location of wells based on the results of the soil boring program.

5.2.9.16 Site 90 - Building 329

Closure Plan

Revised RCRA closure plans for Bldg. 329 include collecting two chip samples and two grab samples of wash water or rinsate and analyzing them for priority pollutant metals.

Proposed RI Plan

Phase I

- Inspect the building and surrounding area for visible contamination.
- Collect one soil sample from each area with visible staining.
- Analyze the samples for TCL volatiles and TCL semivolatiles.

Phase II

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant soil contamination. Collect samples from each boring.
- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

#### 5.2.9.17 Site 93 — Buildings 806 and 807

**Phase I**

- Locate the reported pits behind Bldg. 800 and the reported powder disposal area behind Bldg. 807. Use a visual inspection, detailed maps, or geophysical methods as necessary.

- If the pits are located, drill one soil boring in the center of each pit. Collect at least two samples from each boring over 0.6-m (2-ft) intervals from the top, through the pit bottom, and down to the bottom of each boring.

- If the powder disposal area is located, collect two surface soil samples to a depth of 0.3 m (1 ft) from the center of the area.

- Analyze all samples for propellants and explosives.

**Phase II**

- If the Phase I samples are significantly contaminated, drill two soil borings, one between each building and Picatinny Lake. Collect samples from each boring.

- Analyze the boring samples for propellants and explosives.

**Phase III**

- If the Phase II boring samples are significantly contaminated, collect two sediment samples to a depth of 0.3 m (1 ft) from the lake near the soil boring locations.

- Analyze the sediment samples for propellants and explosives.

#### 5.2.9.18 Site 97 — Building 501

**Phase I**

- Visually inspect the area around Bldg. 501 for signs of soil contamination.
- Collect one surface soil sample from each visibly stained area and from each side of the building to a depth of 0.15 m (6 in.).
- Analyze the samples for TCL semivolatiles and mercury.

**Phase II**

Collect additional soil samples if warranted by the results of the Phase I analyses.

#### 5.2.9.19 Site 102 — Building 3050

**Phase I**

- Inspect the area to locate the car rack and any areas of oil dumping, soil staining, or inhibited vegetative growth.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each area identified by the inspection.
- Analyze the surface soil samples TCL volatiles, TCL semivolatiles, and lead.
- Drill one soil boring at the center of the car rack area and collect samples from the boring.
- Analyze the boring samples for TCL volatiles, TCL semivolatiles, and lead.

**Phase II**

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area. Collect samples from each boring.
- Analyze the boring samples for TCL volatiles, TCL semivolatiles, and lead.

**Phase III**

Determine the need for monitoring wells based on the results of the Phase II sampling program.

**5.2.9.20 Site 105 — Building 511**

**Phase I**

- Visually inspect the location of Bldg. 511 (which was destroyed under TECUP) for signs of contamination.
- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) within 50 ft of each side of the former building location and from the center of each visibly contaminated area.
- Analyze the samples for PCBs.

**Phase II**

Collect additional surface soil samples, drill soil borings, and install monitoring wells if warranted by the results of the Phase I analyses.

**5.2.9.21 Site 108 — Buildings 717, 722, and 732**

**Closure Plan**

The RCRA closure plan for Bldg. 722 includes collecting rinsate grab samples, wipe samples, and core and soil boring samples from the hearth floor after residues are removed and the building is cleaned. The samples will be analyzed for EP toxic metals.

**Proposed RI Plan**

**Phase I**

- Inspect the area to locate areas of reported freon dumping and possible flare activities.
- If such areas are found, collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each area.

- Collect two surface soil samples along the perimeters of Bldgs. 722 and 723 (four samples altogether) and collect one soil sample at the air inlet for the trench in the Bldg. 722 flare testing room.

- Analyze the above soil samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

- Collect four surface soil samples from the perimeter of Bldg. 717.

- Analyze the Bldg. 717 samples for TCL metals.

- Collect two samples from the concrete pit.

- Analyze the pit samples for explosives, TCL metals, and fluoride.

Phase II

- If the surface soil samples are significantly contaminated, drill three soil borings, one each between Bldgs. 717 and 722 and Picatinny Lake and one between Bldg. 722 and Green Pond Brook. Collect samples from each boring.

- Analyze the boring samples for explosives, TCL metals, TCL volatiles, and TCL semivolatiles.

Phase III

- If the soil boring samples are significantly contaminated, collect sediment samples from Green Pond Brook and Picatinny Lake near the contaminated borings. If the Bldg. 732 boring is contaminated, collect surface and bottom water samples from Green Pond Brook.

- Analyze the surface water and sediment samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

5.2.3.22 Site 109 — Building 445, Pyrotechnic Plant

Phase I

- Inspect the area around the building for signs of visible contamination, drains, and the reported sump behind the building.

- Collect one surface soil sample from each area of stained soil to a depth of 0.3 m (1 ft) and collect one surface soil sample from each side of the building to a depth of 0.6 m (2 ft).

- Collect one sediment sample to a depth of 0.6 m (2 ft) from each drain receiving effluents from the building and from the sump.

- Collect one drive point water sample over a 1.5-m (5-ft) interval from the water table at each of three different areas (a total of three samples) potentially downgradient from the building.

- Analyze all samples for TCL metals, nitrates, propellants, and explosives.

**Phase II**

- Drill one soil boring in the center of each significantly contaminated area identified by the Phase I analyses. Collect soil samples and analyze them for the contaminants found in the surface soil samples.

- Install two monitoring wells downgradient from the Site to monitor the the levels of TCL metals, nitrates, propellants, and explosives.

**Phase III**

Determine the need for additional soil and water sampling based on the Phase II results.

**5.2.9.23 Site 110 — 500 Area**

- Inspect the narrow-gauge railroad bed to locate propellant sticks.

- Remove any propellant found during the inspection.

**5.2.9.24 Site 113 — Building 561**

**Phase I**

- Visually inspect the former location of Bldg. 561 (which was destroyed under TECUP) for signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the building location and from the center of each visibly contaminated area.

- Drill one soil boring each on the east and west sides of the former building location and collect at least two samples from each boring.

- Analyze all soil samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase II**

Drill additional soil borings if warranted by the results of the Phase I analyses.

**5.2.9.25 Site 137 - Building 382**

**Phase I**

- Inspect the Site and surrounding area for visible contamination. Locate drains and other migration pathways.

- Conduct a geophysical survey around the building to locate the disposal pit.

- If the pit is found, collect three hand-auger samples from a depth of 0.8 m (2.5 ft). If the pit is paved over, drill through the pavement to obtain samples.

- Collect one surface soil sample from each area of stained soil.

- Analyze all samples for all TCL parameters except dioxin and for explosives.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table in each area of significant surface soil contamination. Collect samples from each boring.

- Analyze the boring samples for the significant contaminants identified by the Phase I analyses.

- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

### 5.2.9.26 Site 147 — Building 520

Before Phase I activities begin, determine the exact location of former Bldg. 520 (the building was destroyed under TECUP) and the route of the guncotton line (Site 16) through the area.

**Phase I**

- Visually inspect the building location for signs of contamination and to locate the reported disposal pits. Use old detail maps and geophysical methods as necessary to locate the pits.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the former building and from the center of each visibly contaminated area, within 6 m (20 ft) of the building location.

- If the disposal pits are found, drill one soil boring in the center of each pit, and drill one soil boring within 9 m (30 ft) of the former building's north side. Collect samples from the top, pit bottom depth, and the bottom of each boring.

- Analyze all soil samples for propellants, TCL semivolatiles, and TCL metals. Analyze the soil boring samples for TCL volatiles.

**Phase II**

Drill additional soil borings if warranted by the results of the Phase I analyses.

### 5.2.9.27 Site 148 — Building 527

**Closure Plan**

Revised RCRA closure plans for Bldg. 527 include collecting 24 chip samples and 2 condensate grab samples and analyzing them for priority pollutant metals.

**Proposed RI Plan**

**Phase I**

- Visually inspect the area around the building to locate signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from the center of each area of visible contamination.

- Analyze the samples for explosives, TCL volatiles, and TCL semivolatiles.

**Phase II**

Drill soil borings if contamination is found. The number and locations depend on the contamination found in the Phase I program.

**5.2.9.28 Site 149 — Building 541**

**Phase I**

- Visually inspect the area around the former building for signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of the former building and from the center of each visibly contaminated area.

- Drill one soil boring at a location downslope from the building's former location. Collect samples from the boring.

- Analyze the surface soil and boring samples for explosives and TCL semivolatiles. Also, analyze the soil boring samples for TCL volatiles.

**Phase II**

Drill additional soil borings if warranted by the results of the Phase I sampling.

**5.2.9.29 Site 150 — Building 555**

**Phase I**

- Visually inspect the area around Bldg. 555 to locate signs of contamination.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) within 16 m (50 ft) of each side of the building at the center of each area of contamination located by the inspection.

- Drill one soil boring at the center of the west side and no farther than 9 m (30 ft) from the building and collect samples.

- If possible, collect samples from the drainpipes in Bldg. 555. Choose sampling locations by inspection of building interior. Because material may be unstable, take caution to ensure safety of workers collecting samples.

- Analyze the samples for propellants and explosives.

**Phase II**

Collect additional surface samples and/or drill soil borings if warranted by the results of the Phase I sampling program.

**5.2.9.30 Site 156 — Buildings 813, 816, and 816B**

**Phase I**

- Visually inspect the area around the buildings for signs of soil contamination.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each visibly contaminated area.

- Drill two soil borings, one between Bldg. 813 and Picatinny Lake and another between Bldg. 816B and the lake. Collect samples from each boring.

- Collect sediment samples to a depth of 0.3 m (1 ft) from four locations along the lakeshore near Bldgs. 813 and 816.

- Analyze all samples for propellants, explosives, and TCL metals.

**Phase II**

- If the surface soil samples are significantly contaminated, drill one soil boring in the center of each contaminated area. Collect samples from each boring.

- Analyze the boring samples for propellants, explosives, and TCL metals.

### 5.2.9.31 Site 157 — Buildings 820 and 823

**Phase I**

- Collect surface samples to a depth of 0.3 m (1 ft) at four locations (two for each building) between Bldgs. 820 and 823 and Picatinny Lake.
- Drill two soil borings, one near each building. Collect samples from each boring.
- Analyze all soil samples for propellants, explosives, and TCL metals.

**Phase II**

- If the Phase I samples are significantly contaminated, collect two sediment samples to a depth of 0.3 m (1 ft) from the shore of Picatinny Lake near each contaminated area.
- Analyze the sediment samples for TCL metals, propellants, and explosives.

### 5.2.9.32 Site 158 — Building 926

**Phase I**

- Collect two sediment samples to a depth of 0.3 m (1 ft) from the shore of Picatinny Lake near Bldg. 926.
- Analyze the samples for propellants and explosives.

**Phase II**

- If the sediment samples are significantly contaminated, collect additional sediment samples from other locations.
- Analyze the samples for propellants and explosives.

### 5.2.9.33 Site 159 — Building 975

**Phase I**

- Conduct a geophysical survey behind Bldg. 975 to locate disturbed soil or buried metal.

- If disturbed soil or buried metal is located, drill two soil borings in each area identified by the survey. Collect samples from the top, depths of the bottoms of disturbed areas or buried metal, and bottom of the borings.

- Analyze the boring samples for lead.

**Phase II**

- If the soil boring samples have significant lead contamination, collect two sediment samples to a depth of 0.3 m (1 ft) from Green Pond Brook near the contaminated borings. Collect surface and bottom water samples from the same locations.

- Analyze the samples for lead.

### 5.2.9.34 Site 178 — TECUP Buildings

Four TECUP building locations have been chosen for RI sampling: (1) Bldg. 557, a propellant plant, (2) Bldg. 565, a propellant plant, (3) Bldg. 323A, a high-explosive magazine, and (4) Bldg. 1052, a lead azide plant. The buildings are representative of those washed or burned under TECUP.

**Phase I**

- Inspect each of the four building locations for signs of visible contamination or soil staining.

- Collect one surface sample to a depth of 0.3 m (1 ft) at the center of each visibly contaminated area.

- Collect one surface soil sample at the center of each side of each building location perimeter; collect the samples just outside of the perimeters (16 samples altogether).

- Analyze the samples as follows:
  - For Bldgs. 557 and 565, analyze the for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.
  - For Bldg. 323A, analyze the samples for explosives, TCL volatiles, and TCL semivolatiles.
  - For Bldg. 1052, analyze the samples for lead, TCL volatiles, and TCL semivolatiles.
- Locate any remaining drain lines at each of the four building locations. If feasible, collect two samples from different locations in each located drain line.
- Analyze the drain line samples for explosives.

**Phase II**

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area at each building location. Collect samples from each boring.
- If the drain line samples are significantly contaminated, use geophysical methods to trace the route of each contaminated line. If feasible, collect additional samples from the traced lines.
- Analyze the soil and drain-line samples for the same parameters as in the Phase I samples.
- Consider removing any contaminated drain lines.

**Phase III**

- If the soil boring samples are significantly contaminated, install monitoring wells. Determine the number and location of the wells based on the soil boring results.
- If any one of the four building locations is found to be significantly contaminated, repeat the sampling program at other TECUP building locations. PTA and USATHAMA personnel should select these other locations.

### 5.2.9.35 Site 184 — Building 523

#### Closure Plan

The revised RCRA closure plan for Bldg. 523 includes sealing off and steam cleaning the building. Two wash water or condensate grab samples and four chip samples will be collected and analyzed for priority pollutant metals. The underground tanks will be sampled, flushed with water, and excavated. Two rinsate grab samples will be collected from each tank, and eight soil samples will be collected around the two tanks (the number of samples depends on the number of tanks). The water samples will be analyzed for priority pollutant metals and the soil samples will be analyzed for priority pollutant metals, VOCs, TPH, and, if necessary, EP toxicity for metals.

#### Proposed RI Plan

#### Phase I

- Inspect the area around the building for signs of visible contamination.
- In addition to sample collection in the closure sampling plan, collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from the center of each area of visible contamination.
- Analyze the samples for explosives, PCBs, TCL volatiles, TCL semi-volatiles, and TCL metals.

#### Phase II

- If significant contamination is found, drill one soil boring in the center of each contaminated area. Collect samples from each boring.
- Analyze the samples for the contaminants found in the Phase I samples.

## 5.2.10 Area J: Around Snakehill Road

### 5.2.10.1 Site 1 — G2 Area, Reaction Motors/Rocket Fuel Test Area (G-2 Road)

**Phase I**

- Conduct a complete field inspection of the Site; begin with a walkover of the Site, and use geophysical methods and aerial photos (Sitton 1989) as appropriate. Record the sizes and locations of building ruins, pads, and areas of soil staining.

- Remove and dispose of all UXO located during the inspection. Sample and remove buried drums or containers located in the inspection.

- Conduct a geophysical survey in an area about 190 by 61 m (620 by 200 ft) along the south-southeastern edge of the Site, in the area of reported dumping. Use aerial photos as a location aid.

- Collect six or more surface soil samples to a depth of 0.3 m (1 ft) at locations around former and existing structures and pads, in formerly bermed areas, and in areas of stained soil.

- Collect two surface soil or sediment samples 100 m (330 ft) apart from the bed of each channel or depression that carries surface runoff. Collect two surface water samples at the same locations used for soil or sediment collection in each channel or depression that contains water.

- Analyze all soil, sediment, and water samples for explosives, TCL volatiles, TCL semivolatiles, lead, chromium, and phthalates.

**Phase II**

- If the dump area or large buried metal objects are located by the Phase I surveys, drill at least five soil borings at locations indicated by the surveys. Collect three to five samples from each boring: sample at least two different depths in the dumped material and at least one depth below it.

- Analyze each subsurface soil (boring) sample for explosives, lead, chromium, phthalates, TCL volatiles, and TCL semivolatiles. Select the three samples with the highest level of contamination and analyze for TCL metals.

- Determine the need for additional surface soil samples and soil borings based on results of surface and subsurface soil sampling programs.

- Install two monitoring wells downgradient from dump area and along the 250-m (825-ft) elevation contour. Exact locations should be determined by the inspection, sampling, and survey results. Screen the wells to intercept the water table. At least two weeks after well installation, collect samples for two successive quarters from the two new wells and Cove well.

- Analyze the groundwater samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrate, nitrite, cyanide, and macroparameters. Continue the groundwater monitoring program for wells with significant contamination.

### 5.2.10.2 Site 2 — G1 Area, Reaction Motors/Rocket Fuel Test Area (3500 Series Buildings)

#### Closure Plans

Revised RCRA closure plans for the concrete pad behind Bldg. 3517 include the following: collect six soil samples to a depth of 0.15 m (6 in.) around the perimeter of the pad northwest of Bldg. 3517, and analyze them for priority pollutant metals, base-neutral extractables, TPH, volatiles, PCBs, and EP toxicity for metals. Collect two chip samples from the pad and two condensate samples, and analyze them for priority pollutant metals and PCBs.

#### Proposed RI Plan

#### Phase I

- Carry out a thorough walkover and field inspection using geophysical and other methods to search for UXO, hazardous metal debris, and underground storage tanks, including those in the area of the former tank farm.

- Remove and dispose of all UXO located during the inspection. Sample and remove buried drums and containers located.

- Sample and analyze the contents of any tank holding unidentifiable material. If possible, test the tanks for integrity. Remove the contents of unsound tanks and tanks that will not be used, and close them in accordance with all applicable state and federal regulations.

- Collect 12 surface soil samples to a depth of 0.3 m (1 ft) from the following locations: two samples from each of the two possibly stained areas shown in aerial photos (Sitton 1989); one sample behind each of Bldgs. 3502, 3507, 3526, and 3540; two samples from outfall(s) of (former) flumes behind the test stands; and samples from two locations in the ditch carrying runoff around Bldg. 3521.

- Analyze the surface soil samples for explosives, TCL metals, TCL semivolatiles, herbicides, cyanide, fluoride, and nitrate.

- Collect surface water and sediment samples from two locations in the pond, and collect sediment samples from three locations in the reservoir and one location in each of the two streams on the Site.

- Analyze the sediment and surface water samples for TCL metals, TCL semivolatiles, explosives, herbicides, cyanide, nitrate, fluoride, gross alpha, and gross beta.

- Drill three soil borings, one in the sump area near Bldg. 3521 and one in each of the spill areas near Bldgs. 3513 and 3541. Collect split-spoon samples from the top, middle, and bottom of each boring (three samples per boring).

- Analyze the subsurface soil samples from borings near Bldgs. 3513 and 3541 for TCL volatiles and TCL semivolatiles. Analyze samples from the sump boring for TCL metals, TCL volatiles, TCL semivolatiles, nitrate, and fluoride.

- Install one monitoring well near Bldg. 3521. Position the screen to intercept the water table. Beginning at least two weeks after well installation, collect groundwater samples and water levels from the new well and from wells L, M, and N on the same day for two successive quarters.

- Analyze the groundwater samples for TCL volatiles, TCL semivolatiles, TCL metals, pesticides, PCBs, explosives, fluoride, nitrate, nitrite, cyanide, macroparameters, gross alpha, and gross beta.

**Phase II**

- If elevated levels of gross alpha or gross beta are found in the surface water, sediment, or groundwater samples, collect additional samples and analyze them to identify the specific radionuclides responsible for the activity.

- Collect additional surface and subsurface soil samples if warranted by the results of the Phase I surface soil sampling program.

- Collect additional surface water and sediment samples if warranted by the results of the Phase I sediment and surface water sampling program.

- Install additional monitoring wells if warranted by the results of the Phase I groundwater monitoring program.

**5.2.10.3 Site 4 — 3600 Series Buildings, Reaction Motors/Rocket Fuel Test Area**

**Phase I**

- Conduct a thorough walkover and field inspection using geophysical methods, if necessary, to search for UXO, underground storage tanks, and other metal objects. Search the western edge of the Site where propellant containers were reportedly buried.

- Remove UXO found by the search. Sample and remove buried drums and containers.

- Sample and analyze the contents of any tank holding unidentifiable material. If possible, test the tanks for integrity. Remove the contents of all unsound tanks or unused tank and close them in accordance with all applicable state and federal regulations.

- Collect six surface soil samples to a depth of 0.3 m (1 ft) from the following locations:

  - One sample from each of two locations near the PCB transformers in Bldg. 3602. Analyze the samples for PCBs.

  - One sample behind each of Bldgs. 3603, 3604, 3606, and 3607. Analyze the four samples for TCL metals, explosives, propellants, TCL semivolatiles, fluoride, nitrate, and aniline.

- Collect two sediment core samples to the lesser of a depth of 0.6 m (2 ft) or the basin bottom from two locations in the catch basin reported to collect runoff from Bldgs. 3601 and 3607. Collect one sample of water if it is present in the basin.

- Analyze the catch basin samples for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, explosives, propellants, PCBs, nitrate, nitrite, fluoride, gross alpha, and gross beta.

- Collect sediment samples to a depth of 0.15 m (6 in.) from two locations in the depression with the pond north of Bldg. 3618.

- Drill two soil borings, one at the depression outlet north of Bldg. 3618 and one near well M. Collect samples over 0.6-m (2-ft) intervals from the top, middle, and bottom of each boring (three samples per boring).

- Analyze the pond sediment and boring samples for explosives, propellants, TCL metals, TCL volatiles, TCL semivolatiles, fluoride, nitrate, nitrite, gross alpha, and gross beta.

- Install two monitoring wells, one near Bldg. 3618 and one between Bldgs. 3611 and 3612. Position the screens to intercept the water table. Beginning at least two weeks after well installation, collect groundwater samples on the same days on which samples are collected from Site 2 wells.

- Analyze the groundwater samples for explosives, TCL metals, TCL volatiles, TCL semivolatiles, pesticides, PCBs, cyanide, fluoride, nitrate, nitrite, gross alpha, gross beta, and macroparameters.

**Phase II**

- Excavate, sample, and dispose of any buried containers found along the western edge of the Site. Drill soil borings at the locations of any containers that have leaked or are surrounded by stained soil. Collect samples at depths below the bottom of containers. Select analytes based on the results of the sampling of the contents.

- Drill additional soil borings if warranted by the results of the Phase I surface soil sampling, sediment sampling in the upper part of the Site, and sampling in the catch basin.

- If elevated alpha or beta activities are measured, analyze additional samples to identify the specific radionuclides responsible for the activity.

#### 5.2.10.4 Site 175 — Building 3801, Helicopter Maintenance

**Phase I**

- Inspect the areas around the building for signs of contamination and the drain outfall in the swamp.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each area of visibly contaminated soil.
- Collect two surface water samples and two sediment samples to a depth of 0.3 m (1 ft) from the swampy area receiving effluent from the Site.
- Inspect the drums stored outside the building for content labels and any leakage.
- Sample and remove any leaking drums. Also collect one soil sample near each leaking drum.
- Analyze the soil, surface water, and sediment samples for TCL volatiles and TCL semivolatiles.

**Phase II**

Collect additional samples if contamination is indicated by the Phase I analyses. Determine sampling media and locations based on the Phase I results.

### 5.2.11 Area E: Navy Hill

#### 5.2.11.1 Site 3 — 1500 Series Buildings, Reaction Motors/Rocket Fuel Test Area

**Closure Plans**

RCRA closure plans for Bldgs. 1515 and 1518 include the following: For Bldg. 1515, analyze wash water and a core sample from the hearth for EP toxic metals. Collect 10 wipe samples. For Bldg. 1518, analyze wash water for EP toxic metals, collect five wipe samples, and analyze one sediment sample from the drainpipe outfall for priority pollutant metals and fluoride.

**Proposed RI Plan**

**Phase I**

- Conduct a thorough field inspection for UXO, underground tanks, and hazardous metal debris. Use geophysical methods if appropriate. Pay special attention to forested and other uncleared areas.

- Remove and dispose of all UXO located during the inspection. Sample and remove buried drums and containers.

- Sample and analyze the contents of any tank holding unidentifiable material. If possible, test the integrity of the tanks. Remove the contents of unsound tanks and tanks that will not be used, and close them in accordance with applicable state and federal regulations.

- Collect nine surface soil samples to a depth of 0.3 m (1 ft) from the following locations:

  - Two samples from the former stained area marked in the 1963 aerial photo and one sample from behind each of the test stands in Bldgs. 1505A, 1505B, 1505C, and 1505D. Analyze the six samples for TCL metals, TCL semivolatiles, explosives, herbicides, PCBs, cyanide, fluoride, nitrate, gross alpha, and gross beta.

  - One sample from waste storage pallet area outside Bldg. 1509. Analyze the sample for explosives, TCL metals, benzene, toluene, xylenes, fluoride, and nitrate. Carry out a GC scan for TCL volatiles and TCL semivolatiles.

  - Two samples by the north-northeast end of Bldg. 1518. Analyze the samples for TCL metals and benzene, toluene, and xylenes (BTX). Carry out GC scan for TCL volatiles and TCL semivolatiles.

  Determine exact locations by field inspection.

- Collect seven sediment and surface water samples from the following locations: two samples from the drainage channel in the eastern part of the Site, three samples from the reservoir, and 2 samples from locations SW/SD3-2 and SW/SD3-3.

- Analyze the surface water and sediment samples for explosives, TCL metals, herbicides, TCL volatiles, TCL semivolatiles, PCBs, fluoride, cyanide, nitrate, gross alpha, and gross beta. In addition, analyze the water samples for macroparameters.

- Collect one water sample from location SW/SD3-4 and analyze for sulfates.

- Install two monitoring wells. Position the screens to intercept the water table. Beginning at least two weeks after well installation, collect groundwater samples from the new wells and well O on the same day for two successive quarters.

- Analyze the groundwater samples for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, PCBs, explosives, nitrate, cyanide, fluoride, gross alpha, gross beta, and macroparameters.

- Collect air samples behind Bldg. 1505 during dry periods in the summer and fall and following the testing of solid fuel engines. Analyze the samples for explosives, TCL metals, and TCL volatiles.

**Phase II**

- If elevated levels of gross alpha or gross beta are found in any sample, then resample the location to identify the specific radionuclides responsible for the activity.

- Collect additional surface soil, sediment, and surface water samples if warranted by results of the Phase I sampling program.

- Drill soil borings and install additional monitoring wells if warranted by the results of the Phase I surface water, groundwater, sediment, and surface soil sampling programs.

#### 5.2.11.2 Site 48 — Buildings 3314 and 3315, 90-Day Waste Accumulation Areas

**Closure Plan**

The revised RCRA closure plan for Bldg. 3314 includes collecting two samples of the condensate and rinsate from steam cleaning and two chip samples from the cleaned floor and analyzing the four samples for priority pollutant metals.

The revised closure plan for Bldg. 3315 includes collecting a surface soil sample from the most stained area under the pallet storage area and analyzing it for priority pollutant metals, TPH, and EP toxicity for metals. A subsurface sample from the same location will be collected and analyzed for VOCs.

**Proposed RI Plan**

**Phase I**

- Collect surface soil samples to a depth of 0.3 m (1 ft) from the following locations: one sample under each drip pipe projecting through the building walls and one sample from each area of soil staining. This includes areas around the pallet storage but excludes the area under the pallet, which is included in the closure sampling plan.
- Analyze the soil samples for TCL volatiles, TCL semivolatiles, lead, and chromium.

**Phase II**

Collect additional surface soil samples, drill soil borings, and/or install monitoring wells if warranted by the results of the Phase I surface soil sampling program.

**5.2.11.3 Site 172 — Parking Area Across from Building 3325**

**Phase I**

- Inspect the parking area and its perimeter for oil staining. Do nothing further if no stained areas are located.
- Collect two asphalt chips from each stained area on the parking area. Collect four surface soil samples to a depth of 0.3 m (1 ft) from each stained area near the parking area.
- Analyze all samples for PCBs.

**Phase II**

- If significant PCB concentrations are found, drill one soil boring at each contaminated area on or next to the paved area. Collect samples from each boring.
- Analyze the boring samples for PCBs.

**Phase III**

Install monitoring wells if warranted by Phase II results.

### 5.2.11.4 Site 173 — Building 3404

**Closure Plan**

The revised RCRA closure plan for Bldg. 3404 includes sealing off and steam cleaning the building. Two rinsate grab samples and seven chip samples will be collected and analyzed for priority pollutant metals.

**Proposed RI Plan**

**Phase I**

- Inspect the area around the building for signs of contamination. Do nothing further if the surrounding area appears to be clean.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each stained area.
- Analyze the samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase II**

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area. Collect samples from each boring.
- Analyze the boring samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

### 5.2.11.5 Site 174 — Building 3420, Old Sewage Treatment Plant

**Phase I**

- Conduct a field inspection to determine the boundaries of the sludge holding beds.

- Collect two sludge samples from each holding bed (six samples altogether).

- Collect one drive-point water sample topographically downgradient of each of the sludge beds (three samples altogether).

- Analyze the sludge and water samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, cyanide, PCBs, gross alpha, and gross beta.

**Phase II**

- Collect additional sludge samples from the beds if contamination is indicated by the Phase I results.

- Analyze the sludge samples for TCLP leachability.

- Determine the need for additional sludge, soil, and/or water samples based on the Phase I results and TCLP analyses.

### 5.2.12 Area L: Explosives Manufacturing

#### 5.2.12.1 Site 5 — Shell Burial Area near Building 3150

**Phase I**

- If it is technically feasible and not dangerous for the workers, conduct a geophysical survey to determine the areal extent of the buried munitions.

- Surface soil and water sampling are not needed because the munitions are buried at depth.

- Install two monitoring wells, one between the Site and Bldg. 3150 and one near the northeast end of the Site. Position the screens to intercept the water table and to sample groundwater at depths greater than 6 m (20 ft) below the surface. Beginning at least two weeks after well installation, collect water samples from the new wells and wells 3, DM5-1, and DM5-2 on the same day for two successive quarters.

- Analyze the groundwater samples for explosives, propellants, TCL volatiles, TCL semivolatiles, TCL metals, nitrate, fluoride, and macroparameters.

**Phase II**

Determine remedial actions and additional Site controls based on the results of the geophysical survey and groundwater monitoring program.

**5.2.12.2 Site 6 — Shell Burial Area near Building 3100**

**Phase I**

- Conduct aquifer slug tests for wells DM6-1, DM6-3, and MW-5; measure static water levels in all wells quarterly for one year; and assess the local groundwater flow regime.

- If the groundwater flows in the northwest direction, install a new water table well between the west boundary of the Site and Belt Road. Determine the exact location of this well based on the aquifer tests and groundwater level data.

- Monitor the new and existing wells for two quarters for VOCs, explosives, propellants, nitrate, nitrite, ammonia, and macroparameters.

**Phase II**

Review the monitoring program after one year, and revise it if warranted by the available monitoring data.

**5.2.12.3 Site 17 — Northern Tetryl Pits**

**Phase I**

- Monitor wells DM17-1, DM17-2, and DM17-3 should continue to be monitored for one year for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrite, nitrate, ammonia, sulfate, and macroparameters.

- Conduct aquifer slug tests for wells DM17-1 and DM17-3, measure static water levels in the three existing wells quarterly for one year, and assess the groundwater flow regime in the study area.

**Phase II**

- If the groundwater data show significant contamination one soil boring should be drilled at the center of each of the four pits. Soil samples should be collected over a 2-ft interval from the top, pit bottom, and bottom of each boring.
- Collect two surface soil samples to a depth of 0.3 m (1 ft) at a location downgradient from the pits.
- Analyze the soil samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrite, nitrate, ammonia, and sulfate.
- Determine the need for additional soil borings and monitoring wells based on the soil sampling results.

**5.2.12.4 Site 18 — Southern Tetryl Pit**

**Phase I**

- Identify the exact location of the tetryl pit by using electromagnetic and ground-penetrating radar methods. Drill one soil boring in the center of the located pit and collect soil samples over a 0.6-m (2-ft) depth interval from the top, pit bottom, and bottom of the borehole.
- Analyze the boring soil samples for TCL volatiles, TCL semivolatiles, TCL metals, explosives, nitrite, nitrate, ammonia, and sulfate.
- Conduct geophysical and soil gas surveys in the open area between Bldgs. 1029 and 1038 to locate the waste disposal area and contaminated area.

**Phase II**

- If the geophysical or soil gas survey results indicate significant contamination, collect surface and subsurface soil samples from the waste disposal area.
- Analyze the soil samples for contaminants found in the Phase I surveys and analyses.

**Phase III**

Implement surface water sampling and groundwater monitoring programs for the area if soil contamination is confirmed.

### 5.2.12.5 Site 35 — Buildings 1361A, 1363A, 1364, and 1365, Nitroglycerin Processing

**Closure Plan**

Revised RCRA closure plans for the spent acid tanks in Bldg. 1365 include sampling the air and liquids in each tank; analyzing the samples for nitrate and VOCs; and washing, steam cleaning, and removing the tanks. Two air samples, two liquid grab samples from each tank, and two steam condensate samples from each tank will be collected and analyzed for nitrates, VOCs (liquid samples only), and priority pollutant metals. The steam condensate samples will also be analyzed for pH.

**Proposed RI Plan**

**Phase I**

- Inspect the Site, especially the areas beneath the tanks, for visible contamination.
- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each area of visible contamination.
- Sample the contents of the two tanks near Bldg. 1363A; then decontaminate, remove, and dispose of them (follow the same procedure as that for the tanks in Bldg. 1365).
- Collect one surface water sample and one sediment sample each from the catch basin outside Bldg. 1361A and from the stagnant water pool near Bldg 1364.
- Conduct a geophysical survey to locate the underground pipe and potentially contaminated areas.
- Analyze the sediment and water samples for nitrates, sulfates, explosives, and TCL metals.

**Phase II**

- If soil sampling confirms contamination, collect additional samples.
- Determine the need for surface and groundwater monitoring.

**5.2.12.6 Site 36 — Building 3100, Hazardous Waste Storage**

**Phase I**

- Inspect the area around the building, including the loading platform and the parking area, for signs of visible contamination. Note the locations of any drainage ditches and drain-pipe outfalls.
- Collect four surface soil samples to a depth of 0.15 m (6 in.) near the platform (two samples) and from the parking area (two samples). Additional samples should be collected from areas with signs of contamination and from any located ditches and drain-pipe outfalls.
- Analyze all the samples for explosives, propellants, TCL volatiles, TCL semivolatiles, TCL metals, cyanide, and nitrates.

**Phase II**

- Drill soil borings and collect composite surface and subsurface soil samples to delineate the extent of contamination if the surface soil samples are found to be contaminated.
- Install groundwater monitoring wells if warranted by the soil sampling results. Take the locations of the Site 6 wells into consideration if wells are installed for Site 36.

**5.2.12.7 Site 41 — Building 1094, Lab-Pack Repacking Facility**

**Phase I**

- Inspect the area around the building, including the parking area, for visible contamination. Locate any drain-pipe outfalls and ditches.
- Collect four surface soil samples to a depth of 0.15 m (6 in.) from the loading area (two samples) and the parking area (two samples).

Collect one soil sample from each area with signs of contamination and from each drain outfall and ditch.

- Analyze the soil samples for TCL metals, herbicides, pesticides, TCL volatiles, PCBs, TCL semivolatiles, and TCLP leachability (if necessary).

**Phase II**

- Install soil borings and collect additional surface and subsurface soil samples to delineate the extent of contamination if warranted by the Phase I analyses.

- Install groundwater monitoring wells if warranted by the soil sampling results. Take the locations of the Site 17 wells into consideration if wells are installed for Site 41.

**5.2.12.8 Site 42 — Building 3114, PCB Storage Facility**

Phase I

- Inspect the area around the building, drain outfalls, and nearby parking area for visible contamination.

- Collect two surface soil samples to a depth of 0.15 m (6 in.) from the south side of the parking area. Core into the paved parking area at four locations to collect four soil samples beneath it. Collect one additional sample from any located drainage ditches or pipe outfalls or from any discolored areas.

- Analyze the soil samples for all TCL parameters, uranium, explosives, propellants, and TCLP leachability (if necessary).

**Phase II**

- Drill soil borings and collect additional surface and subsurface soil samples to delineate the extent of contamination if warranted by the Phase I analyses.

- Collect surface water samples and monitor groundwater if warranted by the soil sample analyses.

### 5.2.12.9 Site 43 — Building 3157, Pesticides Storage Area

#### Closure Plan

Revised RCRA closure plans for Bldg. 3157 include collecting two samples from the waste storage tank and analyzing them for pesticides, herbicides, and VOCs. Two grab samples of condensate from steam cleaning the building will be analyzed for priority pollutant metals. Two chip samples from the cleaned building floor will also be analyzed for priority pollutant metals.

#### Proposed RI Plan

**Phase I**

- Collect chip samples from the center of each of the two pads located outside Bldg. 3157.
- Analyze the chip samples for pesticides, herbicides, and TCL metals.
- Collect three soil samples to a depth of 0.15 m (6 in.) at 15-m (50-ft) intervals along the drainage ditch, starting near the pads. Determine exact locations by field inspection.
- Analyze the soil samples for TCL metals, pesticides, herbicides, Mirex, and cyanide.
- Collect two water samples from the ditch during the spring and summer (four samples altogether), when there is water in the ditch. Collect one sample near the pad and the other 100 m (330 ft) downstream.
- Analyze the surface water samples for TCL metals, pesticides, herbicides, Mirex, fluoride, and cyanide.

**Phase II**

- Collect additional soil or water samples from the ditch if warranted by the results of the Phase I sampling. If contamination in the ditch is found to be high, drill soil borings.
- Clean the pads if significant contamination is found in the chip samples from the pads. Collect chip samples after the cleaning and analyze them for contaminants found prior to the cleaning.

### 5.2.12.10 Site 51 — Hazardous Material Storage Tanks near Building 1380

#### Closure Plan

The revised RCRA closure plan includes collection of one air bomb sample and one liquid sample from each of the two tanks for the analyses of nitrates and VOC (liquid samples only). Each tank will be washed, steamed out, and removed. Two steam condensate grab samples from each tank will be analyzed for priority pollutant metals, nitrates, and pH. If discolored areas are uncovered under the foundation of any tank, soil samples will be collected and analyzed for VOCs, nitrate, and EP toxicity for metals. If an area is found to be contaminated, additional sampling will be done.

#### 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.

### 5.2.12.11 Site 77 — Building 3150

#### Closure Plan

The revised RCRA closure plan for the machine shop waste storage area includes collecting two condensate grab samples and three chip samples and analyzing them for priority pollutant metals.

The revised closure plan for the underground storage tanks includes removal of the tanks and collection of 15 soil samples around each tank; the samples will be analyzed for VOCs, TPH, priority pollutant metals, and possibly EP toxicity for metals. Two wash water or condensate samples will be collected for each tank and analyzed for priority pollutant metals.

The revised closure plan for the basement waste oil storage room includes collecting two rinsate grab samples and two chip samples and analyzing them for priority pollutant metals.

#### Proposed RI Plan

##### Phase I

- Inspect the exterior perimeter of Bldg. 3150, especially near the machine shop and basement waste storage entrances.

- If stained or spill areas are noted, collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each stained area.
- Analyze the samples for TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase II**

- If significant contamination is found in the surface soil samples, drill one soil boring near each area of contamination and collect samples from each boring.
- Analyze the boring samples for TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase III**

Determine the need for monitoring wells based on the results of the soil boring program.

**5.2.12.12 Site 91 — Building 1301**

**Closure Plan**

The revised RCRA closure plan for Bldg. 1301 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.

**Proposed RI Plan**

**Phase I**

- Inspect the area behind Bldg. 1301 to locate the reported lead azide washout area. Use geophysical methods if necessary.
- Collect five surface soil samples to a depth of 0.3 m (1 ft), two from separate locations along the waste storage walkway and three from separate locations in the washout area (if it is located).
- Analyze all samples for explosives, propellants, and lead.

**Phase II**

- If the surface soil samples are significantly contaminated, drill one soil boring in the center of each contaminated area. Collect at least two samples from each boring over 0.6-m (2-ft) intervals.
- Analyze the boring samples for explosives, propellants, and lead.

**Phase III**

Determine the need for monitoring wells based on the results of the Phase II soil boring program.

**5.2.12.13 Site 103 — Reservoir near Building 3159**

**Phase I**

- Survey the reservoir for UXO. Use geophysical techniques, underwater television cameras, and other methods (e.g., those available to EOD teams) as necessary.
- Remove or mark (with buoys) any UXO located during the survey.

**Phase II**

- If UXO are found, collect two surface water samples, two bottom water samples, and two sediment samples near each item.
- Analyze the samples for explosives and lead.

**5.2.12.14 Site 114 — Building 1033**

**Phase I**

- Visually inspect the area around Bldg. 1033 for signs of contamination.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each visibly stained area around the building.
- Collect four sediment samples from Robinson Run at intervals of 30 m (100 ft) along its shore. Sampling should begin at the

discharge point from Bldg. 1033 and should continue 300 ft downstream from the building.

- Analyze all samples for explosives.

**Phase II**

Collect additional surface soil and sediment samples and drill soil borings if warranted by the results of the Phase I analyses.

### 5.2.12.15 Site 160 — Building 1029

**Phase I**

- Visually inspect the area around Bldg. 1029 for signs of contamination.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each contaminated area.
- Analyze all samples for explosives, propellants, and tetrahydrofuran.

**Phase II**

Collect additional surface soil samples and/or drill soil borings if the surface soil samples show contamination.

### 5.2.12.16 Site 161 — Building 1031

**Closure Plan**

Revised RCRA closure plans call for steam or hot-water cleaning of the building and equipment. Two wash water or condensate grab samples and 27 chip samples will be collected and analyzed for priority pollutant metals.

**Proposed RI Plan**

**Phase I**

- Visually inspect the area around Bldg. 1031 for signs of contamination.

- Collect one surface soil sample 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 area of visible contamination.

- Collect surface water and sediment samples from two locations in the swamp behind the building.

- If areas of contamination are identified during the visual inspection, drill one soil boring 16 m (50 ft) downslope from the building toward Robinson Run. Collect samples from the boring.

- Analyze all water, sediment, and soil boring samples for explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase II**

Drill additional soil borings; collect additional surface soil, sediment, and surface water samples; and/or install monitoring wells if warranted by the results of the Phase I investigations.

**5.2.12.17 Site 162 — Buildings 1070, 1071, and 1071C**

Before Phase I activities begin, determine exact location of Bldg. 1070.

**Phase I**

- Visually inspect the areas around Bldgs. 1070, 1071, and 1071C for signs of contamination. Conduct a geophysical survey near Bldg. 1071 to search for a reported explosives wastewater leach field.

- Collect one surface soil sample over a depth interval of 0.15-0.3 m (6-12 in.) from each side of Bldg. 1071 and from the center of each area of visible contamination.

- If the leach field lines are located, drill two soil borings next to each line and to a depth of 0.9-1.5 m (3-5 ft) below the line. Collect samples from each boring.

- Analyze all soil samples for explosives, TCL volatiles, and TCL semivolatiles.

**Phase II**

- If contamination is found in the surface soil samples, drill one soil boring in the center of each contaminated area. Collect samples from each boring.

- Analyze the boring samples for the contaminants found in the Phase I samples.

**5.2.12.18 Site 166 -- Buildings 1354, 1357, and 1359**

**Phase I**

- Visually inspect the areas around Bldgs. 1354, 1357, and 1359 for signs of contamination.

- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each area of soil contamination.

- Analyze all samples for explosives.

**Phase II**

Collect additional surface soil samples and/or drill soil borings if warranted by the Phase I results.

**5.2.12.19 Site 167 — Buildings 1373 and 1374**

**Phase I**

- Visually inspect the areas around Bldgs. 1373 and 1374 to locate signs of contamination. Locate any drain lines leading from the sumps and drain outfalls by field inspection. Use detailed maps and geophysical methods as necessary.

- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each contaminated soil area.
- Collect one water and one sediment sample from each sump in Bldg. 1373.
- If the outfalls to the drain lines can be located, collect one soil sample from each outfall area and one sediment sample from each drainpipe outlet.
- Analyze all samples for explosives.

**Phase II**

Determine the need for additional sampling based on the results of the Phase I sampling.

### 5.2.12.20 Site 168 — Buildings 1400, 1402, and 1403

**Phase I**

- Visually inspect the areas around Bldgs. 1400, 1402, and 1403 to locate signs of contamination. Locate any drain lines leading from the sumps and drain outfalls by field inspection; use detailed maps and geophysical methods as necessary.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each contaminated soil area.
- Collect one water and one sediment sample from the sump in Bldg. 1400 and from each of the two sumps in Bldg. 1403.
- If the outfalls to the drain lines can be located, collect one soil sample from each outfall area and one sediment sample from each drainpipe outlet.
- Analyze all soil samples for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase II**

Determine the need for additional sampling based on the results of the Phase I sampling.

#### 5.2.12.21 Site 169 — Buildings 1408, 1408A-C, 1409, and 1411

**Phase I**

- Visually inspect the areas around Bldgs. 1408, 1408A-C, 1409, and 1411 to locate signs of contamination. Locate any drain lines leading from the sumps and drain outfalls by field inspection; use detailed maps and geophysical methods as necessary.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each contaminated soil area.
- Collect one water and one sediment sample from each sump or catch basin in each building.
- Collect one sediment sample to a depth of 0.3 m (1 ft) from two locations in the swamp between Bldgs. 1408A and 1408B.
- If the outfalls to the drain lines can be located, collect one soil sample from each outfall area and one sediment sample from each drainpipe outlet.
- Analyze all samples for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase II**

- Collect additional soil and sediment samples if warranted by the results of the Phase I sampling.
- Drill soil borings and collect surface water samples from the swamp if warranted.

#### 5.2.12.22 Site 170 — Buildings 1462-1464

**Phase I**

- Visually inspect the area around Bldgs. 1462-1464 for signs of contamination. Search PTA records and, if necessary, interview additional personnel to determine where wastewater discharges (if any) occurred.

- Collect two surface soil samples to a depth of 0.3 m (1 ft) near each of the four sump tanks. Choose sampling locations under valve or pipe inlets or outlets.

- Collect one sample to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area.

- Analyze all samples for explosives, TCL volatiles, and TCL semivolatiles.

**Phase II**

- If significant contamination is found, drill soil borings to determine its depth.

- Collect additional surface soil samples if warranted.

**5.2.12.23 Site 171 -- Buildings 3106, 3109, and 3111**

**Phase I**

- Inspect the areas around the buildings for signs of contamination. Do nothing further if the areas are clean.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from the center of each visibly contaminated area.

- Analyze the samples for TCL volatiles, TCL semivolatiles, and lead.

**Phase II**

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area. Collect samples from each boring.

- Analyze the boring samples for TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase III**

Determine the need for monitoring wells based on the results of the soil boring program.

### 5.2.12.24 Site 176 — Little-League Baseball Field

Phase I

- Conduct a geophysical survey to locate the pits and areas reportedly covered with the dredge material.
- Drill one soil boring in each area of electromagnetic anomalies and collect soil samples from the top, depth of the bottom of each anomaly, and bottom of each boring.
- Analyze the samples for cyanide, TCL volatiles, TCL semivolatiles, TCL metals, PCBs, propellants, explosives, pesticides, and herbicides.

Phase II

- If the Phase I samples contain significant contaminant concentrations, collect additional soil samples for the parameters found in the Phase I analyses.
- Determine the need for monitoring wells based on the Phase I results.

### 5.2.12.25 Site 177 — Sanitary Sewer System Breaks/Leaks

Phase I

- Locate and study the reports of Havens and Emerson Inc. and Visu-Sewer to identify sewer system breaks outside of Subbasins 6 and 7. If the reports cannot be used to identify breaks, survey the PTA sewer system (e.g., with a television camera) to locate breaks and faults (omit Subbasins 6 and 7 from the survey).
- Sample four locations of crushed or cracked pipes in Subbasins 6 and 7 and two locations outside the two subbasins and downstream from important contamination sources. Collect the samples by drilling two soil borings to a depth of 0.6 m (2 ft) below the pipe bottom; drill one boring on each side of the sewer pipe. Collect two samples from each of the 12 borings, one from the depth of the break or fault and the other from the bottom. The six locations are:
  - Between manholes (MHs) 350 and 352 downstream from Site 6 and Bldg. 3100.

- At MH 324 downstream from Bldgs. 3022 and 3028.

- At MH 465 in a region of crushed and cracked pipe.

- At MH 455 in a region of crushed and cracked pipe.

- Near MH 4A downstream from Bldg. 95.

- Near MH 25, downstream from Bldg. 24.

- Analyze the boring samples for propellants, explosives, TCL volatiles, TCL semivolatiles, and TCL metals.

**Phase II**

- Classify as major or minor all sewer system faults or breaks located by the Phase I survey.

- Drill soil borings at all major faults or breaks and collect subsurface samples as described under Phase I.

- Analyze the samples as described under Phase I.

**Phase III**

Determine additional locations for drilling soil borings and collecting samples based on the results of the Phase I and II programs.

### 5.2.13 Area M: 600 Buildings Area

#### 5.2.13.1 Site 15 – Buildings 616 and 654, Munitions Test Area

Static Detonation Area

**Phase I**

- Collect five soil samples from the pad beneath the test stand and the surrounding area. Sample at a depth of 0-0.15 m (0-6 in.) at the corners and center of the area (which is 2.4 m [8 ft] square).

- Analyze the soil samples for TCL metals, explosives, propellants, and uranium.

- Collect soil samples from a depth of 0-0.15 m (0-6 in.) at the base of all on-Site drums, above ground tanks, and a cylinder reported to be partially buried. Analyze for TCL volatiles. TCL semivolatiles, and TCL metals.

Phase II

- Drill soil borings at locations determined by the results of the surface soil sampling program and analyze the boring samples for contaminants determined to be significant from the previous results.

- Groundwater monitoring wells should be installed and sampled if the soil boring samples show significant contamination.

Projectile Firing Area

Phase I

- Collect surface soil samples (the number of samples depends on the circumference of the sand pile) from locations no more than 0.9 m (3 ft) apart in a ring around each sand pile. Each sample should be collected over a depth interval of 0-0.15 m (0-6 in.).

- Collect sand samples from the piles according to Methods II-7 or II-8 (EPA 1987d).

- Analyze all samples for explosives, propellants, uranium, and TCL metals.

Phase II

- Drill soil borings at locations determined by the results of the surface soil and sand pile sampling programs. Collect split-spoon samples at 0.8-m (2.5-ft) intervals for the first 3 m (10 ft) and at 1.5-m (5-ft) intervals thereafter to refusal.

- Analyze the boring samples for contaminants determined to be significant from the previous results.

- Groundwater monitoring wells should be installed and sampled if the soil boring samples show significant contamination.

### 5.2.13.2 Site 115 — Building 611

#### Phase I

- Visually inspect the area around Bldg. 611 to locate signs of contamination.
- Collect one surface soil sample from a depth of 0.15 m (6 in.) from the center of each visibly contaminated area around the building.
- Analyze the samples for explosives.

#### Phase II

Drill soil borings if warranted by the results of the Phase I analyses.

### 5.2.13.3 Site 152 — Buildings 604 and 604C

#### Closure Plan

Revised RCRA closure plans for the underground tanks at Bldg. 604C include excavating and cleaning the tanks. One of the cleaned tanks will be reburied for reuse, and the other will be flashed and scrapped. Two wash or condensate grab samples and four soil samples (three surface and one from beneath tank 2) will be collected and analyzed for priority pollutant metals and nitrates. The soil samples will also be analyzed for VOCs and, if necessary, EP toxicity for metals.

#### Proposed RI Plan

#### Phase I

- Visually inspect the area around the buildings for signs of contamination.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from each side of the storage area, each side of the catch basin, and from the center of each area of visible contamination (at least eight samples altogether).
- Drill two soil borings, one between the two tank locations and one next to the catch basin, to a depth of 1-1.5 m (3-5 ft) below the respective tank or catch basin bottoms. Samples should be

collected at the top, depth of the respective tank or catch basin bottoms, and bottom of the borings.

- Analyze all soil samples for TCL volatiles, TCL semivolatiles, TCL metals, and explosives.

**Phase II**

Collect additional surface soil samples, drill soil borings, and/or install monitoring wells if warranted by the results of the Phase I sampling program.

**5.2.13.4 Site 153 — Building 606**

**Phase I**

- Visually inspect the area around Bldg. 606 for signs of contamination.
- Collect one surface soil to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area.
- Analyze the samples for TCL volatiles, TCL semivolatiles, and TCL metals.
- No further action is required if the area is clean.

**Phase II**

Collect additional surface soil samples and/or drill soil borings if warranted by the results of the Phase I sampling.

**5.2.13.5 Site 154 — Buildings 617 and 617G**

**Phase I**

- Visually inspect the areas around Bldgs. 617 and 617G for signs of contamination.
- Collect one surface soil sample over a depth of 0.15 m (6 in.) from each side of Bldg. 617 and from the center of each visibly contaminated area.

- Analyze the soil samples for TCL volatiles, TCL semivolatiles, and explosives.

**Phase II**

Collect additional surface soil samples and/or drill soil borings around Bldg. 617 if warranted by the results of the Phase I sampling.

#### 5.2.13.6 Site 155 — Buildings 620 and 620B

**Phase I**

- Visually inspect the areas around Bldgs. 620 and 620B for signs of contamination.
- Collect one surface soil sample to a depth of 0.15 m (6 in.) from the center of each visibly contaminated area.
- Analyze the soil samples for propellants, explosives, TCL volatiles, and TCL semivolatiles.

**Phase II**

Collect additional surface soil samples and/or drill soil borings if contamination is found in the surface soil samples.

### 5.2.14 Area N: Firing and Test Ranges

#### 5.2.14.1 Site 7 — Building 1242, Munitions and Propellants Test Area

**Phase I**

- Conduct a surface reconnaissance of the common firing area and the two impact areas to locate any obvious signs of contamination.
- Conduct a geophysical survey to locate UXO, drums, and other buried objects.
- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.

- Collect four surface soil samples from the firing area at 15-m (50-ft) intervals. Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- Collect three surface water and sediment samples from Green Pond Brook in the 900-yd range area, one at the northern boundary of PTA, one at the middle of the Site, and one at the lower edge of the Site. Collect the water samples quarterly and review the results after one year.

- Analyze all soil, sediment, and water samples for TCL metals, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta. Analyze the water samples for macroparameters in addition.

**Phase II**

Collect additional surface soil samples and/or drill soil borings if warranted by the Phase I results.

**5.2.14.2 Site 8 — Building 1222, Munitions and Propellants Test Area**

**Phase I**

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate UXO, drums, and other buried objects.

- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.

- Collect ten surface soil samples to a depth of 0.15-0.3 m (6-12 in.) on a grid of ten sampling points in the southeastern part of the Site. Drill one soil boring at four of the same sampling locations and collect three samples over 0.6-m (2-ft) intervals from each of the four borings.

- Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- Collect at least four soil samples from each spent sand pile near the bunker and the sand pile near the southeast corner of the Site. (An estimated total of 12 sandpile samples will be collected.)

- Analyze all soil samples for TCL metals, TCL volatiles, TCL semivolatiles, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta.

- Collect air samples at two downwind locations, one near the sand bunker and another near the sand pile. Collect samples in the dry periods in the summer and fall and analyze for explosives, TCL metals, and TCL volatiles.

**Phase II**

Collect subsurface and additional surface soil samples and/or install monitoring wells if warranted by the Phase I results.

**5.2.14.3 Site 9 — Building 674, Munitions and Propellants Test Area**

**Phase I**

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate UXO, drums, and other buried objects.

- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.

- Collect five surface soil samples to a depth of 0.15-0.3 m (6-12 in.):

  - Two samples south of Bldg. 673.

  - One sample about 30 m (100 ft) east of Dames & Moore sampling locations SS9-4 and -5.

  - One about 30 m (100 ft) north of sampling location SS9-1.

  - One about 30 m (100 ft) north of sampling location SS9-3.

- Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- Drill one soil boring at each of the five Dames & Moore surface soil sample locations where contamination was detected.

- Drill one soil boring at each of three additional locations at the edge and off the Site in the impact area of some munitions testing.

- Collect each boring sample over a 0.6-m (2-ft) interval at the top, middle, and bottom of each boring for a total of 24 samples.

- Collect three surface water and sediment samples from the unnamed stream crossing the Site. One sample should be collected where the stream enters the Site, another in the middle of the Site, and the third below its exit from the Site.

- Collect and analyze the surface water samples quarterly and review the results after one year.

- Analyze all samples for TCL metals, explosives, propellants, nitrate, nitrite, sulfate, gross alpha, and gross beta.

**Phase II**

Collect additional soil and water samples and/or install monitoring wells if warranted by Phase I results.

**5.2.14.4 Site 10 — Chemical Burial Pit**

**Phase I**

- Conduct a geophysical survey to locate the pit and UXO, drums, and other buried objects. Remove any UXO located during the survey, and sample and remove any located buried drums.

- If the pit can be located, drill one soil boring in the center of the pit and two others in the pit area about 2.4 m (8 ft) from both the northwest and southeast side of the pit. If the pit cannot be located, drill three soil borings in the suspected area of the pit. Collect split-spoon samples at 0.6-m (2-ft) intervals from the surface to 0.3 m (1 ft) below the depth of the pit bottom.

- Analyze all soil and water samples for TCL metals, TCL volatiles, TCL semivolatiles, pesticides, herbicides, PCBs, explosives, propellants, nitrate, nitrite, fluoride, cyanide, fluoroacetate, gross alpha, and gross beta.

- Resample the three existing monitoring wells for two successive quarters to determine if the quality of the groundwater has changed.

**Phase II**

If significant soil contamination is found, additional soil borings and monitoring wells may be needed to determine the extent of contamination.

### 5.2.14.5 Site 11 — Buildings 647, 649, and 650, Munitions Test Range

**Phase I**

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate UXO, drums, and other buried objects.

- Excavate and remove any UXO located by the survey. Remove any located drums after sampling.

- Collect nine surface soil samples to a depth of 0.15-0.3 m (6-12 in.):

  - Four samples in the area between Bldg. 647 and Dames & Moore sampling locations SS11-3 and -4.

  - One sample north of the impact area and sampling locations SS11-3 and -4.

  - One sample each from the areas of Bldg. 649, Bldg. 650, and the burning cage (three altogether).

  - One sample half-way between Bldg. 650 and the burn cage.

- Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.

- Drill two soil borings, one adjacent to Dames & Moore sampling locations SS11-1 and -2 and the other adjacent to sampling location SS11-7. Collect soil samples over 0.6-m (2-ft) intervals from top, middle, and bottom of each boring, starting at a depth of 0.6 m (2 ft).

- Analyze all samples for TCL metals, explosives, propellants, nitrate, nitrite, gross alpha, and gross beta.

- Collect air samples at two locations, one downwind from the Bldg. 647 firing area and the other downwind from Bldg. 650 during dry periods in the summer and fall. Analyze the samples for explosives, propellants, TCL metals, and TCL volatiles.

**Phase II**

Collect additional surface and subsurface soil and air samples and/or install monitoring wells if warranted by Phase I results.

**5.2.14.6 Site 12 — Building 656, Munitions Waste Pit**

**Phase I**

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate the pit (if it is not found during the reconnaissance) and any UXO, drums, and other buried objects.

- Excavate and remove any UXO and drums found during the survey. Remove the located drums after sampling.

- If the pit is located, drill one soil boring at each of at least three locations near the pit. Drill to a depth of 0.3 m (1 ft) below the pit bottom. Collect soil samples over 0.6-m (2-ft) intervals at the top, middle, and bottom of each hole, starting at a depth of 0.6 m (2 ft).

- Drill three additional soil borings, one near Dames & Moore sediment sampling location SD12-1, a second near Bldg. 656, and the third just east of soil sampling location SS12-1. Collect boring samples as described above.

- Analyze all soil samples for TCL metals, explosives, propellants, nitrate, nitrite, cyanide, gross alpha, and gross beta.

**Phase II**

- Collect additional surface and subsurface soil samples if warranted by the results of the Phase I sampling.
- Install monitoring wells in the area if significant contamination is found by the Phase I sampling.

### 5.2.14.7 Site 13 — Building 640, Munitions/Pryotechnics Test Area

**Phase I**

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.
- Conduct a geophysical survey to locate UXO, drums, and other buried objects.
- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.
- Collect four surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.): two from the northwest side of the Site, one from the northeast side of the Site, and one between Bldg. 640 and the swamp. Collect one surface soil sample from each area of obvious soil discoloration, disturbance, or other indicators of contamination.
- Install one additional monitoring well in the area northwest of the swamp area where testing occurred to accurately determine if the groundwater beneath the Site has been affected by surface activities. Establish a monitoring program for this well. During drilling of the well, collect a soil sample over a 0.6-m (2-ft) interval at three depths: 0.6 m (2 ft) below the surface, the middle, and the bottom of the boring.
- Collect two surface water and sediment samples from the swamp.
- Analyze all samples for explosives, propellants, TCL metals, TCL semivolatiles, nitrate, and nitrite. Analyze all water samples for macroparameters in addition.

**Phase II**

- Collect additional surface soil, surface water, and sediment samples if warranted by the Phase I results.

- Drill soil borings and install additional monitoring wells if warranted by the Phase I results.

**5.2.14.8 Site 14 — Building 636, Munitions Test Area**

**Phase I**

- Conduct a surface reconnaissance of the Site to locate any obvious signs of contamination.

- Conduct a geophysical survey to locate UXO, drums, and other buried objects.

- Excavate and remove any UXO located during the survey. Remove the located drums after sampling.

- Collect five surface soil samples over a depth interval of 0.15-0.3 m (6-12 in.) in the area between the firing area and the bunker:

  - Three northwest of Dames & Moore sampling locations SS14-1 and

  - One half-way between Bldgs. 636 and 638.

  - One 15 m (50 ft) southeast of sampling location SS14-3.

- Collect three samples from each spent sand pile in the wetlands. A total of about nine samples will be needed. Also sample all disturbed areas.

- Drill one soil boring at each of the four Dames & Moore surface soil sampling locations where elevated contaminant levels were found. Collect each sample over a 0.6-m (2-ft) interval. The sampling depths are 0.6 m (2.0 ft) below the surface, the middle, and the bottom of each boring.

- Collect two surface water and two sediment samples from the pond.

- Analyze all samples for TCL metals, explosives, propellants, nitrate, nitrite, sulfate, gross alpha, and gross beta.

- Collect air samples 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. Analyze samples for explosives and propellants, TCL metals, and TCL volatiles.

**Phase II**

Collect additional surface soil, surface water, and air samples; drill additional soil borings; and/or install monitoring wells if warranted by Phase I results.

### 5.2.15 Area O: Lake Denmark

#### 5.2.15.1 Site 54 — Lake Denmark

**Phase I**

- Make an effort to locate UXO and other metal debris on the lake bottom. Use techniques such as geophysical surveying and scanning with underwater television cameras.

- Remove or mark (with buoys) any dangerous items that are located.

- Collect 10 surface water and 10 lake-bottom sediment samples. Determine exact locations by field inspection and based on the search for UXO and metal debris on the lake bottom.

- Analyze all sediment and water samples for TCL volatiles, TCL semivolatiles, TCL metals, PCBs, pesticides, herbicides, explosives, nitrate, nitrite, gross alpha, gross beta, and macroparameters (water samples only).

- Collect surface water samples quarterly for one year and analyze for the same parameters. Review the monitoring program after one year.

**Phase II**

Determine the need for additional sediment and water sampling based on the results of Phase I sampling.

#### 5.2.15.2 Site 164 — Building 1217

**Phase I**

- Inspect the area around the building for areas of soil disturbance or staining. Do nothing further if the area is clean.
- Collect one surface soil sample from the the center of each visibly contaminated area.
- Analyze the samples for propellants, explosives, nitrate, and nitrite.

**Phase II**

- If the surface soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area. Collect samples from each boring.
- Analyze the boring samples for propellants, explosives, nitrate, and nitrite.

### 5.2.16 Area P: Miscellaneous Storage

#### 5.2.16.1 Site 27 — Former Salt Storage Area

- Collect surface water samples quarterly from Green Pond Brook at a location about 6 m (20 ft) downstream from the Site.
- Collect groundwater samples for two quarters from monitoring well DM27-1.
- Analyze the surface water and groundwater samples for macroparameters and cyanide.

#### 5.2.16.2 Site 78 — Building 91

**Closure Plan**

Revised RCRA closure plans for Bldg. 91 include collecting two chip samples from cleaned building surfaces and two grab samples of wash water or rinsate and analyzing them for priority pollutant metals.

**Proposed RI Plan**

**Phase I**

- Inspect the Site and surrounding area for visible contamination.
- Collect one soil sample from each area of stained soil.
- Collect three surface soil samples from a depth of 0.15-0.3 m (6-12 in.) from each loading and handling area.
- Analyze all samples for TCL volatiles, TCL semivolatiles, and TCL metals, nitrate, and sulfate.

**Phase II**

- Drill one soil boring to 3 m (10 ft) or the water table, whichever comes first in each area of significant soil contamination. Collect samples from each boring.
- Analyze the boring samples for parameters with elevated concentrations in the surface soil samples.
- Install at least one upgradient and three downgradient monitoring wells if warranted by the results of the soil boring analyses.

**5.2.16.3 Site 94 — Buildings 1600, 1601, 1604, 1609, and 1610**

**Phase I**

- Collect surface soil samples to a depth of 0.3 m (1 ft) from areas near each of Bldgs. 1600, 1601, 1604, and 1609. Collect samples near exits, along perimeters, and from any stained areas.
- If the dry well can be located, collect samples from it:
  - If the well is open, collect one sample from the well bottom.
  - If the well is filled up, drill one soil boring in its center and collect samples over 0.6-m (2-ft) intervals.
- Collect sediment samples to a depth of 0.3 m (1 ft) from two locations in the lagoon at the north end of Bldg. 1604.

- Analyze all samples for TCL volatiles, TCL semivolatiles, explosives, TCL metals, gross alpha, and gross beta.

**Phase II**

- If the Phase I soil samples are significantly contaminated, drill one soil boring at the center of each contaminated area and collect samples from each boring.
- If the Phase I sediment samples are significantly contaminated, collect surface water and additional sediment samples from the lagoon.
- Analyze all samples for explosives, TCL volatiles, TCL semivolatiles, TCL metals, gross alpha, and gross beta.

**Phase III**

Install monitoring wells if the dry well or soil boring samples are significantly contaminated.

**5.2.16.4 Site 119 — Buildings 46, 47, and 48, Propellant Storage**

**Phase I**

- Inspect the areas around the buildings for signs of contamination.
- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area around the buildings and collect one surface soil sample (to the same depth) at the entrance of each building.
- Analyze the surface soil samples for propellants.

**Phase II**

- If significant contamination is indicated by the Phase I analyses, drill one soil boring in the center of each contaminated area and collect samples for each boring.
- Analyze samples for contaminants found in Phase I samples.
- Determine the need for additional groundwater, soil, and surface-water samples based on the results.

**5.2.16.5 Site 120 — Building 50, Propellant Storage**

**Phase I**

- Inspect the area around Bldg. 50 to locate areas with visible contamination and the area in which propellant containers were reportedly opened.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area and collect one surface soil sample from the propellant opening area (if it is located).

- Collect one surface water sample and one sediment sample 0.3 m (1 ft) deep from the drainage ditch southeast of the building.

- Analyze all the samples for propellants.

**Phase II**

- Drill one soil boring in the center of each area of significant contamination identified by the Phase I analyses. Collect subsurface soil samples from each boring.

- Analyze the soil boring samples for the contaminants with elevated concentrations in the surface soil samples.

- Determine the need for additional surface water and groundwater samples based on the Phase I results.

**5.2.16.6 Site 121 — Building 57, Chemical Storage**

**Phase I**

- Inspect the area around the building for signs of contamination.

- Collect one surface soil sample to a depth of 0.3 m (1 ft) from each visibly contaminated area and collect one surface soil sample at the building entrance.

- Collect one surface water and one sediment sample from the drainage ditch southeast of the building.

- Analyze the soil, sediment, and water samples for TCL volatiles, TCL semivolatiles, and TCL metals.

- Collect three surface soil samples to a depth of 0.15 m (6 in.) near the PCB transformer and mix them to make a composite sample for PCB analysis.

**Phase II**

- If contamination is found in the Phase I analyses, drill one soil boring in the center of each contaminated area and collect soil samples from each boring.
- Analyze the boring samples for the contaminants identified during Phase I.
- Determine the need for surface water samples to delineate the extent of contamination.

## 5.3 SAMPLING SUMMARY TABLES

Table 5.1 provides a matrix of types of RI activities proposed for each Site. Sampling prescribed by existing closure plans is not listed in the tables.

Sampling and testing needs are summarized in Tables 5.2-5.10 for the following areas:

- Table 5.2: surface soil and sediment
- Table 5.3: subsurface soil
- Table 5.4: surface water
- Table 5.5: groundwater
- Table 5.6: air
- Table 5.7: field inspections
- Table 5.8: geophysical surveys
- Table 5.9: drums and tanks
- Table 5.10: other.

To save space, many of the analytic categories in the tables are represented by numbers. Each table carries a footnote that provides a key for the numbers and corresponding category names.

**TABLE 5.1 Summary of Proposed RI Activities for All Sites at Picatinny Arsenal[a]**

| Area and Site | Phase[b] | Activity[c] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FI | GS | UX | DS | SS | SB | SE | SW | GW | OT[d] |
| **Area A** | | | | | | | | | | | |
| 34 | See RI/FS plan and also GS and OT | | | | | | | | | | |
| **Area B** | | | | | | | | | | | |
| 20 | I | - | - | - | - | X | - | - | - | - | - |
| 24 | I | - | - | - | - | - | X | X | - | X | - |
| **Area C** | | | | | | | | | | | |
| 19 | I | - | - | - | - | - | - | - | - | X | - |
| 23 | I | - | - | - | X | X | - | - | - | X | AT |
| 25 | I | - | - | - | - | - | - | - | X | X | AT,X |
| 26 | I | - | - | - | - | - | - | - | - | X | - |
| 163 | I | - | X | - | - | - | X | - | - | - | - |
| 180 | I | X | X | - | - | X | - | X | X | - | - |
| **Area D** | | | | | | | | | | | |
| 21/37 | I | - | - | - | - | - | - | - | - | X | X |
| 29 | I | - | - | - | - | - | X | - | - | X | X |
| 39 | I | - | - | - | - | - | - | - | - | - | TT |
| 45 | I | X | - | - | - | X | - | - | - | - | X |
| 69 | I | X | - | - | - | X | - | - | - | - | - |
| 86 | I | X | - | - | - | - | - | - | - | - | - |
| 117 | I | X | - | - | - | X | - | X | X | - | - |
| 118 | I | X | - | - | - | - | - | X | X | - | - |
| | II | - | - | - | - | - | - | - | - | X | - |
| 122 | I | X | - | - | - | X | - | X | X | - | - |
| 123 | I | X | - | - | - | X | - | X | X | - | - |
| 182 | I | X | - | - | - | X | - | - | - | - | - |
| 183 | I | X | - | - | - | X | - | - | - | - | - |
| **Area E** | | | | | | | | | | | |
| 28 | I | X | - | - | - | - | - | X | - | X | - |
| 38 | I | - | - | - | - | X | - | - | - | - | TT |
| 44 | I | - | - | - | - | X | - | - | - | - | TT,AS |
| | II | - | - | - | - | - | X | - | - | - | X |

**TABLE 5.1 (Cont'd)**

| Area and Site | Phase[b] | Activity[c] FI | GS | UX | DS | SS | SB | SE | SW | GW | OT[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area F | | | | | | | | | | | |
| 60 | I | X | - | - | - | X | - | - | - | - | - |
| 61 | I | X | - | - | - | X | - | X | - | - | - |
| 104 | I | X | X | - | - | X | X | X | X | - | - |
| 106 | I | X | - | - | - | X | - | - | - | - | - |
| 111 | I | X | - | - | - | X | - | X | - | - | X |
| 124 | I | X | - | - | - | X | - | - | - | - | - |
| 125 | I | X | - | - | - | X | - | - | - | - | - |
| 126 | I | X | - | - | - | X | - | - | - | - | - |
| 138 | I | X | - | - | - | X | - | X | - | X(DP) | - |
| 139 | I | X | X | - | - | X | X | X | - | - | - |
| 140 | I | - | - | - | - | X | - | - | - | - | - |
| 141 | I | X | - | - | - | X | - | X | - | - | - |
| 142 | I | X | - | - | - | X | - | X | - | - | - |
| 143 | I | X | - | - | - | X | - | X | - | - | - |
| 144 | I | X | - | - | - | X | - | X | - | - | X |
| 145 | I | X | - | - | - | X | - | X | - | - | - |
| 146 | I | - | - | - | - | X | - | X | - | - | X |
| Area G | | | | | | | | | | | |
| 31 | I | X | - | - | - | X | X | - | - | - | - |
| 52/95 | I | - | - | - | - | X | X | - | - | - | - |
| | II | - | - | - | - | - | - | - | - | X | - |
| 96 | I | X | - | - | - | X | - | - | - | - | - |
| 101 | I | X | X | - | - | X | - | - | - | - | - |
| 134 | I | X | X | - | - | X | - | - | - | - | - |
| 135 | I | X | - | - | - | X | - | - | - | - | - |
| 136 | I | X | - | - | - | X | - | - | - | - | - |

**TABLE 5.1 (Cont'd)**

| Area and Site | Phase[b] | Activity[c] FI | GS | UX | DS | SS | SB | SE | SW | GW | OT[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area H | | | | | | | | | | | |
| 55 | I | - | - | - | - | X | - | - | - | - | - |
| | II | - | - | - | - | - | - | - | X | - | - |
| 62 | I | X | - | - | - | X | - | X | X | - | - |
| 64 | I | X | - | - | - | X | - | X | X | - | - |
| 98 | I | X | - | - | - | X | - | - | - | - | - |
| 100 | I | X | - | - | - | X | - | X | X | - | - |
| 127 | I | X | - | - | - | X | - | - | - | - | - |
| 128 | I | X | - | - | - | X | - | - | - | - | - |
| 129 | I | X | - | - | - | - | - | - | - | - | X |
| 130 | I | X | - | - | - | X | - | - | - | - | - |
| 131 | I | X | - | - | - | X | - | - | - | - | - |
| 132 | I | X | - | - | - | X | - | - | - | - | - |
| 151 | I | X | - | - | - | X | - | - | - | - | - |
| Area I | | | | | | | | | | | |
| 16 | I | - | - | - | - | X | - | - | - | - | LT |
| 30 | I | - | - | - | - | X | - | - | - | - | - |
| 32 | I | - | - | - | - | X | - | - | - | - | - |
| 33 | I | - | - | - | - | X | - | - | - | - | - |
| 40 | I | - | - | - | - | X | - | X | - | - | - |
| 47 | I | X | - | - | - | X | - | - | - | - | - |
| 50 | I | X | - | - | - | X | - | X | - | - | - |
| 53 | I | - | - | X | - | X | - | X | X | - | X |
| | II | - | - | - | - | - | - | - | X | - | - |
| 63/65 | I | X | - | - | - | - | X | - | - | - | - |
| 70 | I | X | - | - | - | X | - | - | - | - | - |
| 71 | I | X | - | - | - | X | - | - | - | - | - |
| 79 | I | X | - | - | - | X | - | - | - | - | - |
| 82 | I | X | X | - | - | X | - | - | - | - | - |
| 83 | I | X | X | - | - | X | X | - | - | - | - |
| 90 | I | X | - | - | - | X | - | - | - | - | - |
| 93 | I | X | X | - | - | X | X | - | - | - | - |
| 97 | I | X | - | - | - | X | - | - | - | - | - |
| 102 | I | X | - | - | - | X | - | - | - | - | - |
| 105 | I | X | - | - | - | X | - | - | - | - | - |

**TABLE 5.1 (Cont'd)**

| Area and Site | Phase[b] | Activity[c] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FI | GS | UX | DS | SS | SB | SE | SW | GW | OT[d] |
| **Area I** (Cont'd) | | | | | | | | | | | |
| 108 | I | X | - | - | - | X | - | - | - | - | - |
| 109 | I | X | - | - | - | X | - | X | - | - | X |
| 110 | I | X | - | - | - | - | - | - | - | - | X |
| 113 | I | X | - | - | - | X | X | - | - | - | - |
| 137 | I | X | X | - | - | X | X | - | - | - | - |
| 147 | I | X | X | - | - | X | X | - | - | - | - |
| 148 | I | X | - | - | - | X | - | - | - | - | - |
| 149 | I | X | - | - | - | X | X | - | - | - | - |
| 150 | I | X | - | - | - | X | - | X | - | - | X |
| 156 | I | X | - | - | - | X | X | X | - | - | - |
| 157 | I | - | - | - | - | X | X | - | - | - | - |
| 158 | I | - | - | - | - | - | - | X | - | - | - |
| 159 | I | - | X | - | - | - | X | - | - | - | - |
| 178 | I | X | - | - | - | X | - | X | - | - | X |
| 184 | I | X | - | - | - | X | - | - | - | - | - |
| **Area J** | | | | | | | | | | | |
| 1 | I | X | X | X | X | X | - | - | - | - | - |
| | II | - | - | - | - | - | X | - | - | X | - |
| 2 | I | X | X | X | X | X | - | X | X | X | TT |
| 4 | I | X | X | X | X | X | X | X | - | X | TT |
| | II | - | - | - | X | - | X | - | - | - | - |
| 175 | I | X | - | - | X | X | - | X | X | - | - |
| **Area K** | | | | | | | | | | | |
| 3 | I | X | X | X | X | X | - | X | X | X | TT,AS |
| 48 | I | - | - | - | - | X | - | - | - | - | - |
| 172 | I | X | - | - | - | X | - | - | - | - | CH |
| 173 | I | X | - | - | - | X | - | - | - | - | - |
| 174 | I | X | - | - | - | - | - | X | - | X(DP) | - |

**TABLE 5.1 (Cont'd)**

| Area and Site | Phase[b] | Activity[c] FI | GS | UX | DS | SS | SB | SE | SW | GW | OT[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area L | | | | | | | | | | | |
| 5 | I | - | - | - | - | - | - | - | - | X | - |
| 6 | I | - | - | - | - | - | - | - | - | - | - |
| 17 | I | - | - | - | - | - | - | - | - | X | AT |
| | II | - | - | - | - | X | X | - | - | - | - |
| 18 | I | X | X | - | X | - | X | - | - | - | SG |
| 35 | I | X | - | - | - | X | - | X | X | - | TT |
| 36 | I | X | - | - | - | X | - | - | - | - | - |
| 41 | I | X | - | - | - | X | - | - | - | - | - |
| 42 | I | X | - | - | - | X | - | - | - | - | - |
| 43 | I | - | - | - | - | X | - | - | X | - | CH |
| | II | - | - | - | - | - | - | - | - | - | X |
| 77 | I | X | - | - | - | X | - | - | - | - | - |
| 91 | I | X | X | - | - | X | - | - | - | - | - |
| 103 | I | X | X | X | - | - | - | - | - | - | X |
| | II | - | - | - | - | - | - | X | X | - | - |
| 114 | I | X | - | - | - | X | - | X | - | - | - |
| 160 | I | X | - | - | - | X | - | - | - | - | - |
| 161 | I | X | - | - | - | X | X | X | X | - | - |
| 162 | I | X | X | - | - | X | X | - | - | - | - |
| 166 | I | X | - | - | - | X | - | - | - | - | - |
| 167 | I | X | - | - | - | X | - | X | X | - | - |
| 168 | I | X | X | - | - | X | - | X | X | - | - |
| 169 | I | X | X | - | - | X | - | X | X | - | - |
| 170 | I | X | - | - | - | X | - | - | - | - | - |
| 171 | I | X | - | - | - | X | - | - | - | - | - |
| 176 | I | - | - | - | - | X | - | - | - | - | - |
| 177 | I | X | - | - | - | - | X | - | - | - | X |
| Area M | | | | | | | | | | | |
| 15 | I | - | - | - | - | X | - | - | - | - | - |
| | II | - | - | - | - | - | X | - | - | - | - |
| 115 | I | X | - | - | - | X | - | - | - | - | - |
| 152 | I | X | - | - | - | X | X | - | - | - | - |
| 153 | I | X | - | - | - | X | - | - | - | - | - |
| 154 | I | X | - | - | - | X | - | - | - | - | - |
| 155 | I | X | - | - | - | X | - | - | - | - | - |

**TABLE 5.1 (Cont'd)**

| Area and Site | Phase[b] | Activity[c] FI | GS | UX | DS | SS | SB | SE | SW | GW | OT[d] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Area N | | | | | | | | | | | |
| 7 | I | X | X | X | X | X | - | X | X | - | - |
| 8 | I | X | X | X | X | X | - | - | - | - | AS |
| 9 | I | X | X | X | X | X | X | X | X | - | - |
| 10 | I | - | X | X | X | - | X | - | - | X | - |
| 11 | I | X | X | X | X | X | X | - | - | - | AS |
| 12 | I | X | X | X | X | - | X | - | - | - | - |
| 13 | I | X | X | X | X | X | - | X | X | X | - |
| 14 | I | X | X | X | X | - | X | X | X | - | AS |
| Area O | | | | | | | | | | | |
| 54 | I | - | X | X | - | - | - | X | X | - | X |
| 164 | I | X | - | - | - | X | - | - | - | - | - |
| Area P | | | | | | | | | | | |
| 27 | | - | - | - | - | - | - | - | X | X | - |
| 78 | I | X | - | - | - | X | - | - | - | - | - |
| 94 | | - | - | - | - | X | X | X | - | - | - |
| [illegible] | I | - | - | - | - | - | - | - | - | - | - |
| 119 | | X | - | - | - | X | - | - | - | - | - |
| 120 | | X | | - | - | X | - | X | X | - | - |
| 121 | | X | - | - | - | X | - | X | X | - | - |

[a]Table lists only those Sites for which RI activities are recommended in addition to closure plan activities.

[b]Phase II activities are listed only if they include activities unique to the Site.

[c]Activities are FI = field inspection, GS = geophysical survey, UX = UXO removal, DS = drum sampling and removal, SS = surface soil sampling, SB = soil borings, SE = sediment sampling, SW = surface water sampling, GW = groundwater sampling (by monitoring well or drive point [DP]), and OT = other.

[d]Other activities include TT = tank integrity testing or sampling, LT = line integrity testing or sampling, AT = aquifer slug tests, SG = soil gas survey, AS = air sampling, and CH = chip sampling.

TABLE 5.2 Summary of Surface Soil and Sediment Sampling Data Needs for All Sites at Picatinny Arsenal[a]

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area B | | | | | | |
| 20 | I | S/4 | - | - | 6 | Near Site edges |
| 24 | I | SE/4 | - | - | 1, 2, 6, uranium | From area south of (upgradient to) and from northern drainage ditch between pond and brook |
| Area C | | | | | | |
| 19 | I | TBD | - | - | 1a, 1c | |
| 23 | I | S/TBD | - | - | 1a-1e, 2, 8 | Near drums in the woods |
| | II | TBD | - | - | TBD | Based on Phase I results |
| 25 | I | SE/2 | - | - | 1, 2, 3, 5, 6, 7 | From brook |
| 163 | II | S/TBD | - | - | TBD | Based on Phase I results |
| 180 | I | S/TBD | - | - | 1a-1e | One from each stained area |
| | I | S/10 | 15 (grid) | 0.6 | 1a-1e | From former disposal area |
| | I | SE/3 | - | - | 1a-1e | From swampy area |
| Area D | | | | | | |
| 21/37 | I | TBD | - | - | 1a, 1c | |
| 45 | I | S/TBD | - | 0-0.15 | TPH, BTX | Outside doors and stained areas |
| 69 | I | S/3+ | - | 0.15-0.3 | 1a-1c, 5a, CN, $SO_4$ | Three from each loading and handling area and one from each stained area; collect three deeper samples (0.6 m) around UST |
| | I | SE/2 | 30 | - | 1a-1c, 5a, CN, $SO_4$ | From Bear Swamp Brook at former outfall |

**TABLE 5.2 (Cont'd)**

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area D (Cont'd) | | | | | | |
| 117 | I | S/TBD | 30 | 0.15-0.3 | 1a, 1b, 1c, uranium | Three from each loading and handling area and one composite from each stained area |
| | I | SE/3 | - | - | 1a, 1b, 1c, uranium | From Bear Swamp Brook: one upstream, one at Site, and one downstream |
| 118 | I | SE/3 | - | 0-0.3 | 1a-1e, CN | One from brook at each pipe outlet and two from pond |
| 122 | I | S/TBD | - | 0.15-0.3 | 1a, 1b, 2 | Three from each loading and handling area and one composite from each stained area |
| | I | SE/3 | 30 | - | 1a, 1b, 2 | From Bear Swamp Brook: one upstream, one at Site, and one downstream |
| 123 | I | S/TBD | - | 0.15-0.3 | 1c, 5a, CN, $SO_4$, uranium | Three from each loading and handling area and one composite from each stained area |
| | I | SE/3 | 30 | - | 1c, 5a, CN, $SO_4$, uranium | From Bear Swamp Brook: one upstream, one at Site, and one downstream |
| 182 | I | S/TBD | - | 0-0.3 | 1c, CN | From each stained area |
| 183 | I | S/TBD | - | - | 1c, CN | One from each stained area |
| Area E | | | | | | |
| 28 | I | SE/12 | - | 0-0.15 | 1a-1c, 1e | From secondary settling tanks |
| 38 | I | S/6 | - | - | 1, 6, CN | Below bottom of each tank |
| | II | TBD | - | - | TBD | Based on Phase I results |
| 44 | I | S/2 | - | 0-0.15 | 1a, 1b | Under gasoline tank if there is leakage |
| | II | S/TBD | - | - | TBD | Based on Phase I results |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area F | | | | | | |
| 60 | I | S/TBD | - | 0-0.15 | 1c, CN | One from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 61 | I | S/4 | - | 0.15-0.3 | 1c, 8, CN | Behind Bldg. 171 |
| | I | S/4 | - | 0.15-0.3 | 1c, CN | Around Bldg. 176 |
| | I | S/TBD | - | - | 1c, 8, CN | From stained areas |
| | I | SE/4 | - | - | 1c, 2, 8 | From creek near Bldg. 176 |
| | I | SE/2 | - | 0-0.6 | 1c, 8, CN | From creek south of Bldg. 171 |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| | II | SE/TBD | - | - | TBD | Based on Phase I results |
| 104 | I | S/8+ | - | - | 1c, 2, 8, $CCl_4$ | From each side of each building, identified propellant dump, and stained areas |
| | I | SE/4+ | - | - | 1c, 2, 8, $CCl_4$ | Three from swamp, one from creek downgradient from Site, and one from each building drain |
| | III | S, SE/TBD | - | - | TBD | Based on Phase II results |
| 106 | I | S/8+ | - | 0.15-0.3 | 1e, 5a, 8 | One sample from each side of building location and transformer storage area; one from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results sampling |
| 111 | I | S/10+ | - | 0-0.15 | 8 | Two from each side of Bldg. 455 and 454 loading areas |
| | I | S/TBD | - | 0-0.6 | 8 | From each stained area |
| | I | SE/TBD | - | 0-0.3 | 8 | From each drain outfall |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 124 | I | S/TBD | - | 0-0.3 | 2, 8 | From stained areas around Bldg. 166 |
| | I | S/1 | - | 0-0.3 | 1e | Composite from near PCB transformer |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) | | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| | | | Distance | Depth | | |
| Area F (Cont'd) | | | | | | |
| 125 | I | S/8+ | - | 0-0.3 | 1b, 1c, 5a, $SO_4$ | Eight from around Bldgs. 172 and 183 and one from each stained area |
| | I | S/2 | - | 0-0.3 | 1c | Composite from near two PCB transformers |
| 126 | I | S/TBD | - | 0-0.3 | 8 | From stained areas around Bldg. 197 |
| 138 | I | S/4+ | - | 0-0.6 | 1a, 1c, 2, 8 | From each side of Bldg. 407 and each stained area |
| | I | SE/4+ | - | - | 1a, 1c, 2, 8 | One from each settling basin near Bldg. 408, two from swamp, and one from each drain outfall |
| | I | S/1 | - | 0-0.3 | 1c | Composite from near PCB transformer at Bldg. 404 |
| | II | S/TBD | - | - | 1a, 1c, 2, 8 | Based on Phase I results |
| 139 | I | S/TBD | - | 0-0.6 | 8 | One from bottom of each located decontamination pit |
| | I | SE/2 | - | 0-0.3 | 8 | From swamp behind building |
| 140 | I | S/4+ | - | 0-0.3 | 2, 8 | Four around Bldg. 427 and one from each stained area |
| | I | SE/5 | - | 0-0.3 | 2, 8 | From open drain around buildings and concrete pit near Bldg. 427 |
| | I | SE/1 | - | - | 1a, 1b, 2, 8, acetone, ethyl acetate | Grab sample from catch tank in Bldg. 427 |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 141 | I | S/TBD | - | 0-0.3 | 8 | From each stained area |
| | I | SE/1 | - | 0-0.3 | 1a-1c, 8 | From bottom of each catch tank |
| 142 | I | S/TBD | - | - | 8, 5a, chloride, ethyl acetate, acetone | From each stained area |
| | II | SE/TBD | - | - | 8, 5a, chloride, ethyl acetate, acetone | One from each drain outfall |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) | | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| | | | Distance | Depth | | |
| Area F (Cont'd) | | | | | | |
| 143 | I | S/TBD | - | - | 8 | From each stained area |
| | I | SE/TBD | - | - | 8 | From each located drain outfall |
| 144 | I | S/TBD | - | - | 2, 8 | From each stained area |
| | I | SE/TBD | - | - | 2, 8 | One from each drain or drain outfall (if located) |
| 145 | I | S/4+ | - | 0-0.3 or 0-0.6 | 1c, 2, 8 | Four around Bldg. 477, one from each stained area, and from any waste dumps |
| | I | SE/TBD | - | 0-0.3 | 1c, 2, 8 | Two from bottom of sand filter (if located), two near drainage receiving effluent, and one from each drain outfall |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 146 | I | S/4+ | - | - | 8 | Four around Bldg. 497 and, if possible, two from under building |
| | I | SE/TBD | - | 0-0.3 | 8 | One from each drain outfall |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| Area G | | | | | | |
| 31 | I | S/TBD | - | 0-0.15 | 1c, 1d, TPH | One from each stained area and one from each loading and handling area |
| 52/95 | I | S/10 | - | 0.15-0.3 | 1c, 1d, TPH | From points evenly distributed across brook area |
| 96 | I | S/8+ | - | 0.15-0.3 | 1a, 1b, 1e | Four from perimeters of each building, three from each storage area, and one composite from each stained area |
| 101 | I | S/10+ | - | 0.15-0.3 | 1a, 1b, 1c, 2, 5 | Ten from burning ground area, six from disposal pit area (if located), and one composite from each stained area |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area G (Cont'd) | | | | | | |
| 134 | I | S/TBD | - | 0-0.6 | 1a-1c, 2, 5 | Three from each storage area, one 0.6 m from disposal pit (if located), and one composite from each stained area |
| 135 | I | S/TBD | - | 0.15-0.3 | 1a, 1b, 2, 5a, $SO_4$ | Three from each loading and handling area and |
| 136 | I | S/TBD | - | 0.15-0.3 | 1a-1c, 5a, $SO_4$ | Three from each loading and handling area and one composite from each stained area |
| Area H | | | | | | |
| 55 | I | S/16 | - | - | 1a, 1b, 2, 5 | Two from each of four sides of Bldgs. 221 and 223 |
| | I | S/TBD | 3 (grid) | 0-0.15 | 1a, 1b, 2, 5 | Under raised flow trough between Bldgs. 225 and 232 and around holding tank near Bldg. 225 |
| | I | S/5+ | - | 0-0.15 | 1a-1e, 2, 5 | Area under discharge point in Bear Swamp Brook |
| 62 | I | S/TBD | - | 0.3 | 1a, 1b, 1e, 2, 5, $SO_4$ | Three from each loading and handling area and one from each stained area |
| | I | SE/2 | - | - | 1a, 1b, 1e, 2, 5, $SO_4$ | From former outfall location in Bear Swamp Brook |
| 64 | I | S/TBD | - | 0.15-0.3 | 1a, 1b, 1e, 2, 5, $SO_4$ | Three from each loading and handling area and one from each stained area |
| | I | SE/2 | - | - | 1a, 1b, 1e, 2, 5, $SO_4$ | From Bear Swamp Brook at former outfall |
| 98 | I | S/TBD | - | 0.15-0.3 | 1a, 1b, 2, 5 | Three from each loading and handling area and one composite from each stained area |
| 100 | I | S/10+ | - | 0.15-0.3 | 1a, 1b, 1e, 2, 5 | Ten from former building location and one composite from each stained area |
| | I | SE/2 | - | - | 1a, 1b, 1e, 2, 5 | From Bear Swamp areas convenient for dumping |

**TABLE 5.2 (Cont'd)**

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area H (Cont'd) | | | | | | |
| 127 | I | S/4+ | - | 0.15-0.3 | 2, 5 | Three from each loading and handling area, one from each side of building, and one composite from each stained area |
| 128 | I | S/8+ | - | 0.15-0.3 | 2, 5 | Three from each loading and handling area, one from each side of two buildings, and one composite from each stained area |
| 130 | I | S/4+ | - | 0.15-0.3 | 2, 5, 8 | Three from each loading and handling area, one from each side of building, and one composite from each stained area |
| 131 | I | S/TBD | - | 0.15-0.3 | 1a, 1b, 1e, 2, 5, $SO_4$ | Three from each loading and handling area and one composite from each stained area |
| 132 | I | S/28+ | - | 0.15-0.3 | 1a, 2, 5, 8 | Three from each loading and handling area, one from each side of each building, and one composite from each stained area |
| 151 | I | S/4+ | - | 0.15-0.3 | 2, 8 | One from each side of Bldg. 600 and one from each stained area |
| Area I | | | | | | |
| 16 | I | S/TBD | - | 0-0.15 | 2 | Collect when line excavation begins |
| 30 | I | S/4 | - | 0-0.15 | 1a-1c, 4, 5, chloride, fluoride, bromide | Around building and on roof embankment |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 32 | I | S/14 | - | 0.15-0.3 | 1a, 1b, 5, NC | Under the filling or discharge points for each tank and along northwest side of Bldg. 553 |
| | I | S/3 | - | 0.15-0.3 | 1a, 1b, 5, NC | Under pipeline |
| | II | S/TBD | - | - | TBD | Based on Phase I results |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area I (Cont'd) | | | | | | |
| 33 | I | S/2 | - | 0.15-0.3 | 1a, 2 | From area between Bldg. 527A and Picatinny Lake |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 40 | I | SE/6 | - | 0-0.15 | 1c, 2, 4, 5 | Three from ditch, two along lakeshore, and one from pipe drain |
| | I | S/TBD | - | 0-0.15 | 1c, 2, 4, 5 | From area between Bldgs. 809 and 810, from areas of disturbed or stained soil, and from possible spill areas |
| 47 | I | S/3 | - | 0.15-0.3 | 1b, 1c, 1e, O&G | Around storage area behind Bldg. 3005 |
| | I | S/TBD | - | 0.15-0.3 | 1b, 1c, 1e, O&G | One from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 50 | I | S/4+ | - | 0.3 | 1a-1c, 2 | One from each stained area and one from each side of Bldg. 519 |
| | I | SE/TBD | - | - | 1a-1c, 2 | One from each sump |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 53 | I | S/TBD | 30 (grid) | 0-0.15 | 1a-1c, 2 | On island in lake, especially from stained soil |
| | I | SE/10+ | - | 0-0.3 | 1a-1e, 2, 3, 4, 5, CN, Mirex, fluoride, | From lake bottom; choose locations to avoid disturbing UXO |
| | II | SE/TBD | - | - | TBD | Based on Phase I results |
| 70 | I | S/TBD | - | 0-0.3 | 1a-1c, 2 | One from each stained area |
| 71 | I | S/TBD | - | 0-0.3 | 1c, 2, 8 | One from each stained area |
| | III | SE/2 | - | 0-0.3 | 1c, 2, 8 | From Picatinny Lake shore near borings; based on Phase II results |
| 79 | I | S/TBD | - | 0-0.3 | 1a, 1b | Near southwest corner of Bldg. 3013 and one from each stained area |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area I (Cont'd) | | | | | | |
| 82 | I | S/3 | - | 0-0.3 | Ib, silver | Two along outflow path and one from discharge point |
| | II | SE/2 | - | 0.3 | Ib, silver | From shore of Picatinny Lake along outflow path; based on Phase I results |
| 83 | I | S/TBD | - | 0-0.3 | Ia-Ic, 2 | One from each stained area |
| | I | S/2 | - | 0-0.3 | Ic, 2, 5, 8, $SO_4$ | If pit can be located and it is uncovered |
| 90 | I | S/TBD | - | 0-0.15 | Ia, Ib | One from each stained area |
| 93 | I | S/2 | - | 0-0.3 | 2, 8 | Two from powder disposal area, if located |
| | III | SE/2 | - | 0.3 | 2, 8 | From Picatinny Lake near borings; based on Phase I results |
| 97 | I | S/4+ | - | 0-0.15 | Ib, mercury | Four from building perimeter, one composite from each stained area |
| 102 | I | S/TBD | - | 0-0.3 | Ia, Ib, lead | From stained areas behind ceramic shop and over hill |
| 105 | I | S/4+ | - | 0.15-0.3 | Ie | One from each side of building location and one from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 108 | I | S/4 | - | 0-0.3 | Ic | Four along perimeter of Bldg. 717 |
| | I | S/5+ | - | 0-0.3 | Ia-Ic, 2 | Four along the perimeters of Bldgs. 722 and 723 (two per building), one from flare testing room, and from any dump and flare areas |
| | I | S/2 | - | 0-0.3 | Ic, 2, fluoride | From concrete pit |
| | III | SE/TBD | - | 0-0.3 | Ia-Ic, 2 | From Green Pond Brook and Picatinny Lake; based on Phase II results |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area I (Cont'd) | | | | | | |
| 109 | I | S/4+ | - | - | 1c, 2, 5a, 8 | From each side of Bldg. 445 and from each stained area |
| | I | SE/TBD | - | - | 1c, 2, 5a, 8 | From any building sump or drain outfall |
| 113 | I | S/4+ | - | 0-1.5 | 1a-1c, 2 | One from each stained area |
| 137 | I | S/TBD | - | 0-0.8 | 1a-1e, 2 | Three 0.8 m from disposal pit (if located) and one composite from each stained area |
| 147 | I | S/4+ | - | 0.15-0.3 | 1b, 1c, 8 | One from each side of Bldg. 520 and one from each stained area |
| 148 | I | S/TBD | - | 0.15-0.3 | 1a-1c, 2 | One from each stained area |
| 149 | I | S/4+ | - | 0.15-0.3 | 1b, 2 | One from each side of Bldg. 541 and one from each stained area |
| 150 | I | S/4+ | - | 0.15-0.3 | 2, 8 | One from each side of Bldg. 555 and one from each stained area |
| | I | SE/TBD | - | - | 2, 8 | From drain pipes in building |
| | II | S/TBD | - | - | | Based on Phase I results |
| 156 | I | S/TBD | - | 0-0.3 | 1c, 2, 8 | One from each stained area |
| | I | SE/4 | - | 0.3 | 1c, 2, 8 | Behind Bldgs. 813, 816, and 818B along shore of Picatinny Lake |
| 157 | I | S/4 | - | 0-0.3 | 1c, 2, 8 | Between Bldgs. 820 and 823 and Picatinny Lake |
| | II | SE/2 | - | 0.3 | 1c, 2, 8 | From Picatinny Lake; based on Phase I results |
| 158 | I | SE/2 | - | 0.3 | 2, 8, lead | From Picatinny Lake near Bldg. 926 |
| | II | SE/TBD | - | 0.3 | 2, 8, lead | Based on Phase I results |
| 159 | II | SE/2 | - | 0.3 | lead | From Green Pond Brook; based on Phase I results |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area I (Cont'd) | | | | | | |
| 178 | I | S/8+ | - | 0-0.3 | 1a-1c, 2 | One from center of each side of Bldgs. 541 and 561 and one from each stained area |
| | I | S/4+ | - | 0-0.3 | 1a, 1b, 2 | One from center of each side of Bldg. 323A and one from each stained area |
| | I | S/4+ | - | 0-0.3 | 1a, 1b, lead | One from center of each side of Bldg. 1052 and one from each stained area |
| | II | S, SE/TBD | - | - | TBD | From each located drainline |
| 184 | I | S/TBD | - | 0.15-0.3 | 1a-1c, 1e, 2 | One from each stained area |
| Area J | | | | | | |
| 1 | I | S/6 | - | 0-0.3 | 1a, 1b, 2, chromium, lead, phthalates | Around structures, stained areas, etc. |
| | I | S/2 | 100 | 0-0.15 | 1a, 1b, 2, chromium, lead, phthalates | From each channel carrying runoff |
| | II | TBD | - | - | TBD | Based on Phase I results |
| 2 | I | S/12 | - | 0-0.3 | 1b, 1c, 2, 4, 5a, CN, fluoride | Around structures, pads, tanks, spill areas, building sump, etc. |
| | I | SE/7 | - | - | 1b, 1c, 2, 3, 4, 5a, CN, fluoride | From three locations in reservoir, two in pond, and one in each of two streams |
| | II | TBD | - | - | TBD | Based on Phase I results |
| 4 | I | S/2 | 15 (grid) | 0-0.3 | 1e | Near PCB transformers in Bldg. 3602 |
| | I | S/4 | - | 0-0.3 | 1b, 1c, 2, 5a, 8, fluoride, aniline | Behind each of Bldgs. 3603, 3604, 3606, and 3607 |
| | I | SE/2 | - | 0.6 or basin bottom | 1a-1e, 2, 3, 5, 8, fluoride | Two locations in catch basin near Bldgs. 3601 and 3607 |
| | I | SE/2 | - | 0.15 | 1a, 1b, 1c, 2, 3, 5, 8, fluoride | Two locations in pond north of Bldg. 3618 |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area J (Cont'd) | | | | | | |
| 175 | I | S/TBD | - | - | 1a, 1b | Around drums if leakage is apparent and from each stained area |
| | I | S/TBD | - | 0-0.3 | 1a, 1b | From each stained area |
| | I | SE/2 | - | 0-0.3 | 1a, 1b | From swamp |
| | II | S, SE/TBD | - | - | TBD | Based on Phase I results |
| Area K | | | | | | |
| 3 | I | S/6 | - | 0-0.3 | 1b, 1c, 1e, 2, 3, 4, 5a, CN, fluoride | From stained area and behind test stands |
| | I | S/1 | - | 0-0.3 | 1a-1c, 2, 5a, fluoride | From waste storage pallet area |
| | I | S/2 | - | 0-0.3 | 1a-1c | NNE end of Bldg. 1518 |
| | I | SE/7 | - | 0-0.15 | 1a-1c, 1e, 2, 3, 4, 5a, CN, fluoride | Four from reservoir, two from ditch, and one each near locations SD3-2 and SD3-3 |
| | II | TBD | - | - | TBD | Based on Phase I results |
| 48 | I | S/TBD | - | 0-0.3 | 1a, 1b, lead, chromium | From under drain pipes, stained soil, and around pallets |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 172 | I | S/TBD | - | 0-0.3 | 1e | Four from each oil-stained area adjacent to parking area |
| 173 | I | S/TBD | - | 0-0.3 | 1a-1c, 2 | One from each stained area |
| 174 | I | SE/6 | - | - | 1a-1c, 1e, CN | Two from each holding bed |
| | II | SE/TBD | - | - | 6 | Based on Phase I results |
| Area L | | | | | | |
| 17 | II | S/2 | - | - | 1a-1c, 2, 5, $NH_3$, $SO_4$ | Downgradient of tetryl pits |
| 18 | II | S/TBD | - | - | TBD | Based on Phase I results |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area L (Cont'd) | | | | | | |
| 35 | I | S/TBD | - | 0.15-0.3 | 1c, 2, 5a, $SO_4$ | One from each stained area |
| | I | SE/2 | - | - | 1c, 2, 5a, $SO_4$ | From catch basin and stagnant pool quarterly for one year |
| | II | S, SE/TBD | - | - | TBD | Based on Phase I results |
| 36 | I | S/4+ | - | 0-0.15 | 1a-1c, 2, 5a, 8, CN | From loading platform, parking area, surface drainage, and stained areas |
| 41 | I | S/4+ | - | 0-0.15 | 1, 4, 6 | From parking area, loading area, outfalls, and stained areas |
| 42 | I | S/2 | - | 0-0.15 | 1a-1c, 1e, 2, 6, 8, uranium | From south side of parking area, near building foundation, adjacent surface drainage, and stained areas |
| | I | S/4 | - | - | 1a-1c, 1e, 2, 6, 8, uranium | Below paved area |
| | I | S/TBD | - | - | 1a-1c, 1e, 2, 6, 8, uranium | From discolored areas, ditches, or outfalls |
| 43 | I | S/3 | 15 | 0-0.15 | 1c, 1d, 4, Mirex, CN | Along drainage ditch beginning at pad |
| | II | S/TBD | - | - | | Based on Phase I results |
| 77 | I | S/TBD | - | 0-0.3 | 1a-1c | One from each stained area |
| 91 | I | S/5 | - | 0-0.3 | 2, lead | Three from washout area and two from area adjacent to waste storage walkway |
| 103 | II | SE/TBD | - | 0.3 | 2, lead | Based on results of UXO survey |
| 114 | I | S/TBD | - | 0-1.5 | 2 | One from each stained area |
| | I | SE/4 | 30 | - | 2 | From Robinson Run |
| | II | S, SE/TBD | - | - | TBD | Based on Phase I results |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area I (Cont'd) | | | | | | |
| 160 | I | S/TBD | - | 0-0.15 | 2, 8, tetrahydrofuran | One from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 161 | I | S/4+ | - | 0.15-0.3 | 1a-1c, 2 | One from each side of Bldg. 1031 and one from each stained area |
| | I | SE/2 | - | - | 1a-1c, 2 | From swamp behind building |
| | II | S, SE/TBD | - | - | TBD | Based on Phase I results |
| 162 | I | S/4+ | - | 0-0.15 | 1a, 1c, 2 | One from each side of Bldg. 1071 and one from each stained area |
| 166 | I | S/TBD | - | 0-0.15 | 2 | One from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 167 | I | S/TBD | - | 0-0.15 | 2 | One from each stained area |
| | I | SE/TBD | - | - | 2 | One from each sump in Bldg. 1373 |
| | II | S, SE/TBD | - | - | TBD | Based on Phase I results |
| 168 | I | S/TBD | - | 0-0.15 | 1a-1c, 2, 8 | One from each stained area and one from each outfall area |
| | I | SE/TBD | - | - | 1a-1c, 2, 8 | One from each sump in Bldgs. 1400 and 1403 and one from each drainpipe outlet |
| | II | S, SE/TBD | - | - | TBD | Based on Phase I results |
| 169 | I | S/TBD | - | 0-0.15 | 1a-1c, 2, 8 | One from each stained area |
| | I | SE/2+ | - | 0-0.3 | 1a-1c, 2, 8 | Two from swamp behind Bldgs. 1408A and 1408B, one from each sump or catch basin, and one from each drainpipe outlet |
| | II | S, SE/TBD | - | - | TBD | Based on Phase I results |
| 170 | I | S/8+ | - | 0-0.3 | 2 | Two near each of four sump tanks and one from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area I (Cont'd) | | | | | | |
| 171 | I | S/TBD | - | 0-0.3 | 1a, 1b, lead | One from each stained area |
| 176 | II | S/TBD | - | - | TBD | Based on Phase I results |
| Area M | | | | | | |
| 15 | I | S/5 | - | 0-0.15 | 1a, 2, 8, uranium | 2.4- by 2.4-m area under test stand |
| | I | S/TBD | - | 0-0.15 | 1a, 2, 8, uranium | Drum bases, etc. in detonation area |
| | I | S/TBD | - | 0-0.15 | 1a, 2, 8, uranium | Around each sandpile in firing area |
| 115 | I | S/TBD | - | 0-1.5 | 2 | One from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 152 | I | S/4+ | - | 0.15-0.3 | 1c, 2 | One from each side of storage area and catch basin and one from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 153 | I | S/TBD | - | 0-0.15 | 1a-1c | One from each stained area |
| | II | S/TBD | - | - | | Based on Phase I results |
| 154 | I | S/4+ | - | 0.15-0.3 | 1a-1c, 2 | One from each side of Bldg. 617 and one from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 155 | I | S/TBD | - | 0-0.15 | 1a-1c, 2, 8 | One from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| Area N | | | | | | |
| 7 | I | S/4+ | 15 (grid) | - | 1c, 2, 3, 5, 8 | From firing area and stained areas |
| | I | SE/3 | - | - | 1c, 2, 3, 5, 8 | Along Green Pond Brook |
| | II | S/TBD | - | - | TBD | Based on Phase I results |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area N (Cont'd) | | | | | | |
| 8 | I | S/10 | ≥23 (grid) | 0.15-0.3 | 1a-1c, 2, 3, 5, 8 | Ten from southeast part of Site and one from each stained area |
| | I | S/12 | - | - | 1a-1c, 2, 3, 5, 8 | From sandpiles near SE corner of Site |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 9 | I | S/5+ | - | 0.15-0.3 | 1c, 2, 3, 5, 8, $SO_4$ | Two from south of Bldg. 673; one near each of SS9-4, SS9-5, SS9-1, and SS9-3, and one from each stained area |
| | I | SE/3 | - | - | 1c, 2, 3, 5, 8, $SO_4$ | From unnamed stream crossing Site |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 11 | I | S/9+ | - | 0.15-0.3 | 1c, 2, 3, 5, 8 | Four between Bldg. 647 and SS11-3 and SS11-4, one north of impact area, near Bldgs. 649 and 650 and burn cage, and one from each stained area |
| | II | S/TBD | - | - | TBD | Based on Phase I results |
| 13 | I | S/4+ | - | 0.15-0.3 | 1b, 1c, 2, 5, 8 | Two from northeast side, one from northwest side, one between Bldg. 640 and swamp, and one from each stained area |
| | I | SE/2 | - | - | 1b, 1c, 2, 5, 8 | From swamp |
| | II | S, SE/TBD | - | - | TBD | Based on Phase I results |
| 14 | I | S/5 | - | 0.15-0.3 | 1c, 2, 3, 5, 8, $SO_4$ | From area between firing area and bunker |
| | I | S/9 | - | - | 1c, 2, 3, 5, 8, $SO_4$ | Three from each sand pile in wetlands; from disturbed areas |
| | I | SE/2 | - | - | 1c, 2, 3, 5, 8, $SO_4$ | From pond |
| Area O | | | | | | |
| 54 | I | SE/10 | - | - | 1a-1e, 2, 3, 4, 5, uranium | Choose locations to avoid disturbing UXO |
| | II | SE/TBD | - | - | TBD | Based on Phase I results |
| 164 | I | S/TBD | - | 0-0.3 | 2, 5, 8 | One from each stained area |

TABLE 5.2 (Cont'd)

| Area and Site | Phase | Type[b]/No. of Samples[c] | Sampling Interval (m) Distance | Sampling Interval (m) Depth | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|---|
| Area P | | | | | | |
| 78 | I | S/3+ | - | 0.15-0.3 | 1a-1c, 5a, $SO_4$ | Three from each loading and handling area and one from each stained area |
| 94 | I | S/TBD | - | 0-0.3 | 1a-1c, 2, 3 | Near exits, perimeters, and from stained areas around four buildings |
| | I | S/1 | - | 0-0.3 | 1a-1c, 2, 3 | From bottom of dry well outside Bldn. 1601, if well is uncovered |
| | I | St/2 | | 0.3 | 1a-1c, 2, 3 | From lagoon north of Bldg. 1604 |
| | II | St/TBD | | 0.3 | 1a-1c, 2, 3 | Based on Phase I results |
| 119 | I | S/3+ | - | 0-0.3 | 8 | Three from entrance of each building and one from each stained area |
| | II | S/TBD | - | 0-0.3 | 8 | Based on Phase I results |
| 120 | I | S/TBD | - | 0-0.3 | 8 | From reported spill areas and one from each stained area |
| | I | SE/1 | - | 0-0.3 | 8 | From unnamed ditch southeast of Bldg. 50 |
| 121 | I | S/1+ | - | 0-0.3 | 1a, 1c | One from building entrance and one from each stained area |
| | I | SE/1 | - | 0-0.3 | 1a, 1c | From unnamed ditch southeast of Bldg. 57 |
| | I | S/1 | - | 0-0.3 | 1e | Composite from near PCB transformer |

[a]Only Sites for which the sampling plan specifies soil and sediment sampling are included.

[b]S = surface soil, SE = sediment, St = sludge, and TBD = to be determined.

[c]See Volume 2 for figures showing sampling locations.

[d]The categories are as follows: 1 = all TCL+30 parameters, which is broken down as 1a = TCL volatiles, 1b = TCL semivolatiles, 1c = TCL metals, 1d = TCL pesticides, 1e = PCBs, and 1f = dioxin; 2 = explosives, 3 = gross alpha and beta, 4 = herbicides; 5 = nitrate and nitrite; 5a = nitrate; 6 = TCLP leachability; 6a = TCLP metals, and 8 = propellants. Other abbreviations are BTX = benzene, toluene, and xylene; $CCl_4$ = carbon tetrachloride, CN = cyanide, NC = nitrocellulose; $NH_3$ = ammonia, O&G = oil and grease; TBD = to be determined, TPH = total petroleum hydrocarbons, and $SO_4$ = sulfate.

TABLE 5.3 Summary of Soil Boring Sampling Needs for All Sites at Picatinny Arsenal[a]

| Area and Site | Phase | No. of Borings | Boring Depth[b] (m) | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area C | | | | | |
| 163 | I | TBD | B/G | 1, 2, 8 | One at center of each EM anomaly |
| Area D | | | | | |
| 182 | II | TBD | B/G | 1c, CN | Based on Phase I results |
| 183 | II | TBD | - | TBD | Based on Phase I results |
| Area E | | | | | |
| 44 | II | TBD | - | 1d, 4 | Based on USAEHA results |
| Area F | | | | | |
| 60 | II | TBD | - | 1a, 1c, CN | Based on Phase I results |
| 61 | II | TBD | - | 1c, 2, 8, CN | Based on Phase I results |
| 104 | I | 1 | - | 1c, 2, 8, $CCl_4$ | Drill near lime pit, if located |
| | II | TBD | - | TBD | Based on Phase I results |
| | III | TBD | - | TBD | Based on Phase I results |
| 106 | II | TBD | - | 1e, 5a, 8 | Based on Phase I results |
| 111 | II | TBD | B/G | 8 | Based on Phase I results |
| 124 | II | TBD | - | TBD | Based on Phase I results |
| 125 | II | TBD | - | TBD | Based on Phase I results |
| 139 | I | TBD | Bottom of pit + 2 | 8 | At each located covered pit |
| | II | TBD | B/G | 8 | Based on Phase I results |

TABLE 5.3 (Cont'd)

| Area and Site | Phase | No. of Borings | Boring Depth[b] (m) | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area G | | | | | |
| 31 | I | 8 | G | 1 | One soil boring each at locations SS31-1 to SS31-6, SS31-8, and SS31-10 |
| 52/95 | I | TBD | 3 or G | 1, 2, 6 | From swampy area and former pond bed; based on results of surface soil sampling |
| Area H | | | | | |
| 62 | II | TBD | 3 or G | TBD | Based on Phase I results |
| 151 | II | TBD | - | TBD | Based on Phase I results |
| Area I | | | | | |
| 50 | I | 3 | B/G | 1a | Two downgradient and one upgradient |
| | I | 2 | G | 1a | Collect during well installation |
| 63/65 | I | TBD | 0.9-1.5 | 1a-1c, 1e, O&G | One at center of each stained area |
| | I | 1 | B/G | 1a-1c, 1e, O&G | Between concrete pad and Picatinny Lake |
| | II | TBD | - | TBD | Based on Phase I results |
| 70 | II | TBD | B/G | 1a-1c, 2 | Based on Phase I results |
| 71 | II | 2 | B/G | 1c, 2, 8 | Between Bldg. 910 and Picatinny Lake; based on Phase I results |
| 79 | II | TBD | B/G | 1a, 1b | Based on Phase I results |
| 83 | I | 1 | B/G | 1c, 2, 5, 8, $SO_4$ | If pit is covered |
| | II | TBD | B/G | 1a-1c, 2 | Based on Phase I results |
| 93 | I | TBD | B/G | 2, 8 | At center of each located pit |
| | II | 2 | B/G | 2 | One between each building (800 and 807) and Picatinny Lake |

TABLE 5.3 (Cont'd)

| Area and Site | Phase | No. of Borings | Boring Depth[b] (m) | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area I (Cont'd) | | | | | |
| 102 | I | 1 | B/G | 1a-1c | At rack area |
| | II | TBD | B/G | 1a-1c | Based on Phase I results |
| 108 | II | 3 | B/G | 1a-1c, 2 | Two between Picatinny Lake and Bldg. 717 and one between Bldg. 722 and Green Pond Brook if surface soils are contaminated |
| 109 | II | TBD | - | TBD | Based on Phase I results |
| | III | TBD | - | TBD | Based on Phase II results |
| 113 | I | 2 | B/G | 1a-1c, 2 | One each from east and west sides of Bldg. 561 |
| | II | TBD | - | TBD | Based on Phase I results |
| 147 | I | TBD | B/G | 1a-1c, 2, 8 | One at center of each disposal pit, if found; one within 9 m of Bldg. 520 (north side) |
| | II | TBD | - | TBD | Based on Phase I results |
| 149 | I | 1 | B/G | 1a, 1b, 2 | Downslope from Bldg. 541 |
| | II | TBD | - | TBD | Based on Phase I results |
| 150 | I | 1 | B/G | 2, 8 | At center of west side of Bldg. 555 |
| | II | TBD | - | TBD | Based on Phase I results |
| 156 | I | 2 | B/G | 1c, 2, 8 | Near each building and between Bldgs. 816 and 813 and Picatinny Lake |
| | II | TBD | - | 1c, 2, 8 | Based on Phase I results |
| 157 | I | 2 | B/G | 1c, 2, 8 | Near Bldgs. 820 and 823 |
| 159 | I | 2 | B/G | Lead | In area of disturbed soil or buried metal, if found |
| 178 | II | TBD | B/G | 1a-1c, 2 | Based on Phase I results |

TABLE 5.3 (Cont'd)

| Area and Site | Phase | No. of Borings | Boring Depth[b] (m) | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area J | | | | | |
| 1 | II | 5 | B/G | 1a, 1b, 2, chromium lead, phthalates | In the dump area, if located |
| | | | | 1c | Analyze three above samples with highest contaminant values |
| 2 | I | 2 | B/G | 1a, 1b | Spill areas near Bldgs. 3513 and 3541 |
| | I | 1 | B/G | 1a-1c, 5a, fluoride | Sump area near Bldg. 3521 |
| | II | TBD | - | TBD | Based on Phase I results |
| 4 | I | 2 | B/G | 1-1c, 2, 3, 5, 8, fluoride | One near north end of Bldg. 3618 and one near well M |
| | II | TBD | - | TBD | Based on Phase I results |
| Area K | | | | | |
| 173 | II | TBD | B/G | 1a-1c, 2 | In center of each contaminated area, if any |
| Area L | | | | | |
| 17 | II | 4 | B/G | 1a-1c, 2, 5, $NH_3$, $SO_4$ | In center of pits |
| | II | TBD | - | TBD | Based on Phase I results |
| 18 | I | TBD | B/G | 1a-1c, 2, 5, $NH_3$, $SO_4$ | Begin sampling at apparent pit bottom |
| | II | TBD | - | TBD | Based on Phase I results |
| | II | TBD | - | TBD | Based on Phase I results |
| 36 | II | TBD | - | TBD | Based on Phase I results |
| 41 | II | TBD | - | TBD | Based on Phase I results |
| 42 | II | TBD | - | TBD | Based on Phase I results |

TABLE 5.3 (Cont'd)

| Area and Site | Phase | No. of Borings | Boring Depth[b] (m) | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area L (Cont'd) | | | | | |
| 77 | II | TBD | B/G | Ia-Ic | Based on Phase I results |
| 91 | II | TBD | B/G | 2, 8, lead | Based on Phase I results |
| 160 | II | TBD | - | TBD | Based on Phase I results |
| 161 | I | 1 | B/G | Ia-Ic, 2 | About 50 ft downslope from building |
| | II | TBD | - | TBD | Based on Phase I results |
| 162 | I | TBD | line + 0.9-1.5 | 2 | Two borings near leach field lines, if located |
| | II | TBD | - | TBD | Based on Phase I results |
| 169 | II | TBD | - | TBD | Based on Phase I results |
| 171 | II | TBD | B/G | Ia-Ic | In center of each contaminated area, if any |
| 176 | I | TBD | B/G | 1, 2, 4, 8, CN | One at center of each EM anomaly |
| 177 | I | 12 | pipe bottom + 0.6 | Ia-Ic, 2, 8 | Eight near pipes in Subbasins 6 and 7; four outside the subbasins and downstream from Bldgs. 95 and 24 |
| | II | TBD | pipe bottom + 0.6 | Ia-Ic, 2, 8 | Based on Phase I results |
| | III | TBD | pipe bottom + 0.6 | Ia-Ic, 2, 8 | Based on Phase I and II results |
| Area M | | | | | |
| 15 | II | TBD | - | TBD | Based on Phase I results |
| 152 | I | 2 | Tank or basin bottom + 1-1.5 | Ic, 2 | One between tanks after their removal and one beside catch basin |
| | II | TBD | - | TBD | Based on Phase I results |

TABLE 5.3 (Cont'd)

| Area and Site | Phase | No. of Borings | Boring Depth[b] (m) | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area M (Cont'd) | | | | | |
| 155 | II | TBD | - | TBD | Based on Phase I results |
| Area N | | | | | |
| 8 | I | 4 | B/G | 1a-1c, 2, 3, 5, 8 | In southeast part of Site |
| | II | TBD | - | TBD | Based on Phase I results |
| 9 | I | 5 | B/G | 1c, 2, 3, 5, 8, $SO_4$ | At contaminated surface soil sampling locations |
| | I | 3 | B/G | 1c, 2, 3, 5, 8, $SO_4$ | Near and just off edge of Site |
| | II | TBD | - | TBD | Based on Phase I results |
| 10 | I | 3 | pit bottom + 0.3 | 1a-1e, 2, 3, 4, 5, 8, CN, fluoride, fluoroacetate | One in pit, one 2.4 m northwest of pit, and one 2.4 m southeast of pit |
| | II | TBD | - | TBD | Based on Phase I results |
| 11 | I | 2 | B/G | 1c, 2, 3, 5, 8 | One each beside sampling locations SS11-1 and SS11-2 and one near SS11-7 |
| | II | TBD | - | TBD | Based on Phase I results |
| 12 | I | 3 | B/G | 1c, 2, 3, 5, 8 | One near sediment sampling location SD12-1, one near Bldg. 656, and one just east of SS12-1 |
| | I | 3 | pit bottom + 0.3 | 1c, 2, 3, 5, 8 | In pit, if it can be located |
| | II | TBD | - | TBD | Based on Phase I results |
| 13 | I | 1 | G | 1b, 1c, 2, 3, 5, 8 | During installation of monitoring well |
| 14 | I | 4 | B/G | 1c, 2, 3, 5, 8, $SO_4$ | At contaminated surface soil sampling locations |
| | II | TBD | - | TBD | Based on Phase I results |

TABLE 5.3 (Cont'd)

| Area and Site | Phase | No. of Borings | Boring Depth[b] (m) | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area O | | | | | |
| 164 | II | TBD | B/G | 2, 5, 8 | In center of each contaminated area, if any |
| Area P | | | | | |
| 94 | I | 1 | B/G | 1a-1c, 2, 3 | In dry well, if it is filled up |
| | II | TBD | B/G | 1a-1c, 2, 3 | Based on Phase I results |
| 119 | II | TBD | - | 8 | Based on Phase I results |
| 120 | II | TBD | - | 8 | Based on Phase I results |
| 121 | II | TBD | - | TBD | Based on Phase I results |

[a]Table lists only those Sites for which soil borings are specified in the sampling plan; see Volume 2 for figures showing sampling locations.

[b]B/G = to bedrock or groundwater, whichever comes first, G = to groundwater.

[c]The categories are as follows: 1 = all TCL+30 parameters, which is broken down as 1a = TCL volatiles, 1b = TCL semi-volatiles, 1c = TCL metals, 1d = TCL pesticides, 1e = PCBs, and 1f = dioxin; 2 = explosives; 3 = gross alpha and gross beta; 4 = herbicides; 5 = nitrate and nitrite; 5a = nitrate; 6 = TCLP leachability tests; 6a = TCLP metals; and 8 = propellants. Other abbreviations are CN = cyanide, $CCl_4$ = carbon tetrachloride, O&G = oil and grease, $NH_3$ = ammonia, $SO_4$ = sulfate, TBD = to be determined, and TPH = total petroleum hydrocarbons.

TABLE 5.4 Summary of Surface Water Sampling Needs for All Sites at Picatinny Arsenal[a]

| Area and Site | Phase | No. of Samples | Frequency[b] | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area B | | | | | |
| 24 | I | 4 | S | 1, 2, 3, uranium | Two from southern drainage ditch upgradient from Site and two from northern drainage ditch between pond and brook |
| Area C | | | | | |
| 25 | I | 2 | 4Q | 1, 2, 3, 5, 7 | From locations SW25-1 and SW25-2 on Green Pond Brook |
| | II | TBD | - | TBD | Based on Phase I results |
| 180 | I | 3 | S | 1a-1e | From swampy area |
| Area D | | | | | |
| 69 | I | 3-5 | S | 1, 5a, CN, $SO_4$ | Two from former outfall location in Bear Swamp Brook and one to three from each drainage ditch or gully on Site |
| 117 | I | 3 | S | 1a, 1b, 1c, uranium | From Bear Swamp Brook |
| 118 | I | 2 | S | 1a, 1b, 1c, 1e, CN | From oil-water separator pond |
| 122 | I | 3 | S | 1a, 1b, 2 | From Bear Swamp Brook |
| 123 | I | 3 | S | 1c, 5a, CN, $SO_4$, uranium | From Bear Swamp Brook |
| Area F | | | | | |
| 60 | II | TBD | - | TBD | Based on Phase I results |
| 61 | I | 4 | S | 1c, 2, 8 | From area between Bldgs. 176 and S406 |
| | I | 2 | S | 1c, 8 | From creek south of Bldg. 171 |

TABLE 5.4 (Cont'd)

| Area and Site | Phase | No. of Samples | Fre-quency[b] | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area F (Cont'd) | | | | | |
| 104 | I | 4 | S | 1c, 2, 8, $CCl_4$ | One from creek downgradient from Bldgs. 161 and 162 and three from swamp |
| | III | TBD | - | TBD | Based on Phase II results |
| 138 | I | 2 | S | 1a, 1c, 2, 8 | From swamp near Bldg. 408 |
| | II | TBD | - | 1a, 1c, 2, 8 | Based on Phase I results |
| Area H | | | | | |
| 62 | I | 2 | S | 1a, 1b, 1e, 2, 5, $SO_4$ | Two from former outfall location in Bear Swamp Brook |
| 64 | I | 2 | S | 1a, 1b, 1e, 2, 5, $SO_4$ | Two from former outfall location in Bear Swamp Brook |
| 100 | I | 2 | S | 1a, 1b, 1e, 2, 5 | From Bear Swamp Brook in areas convenient for waste disposal |
| Area I | | | | | |
| 53 | I | 10 | S | 1a-1e, 2, 3, 4, 5, 7, CN, Mirex, fluoride | From Picatinny Lake; sample entire water column |
| | II | TBD | 4Q | 1a, 1c, 2, 5, fluoride, other[d] | Near drinking water intakes and unremoved dangerous items |
| 108 | III | TBD | S | 1a-1c, 2 | One to three from Green Pond Brook; based on Phase II results |
| 159 | II | 2 | - | Lead | From Green Pond Brook near contaminated boring locations |
| Area J | | | | | |
| 1 | I | TBD | - | 1a, 1b, 2, lead, chromium, phthalates | From two locations 100 m apart in each channel or containing water |
| 2 | I | 2 | 4Q | 1b, 1c, 2, 3, 4, 5a, CN, fluoride | From two locations in pond; sample entire water column |

TABLE 5.4 (Cont'd)

| Area and Site | Phase | No. of Samples | Frequency[b] | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area J (Cont'd) | | | | | |
| 4 | I | TBD | S&S | 1a-1e, 2, 3, 5, 8, fluoride | From catch basin, if water is present |
| 175 | I | 2 | S | 1a, 1b | From swamp receiving effluent from building |
| | II | TBD | - | TBD | Based on Phase I results |
| Area K | | | | | |
| 3 | I | 7 | 4Q | 1c, 1d, 1e, 2, 3, 5a, 7, CN, fluoride, TPH | Three from reservoir, two from eastern drainage ditch, and one each from locations SW/SD3-2 and SW/SD3-3 |
| | I | 1 | - | $SO_4$ | From location SW/SD3-4 |
| Area I | | | | | |
| 18 | III | TBD | - | TBD | Based on Phase I and II results |
| 35 | I | 2 | S | 1c, 2, 5a, $SO_4$ | One from catch basin outside Bldg. 1361A and one from stagnant water pool near Bldg. 1364 |
| | II | TBD | - | TBD | Based on Phase I results |
| 43 | I | 2 | S&S | 1c, 1d, 4, CN, Mirex, fluoride | From ditch when runoff is present; one near pad and one 100 m downstream |
| | II | TBD | - | TBD | Based on Phase I results |
| 103 | II | TBD | S | 2, lead | Near any located UXO, four samples per item |
| 161 | I | 2 | S | 1a-1c, 2 | From swamp behind Bldg. 1031 |
| | II | TBD | - | TBD | Based on Phase I results |
| 168 | I | 3 | - | 1a-1c, 2, 8 | One from each building sump |
| 169 | I | 8 | S | 1a-1c, 2, 8 | One from each building sump, catch basin, or holding tank |

TABLE 5.4 (Cont'd)

| Area and Site | Phase | No. of Samples | Frequency[b] | Analytic Categories[c] | Comments |
|---|---|---|---|---|---|
| Area N | | | | | |
| 7 | I | 3 | 4Q | 1c, 2, 3, 5, 7, 8 | From Green Pond Brook |
| 9 | I | 3 | 4Q | 1c, 2, 3, ·, 8, $SO_4$ | From unnamed stream that crosses Site |
| | II | TBD | - | TBD | Based on Phase I results |
| 13 | I | 2 | 4Q | 2 | From swamp |
| | II | TBD | - | TBD | Based on Ph e I results |
| 14 | I | 2 | 4Q | 1c, 2, 3, 5, 8, $SO_4$ | From pond |
| | II | TBD | - | TBD | Based on Phase I results |
| Area O | | | | | |
| 54 | I | 10 | 4Q | 1a-1e, 2, 3, 4, 5, 7 | From Lake Denmark |
| | II | TBD | - | TBD | Based on Phase I results |
| Area P | | | | | |
| 27 | I | 1 | 4Q | 7, cyanide | Location 6 m downstream from Site |
| 94 | II | TBD | 5 | 1a-1c, 2, 3 | One to three from lagoon if Phase I sediment samples are contaminated |
| 119 | II | TBD | - | 8 | Based on Phase I results |

**TABLE 5.4 (Cont'd)**

| Area and Site | Phase | No. of Samples | Fre-quency[b] | Analytic categories[c] | Comments |
|---|---|---|---|---|---|
| Area P (Cont'd) | | | | | |
| 120 | I | 1 | S | 8 | From unnamed ditch southeast of Bldg. 50 |
| | II | TBD | - | TBD | Based on Phase I results |
| 121 | I | 1 | S | 1a, 1c | From unnamed ditch southeast of Bldg. 57 |
| | II | TBD | - | TBD | Based on Phase I results |

[a]Table lists only those Sites for which surface water sampling is specified in the sampling plan; see Volume 2 for figures showing sampling locations.

[b]S = single sample, 4Q = sample quarterly for one year and review results, SSS = sample during spring and summer when water is present.

[c]The categories are as follows: 1 = all TCL+30 parameters, which is broken down as 1a = TCL volatiles, 1b = TCL semivolatiles, 1c = TCL metals, 1d = TCL pesticides, 1e = PCBs, and 1f = dioxin; 2 = explosives; 3 = gross alpha and beta; 4 = herbicides; 5 = nitrate and nitrite; 5a = nitrate; 6 = TCLP leachability, 6a = TCLP metals; 7 = macroparameters; and 8 = propellants. Other abbreviations are $CCl_4$ = carbon tetrachloride, CN = cyanide, $SO_4$ = sulfate, TBD = to be determined, TPH = total petroleum hydrocarbons.

[d]Denotes any other analytes detected in single water sample.

TABLE 5.5 Summary of Groundwater Monitoring Needs for All Sites at Picatinny Arsenal[a]

| Area and Site | Phase | No. of Wells/ Type[b] | Frequency[c] | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|
| Area B | | | | | |
| 24 | | 3/S, N | SA/Q | 1, 2, uranium | Quarterly monitor for significant contaminants found in initial sampling; measure static water levels during sample collection |
| | II | TBD/N | - | TBD | Based on Phase I results |
| Area C | | | | | |
| 19 | I | 3/S, E | 2Q | 1a, 6a | Wells DM19-1, DM19-2, and DM19-3 |
| 23 | I | 2/S, N | 2Q | 1, 3, 2, 5, 7, 8 | Locate west and south of landfill, conduct aquifer tests |
| | | 2/S, E | 2Q | 1, 2, 3, 5, 7, 8 | and measure static water levels for 1 yr |
| | II | TBD/N | - | TBD | Based on Phase I results |
| 25 | I | 5/S, N | 2Q | 1a-1c, 2, 3, 5, 7 | Three between landfill and PTA boundary and two northeast of landfill |
| | | 3/C[e], E | 2Q | 1a-1c, 2, 3, 5, 7 | At PTA southwest boundary |
| | | 10/S, E | 2Q | 1a-1c, 2, 3, 5, 7 | Conduct aquifer tests on wells DM25-5, DM25-3, and LF-[illegible], measure static water levels for 1 yr |
| | II | TBD/N | - | TBD | Based on Phase I results |
| 163 | II | TBD/N | | TBD | Based on Phase I results |
| 180 | II | TBD/N | 2Q | TBD | Coordinate with new wells for Site 34 and existing wells at Site 19 |
| Area D | | | | | |
| 21/37 | I | 33/S, E | 2Q | 1a, 1c, Rn-220, Rn-222 | Monitor all wells installed by USGS |
| 118 | II | 14/S, N | 2Q | TBD | Shallow wells between pond and brook; based on Phase I results |

TABLE 5.5 (Cont'd)

| Area and Site | Phase | No. of Wells/ Type[b] | Fre- quency[c] | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|
| Area E | | | | | |
| 28 | II | 1/C, N | 2Q | See closure plan[f] | Between sewage treatment plant and Green Pond Brook |
| 38 | II | TBD/N | - | TBD | Based on Phase I results |
| Area F | | | | | |
| 60 | II | TBD/N | - | TBD | Based on Phase I results |
| 61 | II | TBD/N | - | TBD | Based on Phase I results |
| 104 | II | TBD/N | 2Q | TBD | Based on Phase I results |
| | III | TBD/N | - | TBD | Based on Phase I results |
| 138 | I | 6/S, N | S | 1a, 1c, 2, 8 | Drive points downgradient from Bldgs. 404, 407, and 408 |
| | II | 2/S, N | 2Q | 1a, 1c, 2, 8 | Shallow wells downgradient from Site |
| 139 | II | TBD/N | - | 8 | Based on Phase I results |
| 140 | II | TBD/N | - | TBD | Based on Phase I results |
| 144 | II | 2/S, N | 2Q | 2, 8 | Two wells downgradient from Bldgs. 462 and 463; based on Phase I results |
| 145 | II | 2/S, N | 2Q | 1c, 2, 8 | Two wells between Bldg. 447 and brook; based on Phase I results |
| Area I | | | | | |
| 30 | II | 2/S, N | - | TBD | One upgradient and one downgradient; based on Phase I results |
| 109 | I | 3/S, N | S | 1c, 2, 5a, 8 | Drive points downgradient from Bldg. 445 |
| | II | 2/S, N | 2Q | 1c, 2, 8 | Downgradient from Site |
| | III | TBD/N | - | TBD | Based on Phase I results |

TABLE 5.5 (Cont'd)

| Area and Site | Phase | No. of Wells/ Type[b] | Fre- quency[c] | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|
| Area J | | | | | |
| 1 | II | 2/S, N | 2Q | 1a-1c, 5, 7, CN | Downgradient from dump area along 250-m elevation contour |
| | II | 1/S, E | 2Q | 1a-1c, 5, 7, CN | Cove well |
| 2 | I | 1/S, N | 2Q | 1a-1e, 2, 3, 5, 7, CN, fluoride | Near Bldg. 3521 |
| | I | 3/S, E | 2Q | 1a-1e, 2, 3, 5, 7, CN, fluoride | Wells L, M, and N |
| | II | TBD[f] | - | TBD | Based on Phase I results |
| 4 | I | 2/S, N | 2Q | 1a-1e, 2, 3, 5, 7, CN, fluoride | One near Bldg. 3618 and one between Bldgs. 3611 and 3612 |
| Area K | | | | | |
| 3 | I | 2/S, N | 2Q | 1a-1e 2, 3, 7, CN, fluoride | None |
| | I | 1/S, E | 2Q | 1a-1e, 2, 3, 7, CN, fluoride | Well O |
| | II | TBD/N | - | TBD | Based on Phase I results |
| 172 | III | TBD/N | 2Q | 1e | Based on Phase II results |
| 174 | I | 3/S, N | S | 1a-1c, 1e, 2, 3, CN | Drive points downslope from sludge beds |
| | II | TBD/N | - | TBD | Based on Phase I results |
| Area L | | | | | |
| 5 | I | 2/S, N | 2Q | 1a-1c, 2, 5a, 7, 8, fluoride | One near Bldg. 3150 and one near northeast end of Site |
| | I | 3/S, E | 2Q | 1a-1c, 2, 5a, 7, 8, fluoride | Wells MW-3, DM5-1, and DM5-2 |

TABLE 5.5 (Cont'd)

| Area and Site | Phase | No. of Wells/ Type[b] | Fre- quency[c] | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|
| Area I (Cont'd) | | | | | |
| 6 | I | 3/S, E | 2Q | 1a, 1c, 2, 8 | Conduct aquifer tests on MW-5, DM6-1, and DM6-3; measure static water levels for 1 yr |
| | II | 1/S, N | - | TBD | Needed only if groundwater flow is not in northerly direction |
| 17 | I | 2/S, E | 2Q | 1a-1c, 2, 5, 7, $NH_3$, $SO_4$ | Conduct aquifer tests on wells DM17-1 and DM17-3 |
| | II | TBD/N | - | TBD | Based on water quality, hydrology studies |
| 18 | III | TBD/N | - | TBD | Based on Phase I and II results |
| 35 | II | TBD/N | - | TBD | Based on Phase I results |
| 36 | II | TBD/N | - | TBD | Based on Phase I results |
| 41 | II | TBD/N | - | TBD | Based on Phase I results |
| 42 | II | TBD/N | - | TBD | Based on Phase I results |
| 167 | I | 1+[e] | S | 2 | One sample from each sump in Bldg. 1373 |
| 168 | I | 1+[e] | S | 1a, 1c, 2 | One sample from each sump in Bldgs. 1400 and 1403 |
| 169 | I | 1+[e] | S | 1a, 1c, 2 | One sample from each sump or catch basin in Bldgs. 1408, 1408A-C, 1409, and 1411 |
| 176 | II | TBD/N | S | TBD | Based on Phase I results |
| Area N | | | | | |
| 10 | I | 3/S, E | 2Q | 1a-1e, 2, 3, 4, 5, 7, 8, CN, fluoride, fluoroacetate | Wells MW-2, DM10-1, and DM10-2 |

TABLE 5.5 (Cont'd)

| Area and Site | Phase | No. of Wells/ Type[b] | Fre- quency[c] | Analytic Categories[d] | Comments |
|---|---|---|---|---|---|
| Area N (Cont'd) | | | | | |
| 13 | I | 1/S, N | 2Q | 1b, 1c, 2, 3, 5, 7, 8 | Locate northwest of swamp |
| | II | TBD/N | - | TBD | Based on Phase I results |
| Area P | | | | | |
| 27 | I | 1/S, E | 2Q | 7, cyanide | Well DM27-1 |
| 120 | II | TBD/N | - | 8 | Based on Phase I results |
| 121 | II | TBD/N | - | TBD | Based on Phase I results |

[a]Table lists only those Sites for which groundwater monitoring is specified in the sampling plan; see Volume 2 for figures showing sampling locations.

[b]S = single well, C = cluster, MP = minipiezometers, N = new well, E = existing well.

[c]S = single sample, 2Q = quarterly monitoring for two quarters followed by review of results.

[d]The categories are as follows: 1 = all TCL+30 parameters, which is broken down as 1a = TCL volatiles, 1b = TCL semivolatiles, 1c = TCL metals, 1d = TCL pesticides, 1e = PCBs, and 1f = dioxin; 2 = explosives, 3 = gross alpha and beta; 4 = herbicides; 5 = nitrite and nitrate; 5a = nitrate; 6 = TCLP leachability; 6a = TCLP metals; 7 = macroparameters; and 8 = propellants. Other abbreviations are CN = cyanide, $NH_3$ = ammonia, $SO_4$ = sulfate, and TBD = to be determined.

[e]Sump water; no wells will be installed.

[f]Analytes for well cluster are those given in the Site 22 closure plan.

**TABLE 5.6 Summary of Air Sampling Needs for All Sites at Picatinny Arsenal[a]**

| Area and Site | Phase | Number of Samples | Analytic Categories[b] | Comments |
|---|---|---|---|---|
| Area E | | | | |
| 44 | I | at least 3 | 1a-1d, 4, asbestos | Around building |
| Area J | | | | |
| 2 | II | TBD | TBD | Based on Phase I surface soil results |
| Area K | | | | |
| 3 | I | at least 2 | 1a, 1c, 2 | Behind Bldg. 1505 during summer and fall and after testing of solid-fuel engines |
| Area N | | | | |
| 8 | I | at least 4 | 1a, 1c, 2 | One location near sand bunker, another near sand piles during summer and fall |
| 11 | I | at least 4 | 1a, 1c, 2, 8 | One location near Bldg. 647 firing area and one near Bldg. 650 during summer and fall |
| | II | TBD | | Based on Phase I results |
| 14 | I | at least 4 | 1a, 1c, 2, 8 | One location near sand bunker (Bldg. 638) and one near firing area during summer and fall |

[a]Table lists only those Sites for which air sampling is proposed.

[b]The categories are as follows: 1a = TCL volatiles, 1b = TCL semivolatiles, 1c = TCL metals, 1d = TCL pesticides, 2 = explosives, 3 = gross alpha and beta, 4 = herbicides, 5a = nitrate, and 8 = propellants.

**TABLE 5.7 Summary of Field Inspections Needed for All Sites at Picatinny Arsenal[a]**

| Area and Site | Description of Inspection |
|---|---|
| <u>Area C</u> | |
| 23 | Locate drums near Site and outside PTA boundary |
| 180 | Locate disposal areas and signs of contamination |
| <u>Area D</u> | |
| 45 | Locate signs of contamination |
| 69 | Locate drains, signs of contamination, and migration pathways |
| 86 | Locate drains, signs of contamination, and migration pathways |
| 117 | Locate drains, signs of contamination, and migration pathways |
| 118 | Locate signs of contamination |
| 122 | Locate drains, signs of contamination, and migration pathways |
| 123 | Locate drains, signs of contamination, and migration pathways |
| 182 | Locate soil staining or other signs of contamination |
| 183 | Locate signs of contamination |
| <u>Area E</u> | |
| 60 | Locate signs of contamination or soil staining |
| 61 | Locate signs of contamination or soil staining |
| 104 | Locate propellant dumping areas and lime pit; inspect the swamp, creek, and building interiors for signs of contamination |
| 106 | Locate signs of contamination and transformer storage area at former location of Bldg. 1010 |
| 111 | Locate drain outfalls and signs of contamination |
| 124 | Locate drains, signs of contamination, and migration pathways |
| 125 | Locate drains, signs of contamination, and migration pathways |
| 126 | Locate drains, signs of contamination, and migration pathways |
| 138 | Locate drains, drain outfalls, and signs of contamination |
| 139 | Locate reported decontamination pits and slurry pipeline and locate signs of contamination |
| 140 | Locate signs of contamination |

**TABLE 5.7 (Cont'd)**

| Area and Site | Description of Inspection |
|---|---|
| Area F (Cont'd) | |
| 141 | Locate signs of contamination |
| 142 | Locate signs of contamination |
| 143 | Locate signs of contamination |
| 144 | Locate drains, drain outfalls, and signs of contamination; inspect any waste cans for leaks |
| 145 | Locate sand filters, signs of contamination, and areas of reported waste dumping |
| 146 | Locate signs of contamination |
| Area G | |
| 31 | Locate signs of contamination around Bldgs. 314B-314E |
| 96 | Locate drains, signs of contamination, and migration pathways |
| 101 | Locate drains, signs of contamination, and migration pathways; also look for evidence of disposal activities around Bldg. 311 |
| 134 | Locate drains, signs of contamination, and migration pathways; look for evidence of disposal activities |
| 135 | Locate drains, signs of contamination, and migration pathways |
| 136 | Locate drains, signs of contamination, and migration pathways |
| Area H | |
| 62 | Locate drains, signs of contamination, and migration pathways |
| 64 | Locate drains, signs of contamination, and migration pathways |
| 98 | Locate drains, signs of contamination, and migration pathways |
| 100 | Locate signs of contamination and past disposal |
| 127 | Locate drains, signs of contamination, and migration pathways |
| 128 | Locate drains, signs of contamination, and migration pathways |
| 129 | Locate drains, signs of contamination, and migration pathways |
| 130 | Locate drains, signs of contamination, and migration pathways |
| 131 | Locate drains, signs of contamination, and migration pathways |

TABLE 5.7 (Cont'd)

| Area and Site | Description of Inspection |
|---|---|
| Area H (Cont'd) | |
| 132 | Locate drains, signs of contamination, and migration pathways |
| 151 | Locate signs of contamination around Bldg. 600 |
| Area I | |
| 40 | Look for reported pit between Bldgs. 809 and 810 |
| 47 | Locate signs of contamination |
| 50 | Locate signs of contamination; note sumps and weir locations |
| 63 | Locate signs of contamination at and near waste oil storage pad |
| 65 | Locate signs of contamination at and near waste oil storage pad |
| 70 | Inspect areas around buildings and near acid pit and sewage lift station at Bldg. 3028 |
| 71 | Locate soil staining and spill or waste disposal areas around Bldg. 910 |
| 79 | Locate soil staining around Bldg. 3013 |
| 82 | Locate original outflow line and outfall point for silver recovery plant |
| 83 | Locate signs of soil and surface contamination around Bldg. 3022 |
| 90 | Locate drains, signs of contamination, and migration pathways |
| 93 | Locate reported pits behind Bldg. 800 and locate reported powder disposal area behind Bldg. 807 |
| 97 | Locate soil staining and other signs of contamination |
| 102 | Locate car rack and areas of oil dumping, soil staining, or inhibited vegetative growth |
| 105 | Locate signs of contamination at former location of Bldg. 511 |
| 108 | Locate areas of reported freon dumping and possible flare activity |
| 109 | Locate signs of contamination |
| 110 | Locate propellant sticks, if any, near narrow-gauge railroad bed |
| 113 | Locate signs of contamination at former location of Bldg. 561 |
| 137 | Locate drains, signs of contamination, and migration pathways |
| 147 | Determine former location of Bldg. 502; locate route of the guncotton line through area |

TABLE 5.7 (Cont'd)

| Area and Site | Description of Inspection |
|---|---|
| Area I (Cont'd) | |
| 148 | Locate soil staining and other signs of contamination |
| 149 | Determine former location of Bldg. 541; locate signs of contamination |
| 150 | Locate signs of contamination around Bldg. 555 |
| 156 | Locate soil staining and other signs of contamination |
| 178 | Locate soil staining and other signs of contamination at former locations of Bldgs. 541, 561, 323A, and 1052 |
| 184 | Locate soil staining and other signs of contamination around Bldg. 523 |
| Area J | |
| 1 | Locate all current and preexisting structures, pads, and areas of soil staining and disturbance |
| 2 | Locate UXO and other metal debris |
| 4 | Locate UXO and other metal debris |
| 175 | Locate signs of contamination |
| Area K | |
| 3 | Locate UXO and other metal debris; closely examine forested and other uncleared areas |
| 172 | Locate signs of oil staining in parking area and its perimeter |
| 173 | Locate soil staining and other signs of contamination around Bldg. 3404 |
| 174 | Locate boundaries of sludge holding beds and locate drain outfall in swamp |
| Area L | |
| 35 | Inspect Site and areas under tanks to locate catch basin, water pool, and signs of contamination |
| 36 | Locate signs of contamination around the loading platform and parking lot; note ditch and drain outfall locations |
| 41 | Locate signs of contamination; note ditch and drain outfall locations |
| 42 | Locate signs of contamination; note ditch and drain outfall locations |

**TABLE 5.7 (Cont'd)**

| Area and Site | Description of Inspection |
|---|---|
| Area L (Cont'd) | |
| 77 | Locate soil staining and spill or waste disposal areas around Bldg. 3150, especially near machine shop and basement storage entrance |
| 91 | Locate the reported lead azide washout area near Bldg. 1301 |
| 114 | Locate soil staining and other signs of contamination |
| 160 | Locate soil staining and other signs of contamination around Bldg. 1031 |
| 162 | Locate soil staining and other signs of contamination around Bldgs. 1070, 1071, and 1071C |
| 166 | Locate soil staining and other signs of contamination around Bldgs. 1354, 1357, and 1359 |
| 167 | Locate soil staining, other signs of contamination around buildings, and any drain lines leading from sumps to drain outfalls |
| 168 | Locate soil staining, other signs of contamination around buildings, and any drain lines leading from sumps to drain outfalls |
| 169 | Locate soil staining, other signs of contamination around buildings, and any drain lines leading from sumps to drain outfalls |
| 170 | Locate soil staining and other signs of contamination around Bldgs. 1462-1465 |
| 171 | Locate soil staining and other signs of contamination around Bldgs. 3106, 3109, and 3111 |
| Area M | |
| 152 | Locate signs of contamination around Bldgs. 604 and 604C |
| 153 | Locate signs of contamination around Bldg. 606 |
| 154 | Locate signs of contamination around Bldgs. 617 and 617G |
| 155 | Locate soil staining and other signs of contamination around Bldgs. 620 and 620B |
| Area N | |
| 7 | Inspect firing area and two impact areas to locate signs of contamination |
| 8 | Locate UXO, metal debris, and disturbed or stained areas |
| 9 | Locate UXO, metal debris, and disturbed or stained areas |
| 11 | Locate areas of soil staining or disturbance |

**TABLE 5.7 (Cont'd)**

| Area and Site | Description of Inspection |
|---|---|
| Area N (Cont'd) | |
| 12 | Locate areas of soil staining or disturbance |
| 13 | Locate waste pit, UXO, metal debris, and areas of disturbance or staining |
| 14 | Locate waste pit, UXO, metal debris, and areas of disturbance or staining |
| Area O | |
| 164 | Locate soil staining and other signs of contamination around Bldg. 1217 |
| Area P | |
| 78 | Locate drains, signs of contamination, and migration pathways |
| 119 | Locate signs of contamination |
| 120 | Locate signs of contamination and areas where propellant containers were opened |
| 121 | Locate signs of contamination |

[a]Table lists only those Sites for which field inspections are needed.

**TABLE 5.8 Summary of Geophysical Surveys Needed for All Sites at Picatinny Arsenal[a]**

| Area and Site | Description of Survey |
|---|---|
| Area A | |
| 34 | Locate buried shells and contaminated areas |
| Area C | |
| 163 | Locate disposal pits and dredge dump areas |
| 180 | Locate disposal area |
| Area F | |
| 104 | Locate lime pit if it cannot be located by visual inspection |
| 139 | Locate reported decontamination pits and slurry pipeline if they cannot be located by visual inspection |
| Area G | |
| 101 | Locate disposal pits |
| 134 | Locate disposal pit |
| Area I | |
| 53 | Locate UXO, containers of explosives, and other dangerous items and debris on bottom of Picatinny Lake and Lake Denmark; use underwater television cameras as necessary |
| 82 | Locate original outflow line and outfall point for the silver recovery plant if they cannot be located by visual inspection |
| 83 | Locate acid pits and drain lines if they cannot be located by visual inspection |
| 93 | ate reported pits behind Bldg. 800 and reported powder disposal area behind Bldg. 807 if they cannot be located by visual inspection |
| 137 | Locate disposal pit |
| 147 | Locate disposal pits if they cannot be located by visual inspection or use of old maps |
| 159 | Locate disturbed soil and buried metal behind Bldg. 975 |
| 178 | Locate drain lines at each of four TECUP building locations (Phase II only) |
| Area J | |
| 1 | Locate buried UXO, metal debris, and large area of reported dumping |
| 2 | Locate UXO, other metal debris, and USTs, especially former tank farm |
| 4 | Locate reported buried propellant containers, UXO, and other items |

**TABLE 5.8 (Cont'd)**

| Area and Site | Description of Survey |
|---|---|
| Area K | |
| 3 | Locate UXO, other metal debris, and USTs |
| Area L | |
| 5 | Determine areal extent of buried munitions |
| 18 | Locate tetryl pit(s) and survey open area between Bldgs. 1029 and 1038 |
| 35 | Locate underground pipe and potentially contaminated areas |
| 91 | Locate repor.:d lead azide washout area near Bldg. 1301 if it cannot be located by vi.:al inspection |
| 103 | Locate UXO or bottom of reservoir; use underwater television cameras |
| 162 | Locate reported explosives wastewater leach field near Bldg. 1071; locate Bldg. [illegible]070 |
| 167-169 | Locate any d[illegible]in lines leading from building sumps to drain outfalls if they ca[illegible]ot be located by visual inspection |
| 176 | Conduct EM survey to locate pits and areas reportedly covered with dredged materials |
| Area N | |
| 7-9 | [illegible] buried objects and UXO |
| 10 | Locate [illegible]aste disposal pit |
| 11 | Locate buried objects, UXO, and areas of soil disturbance |
| 12 | Locate buried objects, UXO, and areas of soil disturbance |
| 13 | Locate UXO, metal debris, areas of soil disturbance, and waste pit |
| 14 | Locate UXO, metal debris, areas of soil disturbance, and waste pit |
| Area O | |
| 54 | Locate UXO, containers of explosives, and other dangerous items and debris on bottom of Picatinny Lake and Lake Denmark; use underwater television cameras as necessary |

[a]Table lists only those Sites for which geophysical surveys are needed.

**TABLE 5.9 Summary of Drum and Tank Integrity Testing and Sampling Needed for All Sites at Picatinny Arsenal[a]**

| Area and Site | Description of Testing or Sampling |
|---|---|
| Area C | |
| 23 | Sample contents of drums located during field inspection |
| Area E | |
| 38 | Collect one grab sample each from tanks T-3 through T-6, T-8, and T-9 |
| 44 | Inspect USTs for leaks |
| Area J | |
| 2 | Sample tanks with unknown contents (both above and underground tanks) and test tanks for integrity |
| 4 | Sample tanks with unknown contents (both above and underground tanks) and test tanks for integrity |
| [illegible]5 | Sample contents of drums and remove any leaking drums |
| Area [illegible] | |
| 5 | Sample tanks with unknown contents (both above and underground tanks) and test tanks for integrity |
| Area L | |
| 35 | Sample and remove two tanks near Bldg. 1363A |
| Area N | |
| [illegible]9 | Sample contents of drums located during field inspection or geophysical survey |
| 10 | Sample contents of drums located during geophysical survey |
| 11-[illegible] | Sample contents of drums located during field inspection or geophysical survey |

[a]Table lists only those Sites for which tank sampling or testing is needed.

TABLE 5.10 Summary of Other Types of Phase I Surveys and Measurements Needed for All Sites at Picatinny Arsenal[a]

| Area and Site | Type of Survey or Measurement | Comments |
|---|---|---|
| Area A | | |
| 34 | Continuous core soil samples | Determine particle size distribution, porosity, and hydraulic conductivity |
| Area C | | |
| 23 | Aquifer slug test | Test new wells and wells DM23-1 and DM23-2 |
| 25 | Gradient study | Determine if glacial aquifers are connected to Quaternary aquifer |
| | Aquifer slug test | Test wells MW-16, DM25-3, and LF-1 |
| Area E | | |
| 28 | Check of units | Look for subsurface leaks at plant units |
| | Sampling | Collect and analyze sewage and sludge samples to determine if industrial wastes are present |
| Area H | | |
| 100 | Review of DEH records | Determine location of former building, loading dock, and doors |
| 129 | Interviews and records search | Establish use of Bldg. 240 |
| Area I | | |
| 16 | Dye trace test | Locate unknown part of guncotton line; test integrity of line |
| 53 | UXO marking and removal | Mark or remove located UXO |
| Area K | | |
| 172 | Sampling | Collect two chips from each stained area of asphalt |
| 174 | Sampling | Collect two sludge samples from each holding bed |
| Area L | | |
| 18 | Soil gas survey | Survey open area between Bldgs. 1029 and 1038 |
| 43 | Sampling | Collect two chip samples from centers of each of two pads outside Bldg. 3157 |
| 103 | UXO marking and removal | Mark or remove any located UXO |
| 170 | Records search | Locate wastewater discharges, if any |

TABLE 5.10 (Cont'd)

| Area and Site | Type of Survey or Measurement | Comments |
|---|---|---|
| Area M | | |
| 15 | Sampling | Use methods II-7 and II-8 (see EPA 1987a) to sample sand piles; analyze for explosives, propellants, uranium, and EP toxicity |
| Area O | | |
| 54 | UXO marking and removal | Mark or remove located UXO |

[a]Table lists only those Sites for which other types of surveys and measurements are needed.

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# APPENDIX A:

# CHEMICALS USED AT PICATINNY ARSENAL

# APPENDIX A:

# CHEMICALS USED AT PICATINNY ARSENAL

Tables A.1-A.10 in this appendix list some chemicals that are in use or have been used in the past at Picatinny Arsenal. Some of the tables list inventories of chemicals. The listings are by no means exhaustive and are only meant to give indications of the extent of different types of chemicals used and the variety of activities occurring at PTA. Many chemicals that are used or have been widely used at PTA are not listed in this appendix. These chemicals include some halogenated organic solvents, petroleum products and components, explosives, mineral acids and bases, and other common chemicals.

**TABLE A.1 Some Chemicals and Waste Products in Hazardous Waste Listed in the RCRA Parts A and B Permit Applications as of November 8, 1985**

| Chemical or Waste Product[a] | Estimated Annual Quantity (lb/yr)[b] | EPA Hazardous Waste Number |
|---|---|---|
| OB/OD explosives, sludge | 1,000 | K044 |
| OB/OD spent carbon from explosives | 500 | K045 |
| Pink-red water | 250 ton | K047 |
| 4-Aminopyridine | 2 | P008 |
| Ammonium picrate (R) | 5 | P009 |
| Barium cyanide | 1 | P013 |
| Benzenethiol | 1 | P014 |
| Calcium cyanide | 15 | P021 |
| Carbon bisulfide | 10 | P022 |
| Chloroacetaldehyde | 1 | P023 |
| Copper cyanide | 80 | P029 |
| Cyanide NOS | 100 | P030 |
| 2,4-Dinitrophenol | 5 | P048 |
| Ethylenimine | 25 | P054 |
| Acetic acid | 1 | P058 |
| Nitric oxide | 2 | P076 |
| p-Nitroaniline | 5 | P077 |
| Nitrogen dioxide | 2 | P078 |
| Nitroglycerin (R) | 100 | P081 |
| Phosgene | 2 | P095 |
| Potassium cyanide | 100 | P098 |
| Potassium silver cyanide | 1 | P099 |
| Sodium azide | 1 | P105 |
| Sodium cyanide | 80 | P106 |
| Strontium sulfide | 1 | P107 |
| Tetraethyl lead | 1 | P110 |
| Tetranitromethane | 2 | P112 |
| Vanadic acid | 2 | P119 |
| Vanadium pentoxide | 2 | P120 |
| Zinc cyanide | 100 | P121 |

TABLE A.1 (Cont'd)

| Chemical or Waste Product[a] | Estimated Annual Quantity (lb/yr)[b] | EPA Hazardous Waste Number |
|---|---|---|
| Acetone | 1,100 | U002 |
| Acetonitrile (I,T) | 2 | U003 |
| Acetophenone | 2 | U004 |
| Acetyl chloride (C,R,T) | 4 | U006 |
| Acrylamide | 2 | U007 |
| Acrylic acid | 4 | U008 |
| Aniline (I,T) | 4 | U012 |
| 1,2-Benzanthracene | 0.5 | U018 |
| Benzene (I,T) | 100 | U019 |
| Benzidine | 0.25 | U021 |
| 1-Butanol (I) | 5 | U031 |
| Calcium chromate | 100 | U032 |
| Chlordane | 5 | U036 |
| Chlorobenzene | 5 | U037 |
| Chloroform | 100 | U044 |
| Creosote | 1 | U051 |
| Cresols/cresylic acid | 1 | U052 |
| Crontonaldehyde | 3 | U053 |
| Cumene (I) | 5 | U055 |
| Cyclohexane | 5 | U056 |
| Cyclohexanone | 5 | U057 |
| DDT | 1 | U061 |
| Methylene bromide | 5 | U068 |
| Dibutyl phthalate | 10 | U069 |
| o-Dichlorobenzene | 5 | U070 |
| m-Dichlorobenzene | 5 | U071 |
| p-Dichlorobenzene | 5 | U072 |
| Dichlorodifluoromethane | 5 | U075 |
| 1,2-Dichloroethane | 5 | U077 |
| 1,1-Dichloroethylene | 5 | U078 |
| 1,2-Dichloroethylene | 5 | U079 |
| Methylene chloride | 5 | U080 |
| Diethyl phthalate | 10 | U088 |
| 3,3-Dimethoxybenzidine | 1.1 | U091 |
| Dimethylamine (I) | 1 | U092 |
| Dimethylaminoazobenzene | 1 | U093 |
| 1,1-Dimethylhydrazine | 1 | U098 |
| 1,2-Dimethylhydrazine | 1 | U099 |
| 2,4-Dimethylphenol | 1 | U101 |
| Dimethyl phthalate | 10 | U102 |
| Sulphuric acid | 1 | U103 |
| Aniline | 1 | U104 |
| 2,4-Dinitrotolune | 5 | U105 |
| 2,6-Dinitrotolune | 5 | U106 |
| Di-n-octyl phthalate | 10 | U107 |
| Ethylacetate (I) | 10 | U112 |
| Ethylene oxide (I,T) | 1 | U115 |
| Ethyl ether (I) | 10 | U117 |
| Formaldehyde | 5 | U122 |
| Formic acid | 1 | U123 |

**TABLE A.1 (Cont'd)**

| Chemical or Waste Product[a] | Estimated Annual Quantity (lb/yr)[b] | EPA Hazardous Waste Number |
|---|---|---|
| Furfural (I) | 5 | U125 |
| Hexachlorobenzene | 2 | U127 |
| Hexachlorobutadiene | 1 | U128 |
| Hexachlorocyclopentadiene | 1 | U130 |
| Hexachloroethane | 1 | U131 |
| Hydrazine (R,T) | 2 | U133 |
| Hydrofluoric acid/hydrogen fluoride | 10 | U134 |
| Hydrogen sulfide | 2 | U135 |
| Lead acetate | 1 | U144 |
| Maleic anhydride | 1 | U147 |
| Mercury | 200 | U151 |
| Methanol (I) | 10 | U154 |
| 4,4'-Methylene-bis(2-chloroaniline) | 5 | U158 |
| Methyl ethyl ketone (I,T) | 1,100 | U159 |
| Methyl ethyl ketone peroxide (R,T) | 10 | U160 |
| Methyl isobutyl ketone (I) | 5 | U161 |
| Methyl methacrylate (I,T) | 2 | U162 |
| Naphthalene | 1 | U165 |
| 1,4-Napthaquinone | 1 | U166 |
| Alpha/1-Napthylamine | 1 | U167 |
| Nitrobenzene (I,T) | 1 | U169 |
| p-Nitrophenol | 1 | U170 |
| 5-Nitro-o-toluidine | 1 | U181 |
| Pentachloroethane | 1 | U184 |
| Phenol | 3 | U188 |
| Phthalic anhydride | 1 | U190 |
| 2-Picoline | 1 | U191 |
| Pyridine | 1 | U196 |
| 1,4-Cyclohexadienedione | 1 | U197 |
| Resorcinol | 1 | U201 |
| Selenious acid; selenium dioxide | 1 | U204 |
| 1,2,4,5-Tetrachlorobenzene | 1 | U207 |
| 1,1,1,2-Tetrachloroethane | 1 | U208 |
| 1,1,2,2-Tetrachloroethane | 1 | U209 |
| Tetrachloroethane | 1 | U210 |
| Carbon tetrachloride | 1 | U211 |
| Tetrahydrofuran (I) | 10 | U213 |
| Thioacetamide | 1 | U218 |
| Thiourea | 1 | U219 |
| Toluene | 1,100 | U220 |
| 1,1,1-Trichloroethane | 1 | U226 |
| 1,1,2-Trichloroethane | 1 | U227 |
| Trichloroethylene | 1,100 | U228 |
| Carbamic acid | 1,100 | U238 |
| Xylene (I) | 10 | U239 |
| Pentachlorophenol | 1 | U242 |
| Auto/truck crankcase oil | 16,000 | X721 |
| Waste oils and bottom sludge cleaning of gas station tanks | 500 | X723 |

TABLE A.1 (Cont'd)

| Chemical or Waste Product[a] | Estimated Annual Quantity (lb/yr)[b] | EPA Hazardous Waste Number |
|---|---|---|
| Waste lube oils | 100 | X726 |
| Waste oils from transformers | 30,000 | X727 |
| Clean-up residue B-31 | 49,000 | X725 |
| o-Anisidine | 1 | D001 |
| N,N-di-n-Butyl acetamide | 1 | D001 |
| N,N-Diphenyl ethylenediamide | 1 | D001 |
| Soquinoline[c] | 1 | D001 |
| Isobutyl alcohol | 45 | D001 |
| N-N-Dimethyl-formide dimethylacetate | 1 | D001 |
| N,N-Diethyl-1,3-propane diamine | 1 | D001 |
| N,N-Diisopropyl ethylene diamine | 1 | D001 |
| Methyl pyrrolidone | 1 | D001 |
| Diisopropanoline | 1 | D001 |
| Pyrrolidine | 1 | D001 |

[a]Some substances are listed with their hazardous characteristics: R = reactive, I = ignitable, C = corrosive, and T = toxic.

[b]Except for deionized water.

[c]It is assumed that this compound is isoquinoline.

Source: [illegible] 1986, Attachment 3.

**TABLE A.2 Constituents of Hazardous Wastes that May Be Stored in Building 1094**

| Waste Group | Group Name | Constituents | Hazard Class |
|---|---|---|---|
| 1 | Nonoxidizing mineral acids | Hydrochloric acid | Corrosive |
| | | Hydrofluoric acid | Corrosive, toxic |
| 2 | Oxidizing mineral acids | Chromic acid | Corrosive |
| | | Nitric acid | Corrosive |
| | | Sulfuric acid | Corrosive |
| 3 | Organic acids | Acetic acid | Corrosive |
| | | Benzoic acid | Corrosive |
| | | Oxalic acid | Corrosive |
| 4 | Alcohols and glycols | 1-Butanol | Ignitable |
| | | n-Butyl alcohol | Ignitable |
| | | Glycerine | - |
| | | Methanol | Ignitable, toxic |
| 5 | Aldehydes | Crotonaldehyde | Toxic |
| | | Formaldehyde | Toxic |
| | | Furfural | Toxic |
| 7 | Aliphatic and aromatic amines | Aniline | Ignitable, toxic |
| | | Benzidine | Toxic |
| | | Diethylenetriamine | - |
| | | Dimethylamine | Ignitable |
| | | p-Dimethylamine azobenzene | Toxic |
| | | Pyridine | Toxic |
| | | Triethylenetetramine | - |
| 8 | Azo and diazo compounds and hydrazines | p-Dimethylamine azobenzene | Toxic |
| | | 1,1-Dimethylhydrazine | Toxic |
| | | 1,2-Dimethylhydrazine | Toxic |
| | | Hydrazine | Reactive, toxic |
| 10 | Caustics | Ammonium hydroxide | Corrosive |
| | | Sodium hydroxide | Corrosive |
| 11 | Cyanides | Cyanide | Toxic |
| | | Potassium cyanide | Toxic |
| | | Sodium cyanide | Toxic |
| | | Zinc cyanide | Toxic |
| 13 | Esters | Di-n-butyl phthalate | Toxic |
| | | Diethyl phthalate | Toxic |
| | | Dimethyl phthalate | Toxic |
| | | Ethyl acetate | Toxic |
| | | Methyl methacrylate | Reactive, toxic |
| 16 | Aromatic hydrocarbons | Benzene | Ignitable, toxic |
| | | Cumene | Ignitable |
| | | Naphthalene | Toxic |
| | | Toluene | Toxic |

TABLE A.2 (Cont'd)

| Waste Group | Group Name | Constituents | Hazard Class |
|---|---|---|---|
| 17 | Halogenated organics | Acetyl chloride | Corrosive, reactive, toxic |
| | | Carbon tetrachloride | Toxic |
| | | Chlordane | Toxic |
| | | Chloroform | Toxic |
| | | Dibromomethane | Toxic |
| | | 1,2-Dichlorobenzene | Toxic |
| | | 1,3-Dichlorobenzene | Toxic |
| | | Dichlorodifluoromethane | Toxic |
| | | 1,2-Dichloroethane | Toxic |
| | | 1,2-Dichloroethylene | Toxic |
| | | 1,2-trans-Dichloroethylene | Toxic |
| | | DDT | Toxic |
| | | Hexachlorobenzene | Toxic |
| | | Methylene chloride | Toxic |
| | | Pentachlorophenol | Toxic |
| | | 1,1,1,2-Tetrachloroethane | Toxic |
| | | 1,1,2,2-Tetrachloroethane | Toxic |
| | | Tetrachloroethylene | Toxic |
| | | Tetrachloromethane | Toxic |
| | | 1,1,1-Trichloroethane | Toxic |
| | | 1,1,2-Trichloroethane | Toxic |
| | | Trichloroethylene | Toxic |
| 19 | Ketones | Acetone | Ignitable |
| | | Acetophenone | Ignitable |
| | | Cyclohexane | Ignitable |
| | | Methyl ethyl ketone | Ignitable, toxic |
| | | Methyl isobutyl ketone | Ignitable |
| | | Quinones | Toxic |
| 20 | Organic sulfides | Carbon disulfide | Acutely toxic |
| | | Polysulfide | a |
| 21 | Elemental, alkaline, and alkali-earth metals | Magnesium | Reactive |
| | | Potassium metal | a |
| | | Sodium metal | Reactive |
| 24 | Toxic metals and metal compounds | Barium chloride | a |
| | | Chromic acid | Toxic, corrosive, reactive |
| | | Lead acetate | Toxic |
| | | Mercuric chloride | a |
| | | Mercuric iodide | a |
| | | Mercuric nitrate | a |
| | | Mercurous nitrate | a |
| | | Mercury | Toxic |
| | | Potassium dichromate | a |
| | | Selenious acid | Toxic |
| | | Stannic chloride | a |

TABLE A.2 (Cont'd)

| Waste Group | Group Name | Constituents | Hazard Class |
|---|---|---|---|
| 24 (cont'd) | | Tetraethyl lead | Acutely toxic |
| | | Vanadic acid | Acutely toxic |
| | | Vanadium pentoxide | Acutely toxic |
| | | Zinc chloride | a |
| | | Zinc cyanide | Acutely toxic |
| | | Zinc sulfate | a |
| 26 | Nitriles | Acetonitrile | Ignitable, toxic |
| 27 | Nitro compounds | 2,4-Dinitrophenol | Toxic |
| | | Nitrobenzene | Ignitable, toxic |
| | | 4-Nitrophenol | Toxic |
| | | Tetranitromethane | Acutely toxic |
| 29 | Saturated aliphatics | Cyclohexane | Ignitable |
| 30 | Organic peroxides | Benzoyl peroxide | Reactive |
| 31 | Phenols and cresols | Creosote | Toxic |
| | | Cresol | Toxic |
| | | 2,4-Dimethylphenol | Toxic |
| | | 2,4-Dinitrophenol | Toxic |
| | | 4-Nitrophenol | Toxic |
| | | Pentachlorophenol | Toxic |
| | | Phenol | Toxic |
| | | Pyrogallol | a |
| | | Resorcinol | Toxic |
| 101 | Combustibles and flammables | Polysulfide | a |
| 102 | Reactants | Benzoyl peroxide | Reactive |
| | | Tetranitromethane | Reactive |
| 103 | Polymerizable compounds | Acrylic acid | Ignitable |
| | | Ethylene oxide | Ignitable, toxic |
| | | Methyl methacrylate | Ignitable, toxic |
| 104 | Strong oxidizing agents | Bromine | a |
| | | Chromic acid | Toxic |
| | | Mercuric nitrate | a |
| | | Mercurous nitrate | a |
| | | Potassium dichromate | a |

TABLE A.2 (Cont'd)

| Waste Group | Group Name | Constituents | Hazard Class |
|---|---|---|---|
| 105 | Strong reducing | Acetyl chloride | Corrosive, reactive, toxic |
| | | Magnesium | Reactive |
| | | Phosphorus pentoxide | a |
| | | Red phosphorus, amorphous | a |
| | | Sodium metal | Reactive |
| | | Stannic chloride | a |
| | | Sulfuric acid | Corrosive |

[a]Wastes that do not meet hazard criteria or for which no information is available.

Source: Foster Wheeler 1987a.

**TABLE A.3 Types and Amounts of Pesticides, Dyes, Soil Conditioners, and Micronutrients Stored in Buildings 39 and 41**

| Material | Amount | Material | Amount |
|---|---|---|---|
| Fungicides | | | |
| Subdue | 4 cans + 2.5 gal | Clearys 3336 F | 5 gal |
| Banol | 2 cans + 4 qt | Alliette | 4 2-lb boxes |
| Bayleton | 7 cans | Koban 30 | 2 lb |
| Daconil 2787 | 10 cans + 1 gal | Acti Dione RZ | 10 lb |
| Rubigan | 5.5 cans | Banner F | 4 cans + 2 gal |
| Acti Dione TGF | 5 cans | Chipco 26019 | 8 cans |
| Spotrete F | 8 cans | Tersan 1991 | 8 cans |
| Spotrete WP | 17 cans + 3 lb | Caddy | 10 gal |
| Dyrene 4 | 20 cans + 2.5 gal | P.M.A.S. | 9.5 gal |
| Manzate 200F | 7 cans + 1 gal | | |
| Insecticides | | | |
| Carbaryl 4L | 7 cans | Proxol 80SP | 1 can |
| Diazinon | 2 gal | Dursban | 11 gal |
| Oftanol F | 3 gal | Turcam | 6 cans |
| Herbicides | | | |
| Weed-E-Rad (DSMA) | 2 cans + 5 gal | Tupersan | 16 lb |
| Acclaim | 1 gal | Round Up | 4 gal |
| Trimec-(Broad) | 4 cans + 1 gal | Tretlan G | 3 40-lb bags |
| Trimec (Bent) | 5 cans + 4 gal | Eptam G | 2 25-lb bags |
| Betasan-4 EC | 28 gal | Banvel | 2.5 gal |
| Formula A | 5 gal | MCPP-2,4-D | 1 gal |
| Soil Conditioners | | | |
| Pen Turf | 16 cans | Aqua Gro F | 2 gal |
| Aqua Gro G | 30 drums | Vapor Guard | 3 gal |
| Micronutrients | | | |
| Agri Plex | 4 cans | Micro-Green Liquid | 1 can |
| Dyes | | | |
| Biazon | 4 cans | Dyon | 6 cans |
| Tru Green | 0.5 gal | | |

Source: Clune and Milio 1988.

**TABLE A.4 1979 Inventory of Pesticides in Building 39**

| Name | Active Ingredient | Quantity |
|---|---|---|
| Acti-dione Thiram | Cycloheximide 0.75%, thiram 75% | 3 lb |
| Banvel 4-S | Dicamba 49% | 5 gal |
| Caddy | Cadmium chloride 20.1% | 21 gal |
| CALO-CLOR | Mercury chlorides 90% | 25 lb |
| Chloro-40% W | Chlordane 40% | 4 lb |
| Chlordane 72% EC | Chlordane 72% | 10 gal |
| Cleary's 3336 | Thiophanate 50% | 2 lb |
| Corrosive sublimate | Mercuric chloride 99.5% | 25 lb |
| Daconil 2787 | Chlorothalonil 75% | 18 lb |
| Diazinon AG-48 | Diazinon 48% | 6 gal |
| Dursban 2E | Dursban 22.5% | 10 gal |
| Dyrene | Anilazine 50% | 5 lb |
| Formula 40 | 2,4-D 38.5% | 10 gal |
| Greg Turf | Copper 9.9%, cadmium 4.2%, zinc 4.1%, chromium 3.2% | 25 lb |
| MCPP | 2-(4-chloro-2-methylphenoxy) propionic acid 25.9% | 5 gal |
| Mather 30 | Disodium methanearsonate 18.9% | 10 gal |
| Mather 80 | Disodium methanearsonate 80% | 150 lb |
| PMAS | Phenyl mercuric acetate 10% | 90 gal |
| Proxol SP | Dimethyl phosphonate 80% | 8 lb |
| Spotrete F | Thiram 42% | 3 gal |
| Spotrete | Thiram 75% | 72 lb |
| Tersan ON | Hydroxymercurichlorophenols 10%, thiram 45% | 9 lb |
| Tersan SP | Chloroneb 65% | 6 lb |
| Tersan 75 | Thiram 75% | 6 lb |
| Tersan 1991 | Benomyl 50% | 12 lb |
| Trimec | 2,4-D 6.5%, MCPP 19.87%, dicamba 2.63% | 5 gal |

Source: USAEHA 1979a.

**TABLE A.5 1979 Inventory of Pesticides in Building 41**

| Name | Active Ingredient | Quantity |
|---|---|---|
| Acti-dione | Ferrated cycloheximide 2.26% | 102 oz |
| Acti-dione RZ | Pentachloronitrobenzene 75%, cycloheximide 1.3% | 50 lb |
| Acti-dione TGF | Cycloheximide 2.1% | 450 oz |
| Acti-dione Thiram | Cycloheximide 0.75%, thiram 75% | 1,410 lb |
| Aquathole | Silvex 5.6%, endothall 5.1% | 500 lb |
| Auragreen | Basic copper carbonate 50% | 5 lb |
| Balan | Benefin 2.5% | 9,200 lb |
| Cadmium chloride | Cadmium chloride 20.1% | 50 gal |
| Captan | Captan 50% | 335 lb |
| Cleary's 3336 | Thiophanate 50% | 84 lb |
| Crabgrass preventer | Dimethyl ester of tetrachloro-terephthalic acid 4.7% | 60 lb |
| Crown WP sulfur 95% | Sulfur 95% | 900 lb |
| Daconil | Chlorothalonil 40.4% | 58 gal |
| Daconil | Chlorothalonil 54% | 10 gal |
| Daconil | Chlorothalonil 75% | 24 lb |
| Dicot Weed Control II | 2,4-D 1.15%, propinic acid 1.15% | 3,470 lb |
| DSB | Benomyl 1.5% | 840 lb |
| Fore | Manganese ethylene bisedithio-carbamate 80% | 48 lb |
| Granular copperas | Ferrous sulfate | 300 lb |
| Koban30 | 5-Ethoxy-3-trichloro-methyl-1-1,2,4-thiodiazole 30% | 128 lb |
| Koban | 5-Ethoxy-3-trichloro-methyl-1-1.2,4-thiodiazole 35% | 90 lb |
| K-O-G | Dicamba 70% | 1,775 lb |
| Proturf | Chloroneb 6.5% | 1,277 lb |
| Proxol 80 SP | Richlofon 80% | 72 lb |
| SLO-GRO | 6-Hydroxy-3-(2H)-pyridazinone, diethylanolamine salt 58% | 90 gal |
| Spotrete | Thiram 75% | 432 lb |
| Spotrete-F | Thiram 42% | 84 gal |
| Tersan LSR | Maneb 80% | 99 lb |
| Tersan 1991 | Benomyl 50% | 180 lb |
| Tersan OM | Hydroxymercurichlorophenols 10%, thiram 15% | 18 lb |
| Tersan SP | Chloroneb 65% | 324 lb |
| Tersan75 | Thiram 75% | 144 lb |
| TPO | Thiram 5%, cadmium chloride 0.75% | 80 lb |
| Tupersan | Siduron 50% | 20 lb |
| Aquathol Plus | Potassium salts of endothall 22.1% and silvex 52.6% | 25 gal |
| Aquathol Plus | Potassium salts of endothall 5.1% and silvex 5.6% | 600 lb |
| Captan | Captan | 540 lb |
| Chip-Cal | Tricalcium arsenate 48% | 80 lb |
| Copper-Tox | Copper 3% | 1 gal |
| Dapsodar | Disodium monomethyl arsenate hexahydrate 50% | 10 lb |
| Floral dust | Sulfur 26.2%, methoxychlor 5%, ferric dimethyldithiocarbamate 7.6%, rotenone 0.75% | 9 lb |
| Lead arsenate | Lead arsenate | 96 lb |

**TABLE A.5 (Cont'd)**

| Name | Active Ingredient | Quantity |
|---|---|---|
| Lethane 384 | b-Butoxy-b-thiocyanodiethyl ether | 55 gal |
| Lindane-aramite | Lindane 6% | 10 gal |
| Malathion 25% WP | Malathion 25% | 50 lb |
| Malathion 57% EC | Malathion 57% | 5 gal |
| Methar 100 | Disodium methanearsonate 63% | 50 lb |
| Methar 80 | Disodium methanearsonate 50.4% | 50 lb |
| MH-30 | Maleic hydrazide 585 | 55 gal |
| Monuron 80% WP | Monuron 80% | 100 lb |
| Nicotine 20% | Nicotine 20% | 5 gal |
| Nicotine 40% | Nicotine 40% | 10 gal |
| Pyrethrins | Pyrethrins | 5 gal |
| Red Arrow garden spray | Pyrethrins 0.5%, rotenone 1.5% | 6 gal |
| Rotenone | Rotenone 1% | 100 lb |
| Samesan | Hydroxymercurichlorophenol 25.3% | 50 lb |
| SLO-GRO | Diethanolamine salt of 6-hydroxy-3-(2H)-pyridazinone 58% | 120 gal |
| Sulfur 95% WP | Sulfur 95% | 50 lb |
| Telvar | Monuron 80% | 100 lb |
| Tepp 40% | Tepp 40% | 4 gal |
| Thiram | Thiram 75% | 36 lb |
| 2,4-D | 2,4-D in concentrations up to 95% | 77 gal + 30 lb |
| 2,4,5-T | 2,4,5-T | 55 gal |
| Ureabor | Disodium tetraborate hydrates 93.5%, 2,3,6-trichlorobenzoic acid 0.6% | 1,100 lb |

Source: USAEHA 1979a.

**TABLE A.6 Inventory of Pesticides in Building 3157**

| Trade Name | Active Ingredient (%) | 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 (--) | 70 lb |
| Abate 4E | Temephos (43%) | 1 gal |
| Baygon | Propoxur (14.6%) | 8 gal |
| Combat ant baits | Hydramethylnon (0.9%) | 852 bait trays |

Sources: Ludemann et al. 1981; Clune and Milio 1988.

**TABLE A.7 Herbicide Use at Picatinny Arsenal in 1973 and 1974**

| Date Used and Herbicide | Amount of Active Ingredient | Annual Usage |
|---|---|---|
| Used in 1973 | | |
| Ammate "X" | - | 4,250 lb |
| 2,4,5-T | - | 19 gal |
| 2,4-D | - | 53 gal |
| Used in 1974 | | |
| Hyver[a] | - | 310 lb |
| Dowpon[a] | - | 790 lb |
| 2,4-D[a] | - | 120 lb |
| Copper sulfate | - | 900 lb |
| Dacthol, granulated | 4.7% | 1,000 lb |
| DSMA 100, powder | 63% | 125 lb |
| 2,4-D amine, liquid | 95.4%, 4 lb/gal | 5 gal |
| Dicamba, liquid | 49%, 4 lb/gal | 3 gal |

[a]Used for soil sterilization.

Source: Rigassio et al. 1975.

**TABLE A.8 Other Chemicals at the Picatinny Arsenal**

| Chemical | Quantity | Reference | Uses |
|---|---|---|---|
| Cadmium cyanide | - | a | Cadmium plating |
| Zinc cyanide | - | a | Zinc plating |
| Sulfuric acid | - | a | Anodizing |
| Chromic acid | - | a | Chrome plating |
| Polychloronaphthalenes | - | a | Component of risers |
| Cellulose acetate | - | a | Plastic dipping |
| Cellulose butyrate | - | a | Plastic dipping |
| Lead azide | - | a | Component of detonators |
| Lead sulfocyanate | - | a | Component of detonators |
| Antimony sulfite | - | a | Component of detonators |
| Lead stearate | - | a | - |
| Diethyl phthalate | - | a | - |
| Triacetin | - | a | - |
| 2-nitrodiphenylamine | - | a | - |
| Dinitroethylbenzene | - | a | Casting small arms powder |
| Barium chromate | - | a | Delay powder manufacture |
| Potassium perchlorate | - | a | Delay powder manufacture |
| Ether | - | a | Mixing operations |
| Arsenic trisulfide | - | a | Used in M-12 smoke mixture |
| Methyl ethyl ketone | - | a | Mixing tracer composition |
| Hydrogen cyanide | - | b | Metal treatment and plating |
| Mercury vapor | - | b | Testing of propellants |
| Hydrazoic acid | - | b | Laboratory research |
| Butyl glycerol ether | - | b | Potting and mixing resins |
| 4,4'-Methylene-bis(2-chloroaniline) | - | b | Potting electronic parts |
| Styrene monomer | - | b | Attaching pin extensions |
| Vinyl methyl ether | 2 lb | c | - |
| Chlorine trifluoride | 13 cyl. | c | Propellant |
| Perchloral fluoride | 1 cyl. | c | Propellant |
| Bromine pentafluoride | 2 cyl. | c | Propellant |
| Halox | 7 cyl. | c | Propellant |

[a]U.S. Army 1952.

[b]USAEHA 1975a.

[c]Crane 1982.

**TABLE A.9 Propellant Components**

| | |
|---|---|
| Acetone | Lead stearate |
| Ammonium dichromate | M & V |
| Ammonium nitrate | N-Methyl-p-nitroaniline |
| Ammonium perchlorate | Metriol trinitrate |
| Ammonium picrate | Mineral jelly |
| Asphalt | Nitrocellulose, 12.2% N |
| Bd-MVP copolymer (90% butadiene, 10% 2-methyl-5-vinylpyridine copolymer) | Nitrocellulose, 12.6% N |
| | Nitrocellulose, 13.15% N |
| | 2-Nitrodiphenylamine |
| Butyl carbitol adipate | Nitroglycerin |
| Butyl carbitol formal | Nitroguanidine |
| Carbon black | PETN, Pentaerythritol tetranitrate |
| Cellulose acetate | |
| Diallyl maleate | Petrin |
| Di-n-butyl-phthalate | Polyester |
| Dibutyl sebacate | Polyisobutene |
| Di-(2-ethylhexyl)acetate | Polymethyl acrylate |
| Diethyl phthalate | Polystyrene |
| Diglycol dinitrate | Polyurethane |
| Dinitrophenoxyethanol | Polyvinyl chloride |
| Dioctyl phthalate | Potassium nitrate |
| Diphenylamine | Potassium perchlorate |
| Diphenylguanidine | Potassium sulfate |
| Ether | RDX, Cyclotrimethylene-trinitramine |
| Ethyl alcohol | |
| Ethyl centralite | Sucrose octaacetate |
| Graphite | Triacetin |
| GR-I rubber | Triethylene glycol dinitrate |
| HMX, Cyclotetramethylene-tetranitramine | Trinitrotoluene |

Source: USAEHA 1975a.

**TABLE A.10 Solventless Rocket Propellant Ingredients**

| Substance | Function | % |
|---|---|---|
| Nitrocellulose | Propellant | 49.4 |
| Nitroglycerin | Propellant | 35.3 |
| Diethyl phthalate | Plasticizer | 10.5 |
| Candelilla wax | Extrusion lubricant | 2.0 |
| 2-Nitrodiphenylamine | Stabilizer | 2.0 |
| Lead 2-ethylhexoate | Burning rate | 1.4 |
| Lead salicylate | Burning rate | 1.2 |

Source: USAEHA 1975a.

# APPENDIX B:

## RADIOACTIVE MATERIALS AT PICATINNY ARSENAL

TABLE B.1 Location and Conditions of Radiation Operations at Picatinny Arsenal[a]

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| 6 | Tritium watches (exempt items) were examined. Now removed. | H-3, mCi quantity | None. Area was swiped and found clean. |
| 18/Radio-Luminous Light Lab | Work with tritium lamps. | H-3, kCi quantity | None. Area is swiped regularly and kept clean. |
| 19 | Former weapons training facility that used DU items. Facility has since been renovated and is used as an inert training area. | U-238, mCi quantity | None. Tested in 1982 and found to be clean. |
| 22 | Machining of DU and thorium alloys. | U-238, lb quantity<br>Th-232, lb quantity | Surfaces are clean but there is potential for retention in or below wooden floor. |
| Boxcar behind Bldg. 22 | Change area for DU thorium machining operation in Bldg. 22. | U-238, trace quantity | None. Area was surveyed and found clean. |
| 23 | Machining of DU and thorium alloys in the 1950s. | U-238, mCi quantity<br>Th-232, mCi quantity | Minimal. Area checked in 1971 and found clean. Trace quantities could remain in the cracks in the floor, etc. |
| 31 | Machining of DU and thorium alloys. | U-238, mCi quantity<br>Th-232, mCi quantity | Surfaces are clean but there is potential for retention in or below wooden floor. |
| 55/56 | Storage facility for incoming shipments. | Mostly U-238 and H-3, occasionally others | None. Rad material not opened here. Area is swiped regularly and kept clean. |

TABLE B.1 (Cont'd)

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| 60/Test Area | Environmental testing of military equipment, some of which contained DU, tritium, or thorium. | U-238, mCi quantity<br>H-3, Ci quantity<br>Th-232, trace quantity | All areas known to have been contaminated have been decontaminated. |
| 60/vault | Used to store radioactive items between tests. Vault was contaminated in 1978 and was decontaminated by RAD SVCS Inc. | U-238, mCi quantity<br>Th-232, trace quantity | None. Area is clean. |
| 64 | DU items handled in building. Also thermal batteries and some other sealed sources. | U-238, mCi quantity<br>Pu-238, 8 Ci<br>Pm-147, mCi quantity | No record of contamination. Operations were of type unlikely to cause contamination. Building has since been renovated. |
| 68 | Weapons maintenance procedures developed utilizing DU items. | U-238, mCi quantity | None. Area kept clean. |
| 70 | Earth-covered magazine previously used to store three tritium gun sights. Now none. | H-3, mCi quantity | None. Area is clean. |
| 84 | Weapons maintenance procedures developed utilizing DU items. | U-238, mCi quantity | None. Area kept clean. |
| 91/Cage | Temporary storage of radioactive shipments. | H-3, Ci quantity<br>U-238, mCi quantity | None. Area monitored and kept clean. |

TABLE B.1 (Cont'd)

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| 92/Cal. Lab | Thickness gauging using betascope. Calibration using sealed sources. | Various beta emitters, sealed sources<br>Co-60, mCi quantity<br>Sr-90, mCi quantity<br>Am-241, mCi quantity | None. Area was monitored and sources have not leaked. |
| 92/Shock Test Area | Shock testing of DU-containing items. | U-238, mCi quantity | None. |
| 92/Lab Area | Optical comparer measurements of DU cores. | U-238, mCi quantity | None. A noninvasive test. |
| 94 | An administrative area in which some sabot rounds were found in 1982. Similar situations may have occurred other times, as well. | U-238, about 50 lb | None. No leakage was found. |
| 95 | Gauging of DU items. | U-238, mCi quantity | None. Area has been checked. |
| 95/Rm. 1 | Thickness gaging using betascope. | Various beta emitters, sealed sources | None. Area was monitored and sources have not leaked. |
| 167 | Radioactive tracers used in chemistry experiments. | H-3, mCi quantity<br>C-14, mCi quantity<br>U-238, mCi quantity<br>Th-232, mCi quantity | Minimal. The lab was decontaminated. The sink had unremovable U-238 contamination in a crack. Presumably some small quantity also went down the drain during the building's lifespan but could not be detected. |

TABLE B.1 (Cont'd)

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| Cage outside 167 | Waste storage for Bldg. 167 operations. | C-14<br>I-129, mCi quantity<br>Ba-133, mCi quantity<br>Pb-210, mCi quantity<br>Th-232, mCi quantity<br>Al-activated, mCi quantity<br>U-238, mCi quantity | No record of problems. |
| 183/ Wegman's Lab. | Surface measurements using meseran test solution. | C-14, µCi quantity | None. All particles detectable by meter were cleaned up. |
| 221 | Radiography using Cs-137 sealed source, currently in storage mode. | Co-60, 6.8 Ci (sealed) | None. No leaks. |
| 266 | Dew point measurements using radium-containing device. | Ra-266, 6.25 mCi | None. Item is leak tested and does not leak. |
| 307 | Electric shop worked on tritium-contaminated motor in 1983. | H-3, insignificant quantities (189 dpm/100 $cm^2$) | None. Quantities were too small to cause contamination. Area was found clean. |
| 312 | Storage area for health physics lab used primarily to hold material waiting for disposal. | U-238, mCi quantity<br>H-3, Ci quantity<br>Co-60, Ci quantity (sealed)<br>Other isotopes in future | None. Area is kept clean and swiped frequently. |
| 315 | Machining, mechanical testing, sample preparation and corrosion testing of DU. | U-218, Ci quantity | Minor. This facility is slightly contaminated but can be easily decontaminated. |

TABLE B.1 (Cont'd)

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| 316 | Research in high-rate cooling of DU alloys. | U-238, mCi quantity | Minor. This facility is slightly contaminated but can be easily decontaminated. |
| 318 | Closed oven with DU contamination inside was found in 1987. Probably from Frankford Arsenal. Exterior of oven was clean. Oven was disposed of. | U-238, trace quantity | None. Area was swiped and found clean. |
| 319 | Static meters stored in cabinet. | H-3, mCi quantity | None. No leaks. |
| 320 | Health physics lab and storage area. | Alpha, beta, and gamma emitters of many types in sealed sources<br>Solid uranium and thorium compounds, lb quantity<br>Solid uranium metal for ammo. penetrators, up to 200 lb<br>H-3 in sealed vials for luminous light sources, several hundred Ci<br>Low-level waste for disposal | None. Facility is swiped regularly and kept clean. |
| 352 | Metallurgical tests (hardness, tensile strength). | U-238, µCi quantity | None. Area was monitored. |
| 355/Rm. 20 | Examination of DU metallurgical samples. | U-238, µCi quantity | None. Area kept clean. |
| 355/Rm. 18 | Mechanical testing of DU samples. | U-238, mCi quantity | None. Area kept clean. |

TABLE B.1 (Cont'd)

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| 355/Rm. 38 | Past corrosion testing of DU samples. | U-238, mCi quantity | None. Area kept decontaminated. |
| 355/Other rooms | Electron micrography of DU samples. | U-238, nCi quantity | None. Area kept clean. |
| 407/Rm. 40 | Some work with small quantities of tracers. | H-3 and C-14, µCi quantity | None. Area is clean and has since been renovated. |
| 407/Rms. 36 and 42 | Storage and use of an explosives detector and a research chromatograph. | Ni-63 sealed sources, mCi quantity | None. No leakage. |
| 514 | Radiography using sealed Co-60, Cs-137, and PuBe sources. | Co-60, 12 kCi<br>Cs-137, 250 Ci<br>Pu, unknown quantity (all sealed) | None. Area monitored regularly and no leaks occurred. |
| 604C | Removal of DU cores from DU penetrators by remote control. Ongoing. Some work was done on broken LAW sights. | U-238, mCi quantity<br>Pm-147, mCi quantity in microspheres | None. Area is checked for DU. PM-147 was cleaned up. |
| 611B | Indoor firing range for DU subcaliber penetrators. | U-238, mCi quantity | Interior of facility is contaminated. A fire in the HEPA filter system released a few particles of DU, which were cleaned up. |
| 617C | Removal of DU cores from DU penetrators in 1978. Other similar activities since. | U-238, mCi quantity | None. Area was checked. |
| 620 | Powder level gaging using a sealed Cs-137 sealed source. | Cs-137, 2 Ci (sealed) | None. No leaks. |

TABLE B.1 (Cont'd)

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| 654/ (Area 3) | Outdoor tests of 2 BLU-63 warheads containing a total of less than 2 lb DU for velocity measurements. | U-238, less than 2 lb | None. All particles detectable by meter were removed. Remainder (too small to detect) was spread over an area of 30,000 $ft^2$. Air was sampled during test and never exceeded 1.1 E-11 µCi/mL. |
| 908 | Development of radiographic devices. Eddy current testing of DU cores. | Co-60, 100 Ci (sealed)<br>Cf-252, 5.4 Ci (sealed)<br>U-238, mCi quantity | None. Sources are leak tested regularly. Eddy current test area was swiped regularly. |
| 1090 | Radiographic System under development. | Co-60, 13 kCi | None. No leakage. |
| 1207 | A box with one DU-containing item was found in 1982. | U-238, mCi quantity | None. Area was checked and found to be clean. |
| 1462 | Used a sealed Ba-133 source. | Ba-133, mCi quantity | None. Source did not leak. |
| 1503 Chamber 7 | Conditioning box in which broken M422s (contained DU) were stored. | U-238 , mCi quantity | None. Area was decontaminated. |
| 1505 Area | Used to test M422s. Some broke, releasing pieces of uranium. | U-238, mCi quantity | Possible. Detectable material was picked up and stored in 1503. |
| 3018 | Earth-covered magazine used as a radioactive material storage area for the Health Physics laboratory. | Various isotopes and quantities similar to those listed for Bldgs. 320, 3021, and 3030 | None except small quantity of H-3, which remains from the operation, that evaded all decontamination efforts. |

TABLE B.1 (Cont'd)

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| 3021/Vault Rm. D | Former Health Physics Lab storage area. | U-238, several hundred lb<br>H-3, several hundred Ci<br>Co-60, several hundred Ci (sealed)<br>Cs-137, multi Ci, (sealed)<br>Ir-192, mCi (sealed)<br>Ra-226, µCi (compasses)<br>Cf-252, mG (sealed)<br>Sr-90 mCi (sealed)<br>Pu-238, 8 Ci in thermal batteries<br>C-14, µCi quantities in small solution vials<br>Other isotopes, µCi quantities in sealed sources | None. Area is clean except for a slightly contaminated hood used to hold leaking H-3 light sources. This hood may be removed. |
| 3021/ Dougherty Box | Irradiation of samples using a sealed Co-60 source. | Co-60, 15 kCi (sealed) | None. No leakage. |
| 3028/ Rms. 124 and 198 | Storage of explosives detector and research chromatograph. | Ni-63, 10 mCi (sealed) | None. Leak tested. No leaks found. |
| 3028/ Several rooms | Some thorium and uranium compounds were found stored but not used. | U-238, mCi quantity<br>Th-232, mCi quantity | None. Chemicals were collected and area surveyed and found clean. |

TABLE B.1 (Cont'd)

| Bldg./Room | Description of Operation | Isotopes and Quantities | Contamination Potential |
|---|---|---|---|
| 3030 | Current Health Physics Lab storage facility. In the past was used to store a wide variety of isotopes. Currently used for classified storage. | U-238, mCi quantity<br>H-3, Ci quantity in luminous sources<br>Pm-147, mCi quantity in compounds<br>Co-60, Ci quantity<br>Cs-137, Ci quantity<br>C-14, mCi quantity sealed and in tagged compounds<br>Sr-90, mCi quantity<br>Various other isotopes in check sources | None except small quantity of H-3 (200 dpm/100 cm) remaining on the shelves where H-3 light sources were stored. |
| 3109 | Environmental testing of military items, some with DU or H-3. | U-238, mCi quantity<br>H-3, Ci quantity | None known. |
| 3114 | Once had items containing DU. | U-238, unknown small quantity | None. Checked and found clean. |
| 3208 | Use and storage of several static meters containing H-3. | H-3, mCi quantity | None. No leakage. |
| 3337 | Storage of a lathe contaminated with DU. | U-238, trace quantity | None. Area was checked. |
| 3338 | Storage of an oven with possible interior contamination of DU. | U-238, trace quantity | None. Oven is closed. Exterior is clean. |

[a]It is DOD policy not to release information accessible to the public or foreign governments that would tend to confirm or deny the presence of nuclear weapons or their parts or that might otherwise indicate their presence or absence. Under this policy, DOD cannot list the presence or absence of special nuclear material such as plutonium-239, uranium-235, or other similar materials. However, DOD is not aware of any location that contains any significant environmental contamination of special nuclear material and believes that if there were any such locations at Picatinny Arsenal, DOD would be aware of them.

Source: Duncan 1990.

# APPENDIX C:

# CHEMICAL ANALYSIS CATEGORIES

# APPENDIX C:

# CHEMICAL ANALYSIS CATEGORIES

**TABLE C.1 The Contract Laboratory Program Hazardous Substances (TCL+30 Parameters)**

| Compound | USATHAMA Test Name | Compound | USATHAMA Test Name |
|---|---|---|---|
| Volatiles | | 40. 1,4-Dichlorobenzene | 14DCLB |
| | | 41. Benzyl alcohol | BZALC |
| 1. Chloromethane | CH3CL | 42. 1,2-Dichlorobenzene | 12DCLB |
| 2. Bromomethane | CH3BR | 43. 2-Methylphenol | 2MP |
| 3. Vinyl chloride | C2H3CL | 44. Bis(2-chloroisopropyl) ether | B2CIPE |
| 4. Chloroethane | C2H5CL | 45. 4-methylphenol | 4MP |
| 5. Methylene chloride | CH2CL2 | 46. N-Nitrosodipropylamine | NNDNPA |
| 6. Acetone | ACET | 47. Hexachloroethane | CL6ET |
| 7. Carbon disulfide | CS2 | 48. Nitrobenzene | NB |
| 8. 1,1-Dichloroethene | 11DCE | 49. Isophorone | ISOPHR |
| 9. 1,1-Dichloroethane | 11DCLE | 50. 2-Nitrophenol | 2NP |
| 10. trans-1,2-Dichloroethylene | T12DCE | 51. 2,4-Dimethylphenol | 24DMPN |
| 11. Chloroform | CHCL3 | 52. Benzoic acid | BENZOA |
| 12. 1,2-Dichloroethane | 12DCLE | 53. Bis(2-chloroethoxy) methane | B2CEXM |
| 13. 2-Butanone | MEK | 54. 2,4-Dichlorophenol | 24DCLP |
| 14. 1,1,1-Trichloroethane | 111TCE | 55. 1,2,4-Trichlorobenzene | 124TCB |
| 15. Carbon tetrachloride | CCL4 | 56. Naphthalene | NAP |
| 16. Vinyl acetate | C2AVE | 57. 4-Chloroaniline | 4CANIL |
| 17. Bromodichloromethane | BRDCLM | 58. Hexachlorobutadiene | HCBD |
| 18. 1,1,2,2-Tetrachloroethane | TCLEA | 59. 4-Chloro-3-methylphenol | 4CL3C |
| 19. 1,2-Dichloropropane | 12DCLP | (para-chloro-meta-cresol) | |
| 20. trans-1,3-Dichloropropene | T13DCP | 60. 2-Methylnaphthalene | 2MNAP |
| 21. Trichloroethene | TRCLE | 61. Hexachlorocyclopentadiene | CL6CP |
| 22. Dibromochloromethane | DBRCLM | 62. 2,4,6-Trichlorophenol | 246TCP |
| 23. 1,1,2-Trichloroethane | 112TCE | 63. 2,4,5-Trichlorophenol | 245TCP |
| 24. Benzene | C6H6 | 64. 2-Chloronaphthalene | 2CNAP |
| 25. cis-1,3-Dichloropropene | C13DCP | 65. 2-Nitroaniline | 2NANIL |
| 26. 2-Chloroethylvinyl ether | 2CLEVE | 66. Dimethyl phthalate | DMP |
| 27. Bromoform | CHBR3 | 67. Acenaphthylene | ANAPYL |
| 28. 2-Hexanone | MNBK | 68. 3-Nitroaniline | 3NANIL |
| 29. 4-Methyl-2-pentanone | MIBK | 69. Acenaphthene | ANAPNE |
| 30. Tetrachloroethene | TCLEE | 70. 2,4-Dinitrophenol | 24DNP |
| 31. Toluene | MEC6H5 | 71. 4-Nitrophenol | 4NP |
| 32. Chlorobenzene | CLC6H5 | 72. Dibenzofuran | DBZFUR |
| 33. Ethylbenzene | ETC6H5 | 73. 2,4-Dinitrotoluene | 24DNT |
| 34. Styrene | STYR | 74. 2,6-Dinitrotoluene | 26DNT |
| 35. Total xylenes | TXYLEN | 75. Diethyl phthalate | DEP |
| | | 76. 4-Chlorophenylphenyl ether | 4CLPPE |
| Semivolatiles | | 77. Fluorene | FLRENE |
| | | 78. 4-Nitroaniline | 4NANIL |
| 36. Phenol | PHENOL | 79. 4,6-Dinitro-2-methylphenol | 46DN2C |
| 37. Bis(2-chloroethyl) ether | B2CLEE | 80. N-Nitrosodiphenylamine | NNDPA |
| 38. 2-Chlorophenol | 2CLP | 81. 4-Bromophenylphenyl ether | 4BRPPE |
| 39. 1,3-Dichlorobenzene | 13DCLB | 82. Hexachlorobenzene | CL6BZ |

TABLE C.1 (Cont'd)

| Compound | USATHAMA Test Name | Compound | USATHAMA Test Name |
|---|---|---|---|
| Semivolatiles (Cont'd) | | 118. Chlordane | CLDAN |
| | | 119. Toxaphene | TXPHEN |
| 83. Pentachlorophenol | PCP | 120. Aroclor 1016 | PCB016 |
| 84. Phenanthrene | PHANTR | 121. Aroclor 1221 | PCB221 |
| 85. Anthracene | ANTRC | 122. Aroclor 1232 | PCB232 |
| 86. Di-n-butyl phthalate | DNBP | 123. Aroclor 1242 | PCB242 |
| 87. Fluoranthene | FANT | 124. Aroclor 1248 | PCB249 |
| 88. Pyrene | PYR | 125. Aroclor 1254 | PCB254 |
| 89. Butylbenzyl phthalate | BBZP | 126. Aroclor 1260 | PCB260 |
| 90. 3,3'-Dichlorobenzidine | 33DCBD | | |
| 91. Benzo(a)anthracene | BAANTR | Dioxin | |
| 92. Bis(2-ethylhexyl) phthalate | B2EHP | | |
| 93. Chrysene | CHRY | 127. 2,3,7,8-TCDD | |
| 94. Di-n-octyl phthalate | DNOP | | |
| 95. Benzo(b)fluoranthene | BBFANT | Metals | |
| 96. Benzo(k)fluoranthene | BKFANT | | |
| 97. Benzo(a)pyrene | BAPYR | 128. Aluminum | AL |
| 98. Indeno(1,2,3-c,d)pyrene | ICDPYR | 129. Antimony | SB |
| 99. Dibenzo(a,h)anthracene | DBAHA | 130. Arsenic | AS |
| 100. Benzo(g,h,i)perylene | BGHIPY | 131. Barium | BA |
| | | 132. Beryllium | BE |
| Pesticides and PCBs | | 133. Cadmium | CD |
| | | 134. Calcium | CA |
| 101. Alpha-BHC | ABHC | 135. Chromium | CR |
| 102. Beta-BHC | BBHC | 136. Cobalt | CO |
| 103. Delta-BHC | DBHC | 137. Copper | CU |
| 104. Gamma-BHC (Lindane) | LIN | 138. Iron | FE |
| 105. Heptachlor | HPCL | 139. Lead | PB |
| 106. Aldrin | ALDRN | 140. Magnesium | MG |
| 107. Heptachlor epoxide | HPCLE | 141. Manganese | MN |
| 108. Endosulfan I | AENSLF | 142. Mercury | HG |
| 109. Dieldrin | DLDRN | 143. Nickel | NI |
| 110. 4,4'-DDE | PPDDE | 144. Potassium | K |
| 111. Endrin | ENDRN | 145. Selenium | SE |
| 112. Endosulfan II | BENSLF | 146. Silver | AG |
| 113. 4,4'-DDD | PPDDD | 147. Sodium | NA |
| 114. Endosulfan sulfate | ESFSO4 | 148. Thallium | TL |
| 115. 4,4'-DDT | PPDDT | 149. Vanadium | V |
| 116. Endrin ketone | ENDRNK | 150. Zinc | ZN |
| 117. Methoxychlor | MEXCLR | | |

**TABLE C.2 Explosives**

| Compound | USATHAMA Test Name |
|---|---|
| 1,3-Dinitrobenzene | 13DNB |
| 1,3,5-Trinitrobenzene | 135TNB |
| 2,4-Dinitrotoluene | 24DNT |
| 2,6-Dinitrotoluene | 26DNT |
| 2,4,6-Trinitrotoluene (TNT) | 246TNT |
| Cyclotetramethylenetetranitramine (HMX) | HMX |
| Hexahydro-1,3,5-trinitro-1,3,4-triazine (RDX) | RDX |
| N-methyl-N,2,4,6-tetranitroaniline (tetryl) | TETRYL |
| Nitrocellulcse | NC |
| Nitroglycerin | NG |

**TABLE C.3 Macroparameters**

| | |
|---|---|
| Sulfate | Chloride |
| Calcium | Sodium |
| Field pH | Field specific conductance |
| Total dissolved solids | Depth to groundwater |

**TABLE C.4 TCLP Parameters**

| | |
|---|---|
| Metals | |
| Arsenic | Lead |
| Barium | Mercury |
| Cadmium | Selenium |
| Chromium | Silver |
| Organics | |
| Benzene | Hexachlorobenzene |
| Carbon Tetrachloride | Hexachlorobutadiene |
| Chlordane | Hexachloroethane |
| Chlorobenzene | Methoxychlor |
| Chloroform | Methyl ethyl ketone |
| o-Cresol | Nitrobenzene |
| m-Cresol | Pentachlorophenol |
| p-Cresol | Pyridine |
| 2,4-D | Tetrachloroethylene |
| 1,4-Dichlorobenzene | Toxaphene |
| 1,2-Dichlorobenzene | Trichloroethylene |
| 1,1-Dichloroethylene | 2,4,5-Trichlorophenol |
| 2,4-Dinitrotoluene | 2,4,6-Trichlorophenol |
| Endrin | 2,4,5-TP (Silvex) |
| Heptachlor (and its hydroxide) | Vinyl Chloride |

Source: Federal Register Vol. 55, No. 61, pp. 11798-11877, March 29, 1990.

**TABLE C.5 Herbicides**

| | |
|---|---|
| 2,4-D | 2,4,5-TP (Silvex) |
| Dacthol | Dicamba |
| Ammate "X" | Dowpon |
| Hyver | Dinoseb |
| Dichloroprop | MCPA |
| 2,4-DB | MCPP |

Sources: Rigassio et al 1975; Analyte Comparison List for TCL, PPL, and SW-846.

**TABLE C.6 Selected Propellant Components[a]**

| | |
|---|---|
| Explosives | Metals |
| Nitrocellulose | Chromium (+6) |
| Nitroglycerin | Lead |
| HMX | |
| RDX | Other |
| PETN | Diphenylamine |
| TNT | 2-Nitrodiphenylamine |
| | Nitrate |
| Phthalates | |
| Di-n-butyl phthalate | |
| Diethyl phthalate | |
| Dioctyl phthalate | |

[a]Propellants are listed as analytical category 8 in Tables 5.2-5.4 (see Sec. 5.3 of this volume).

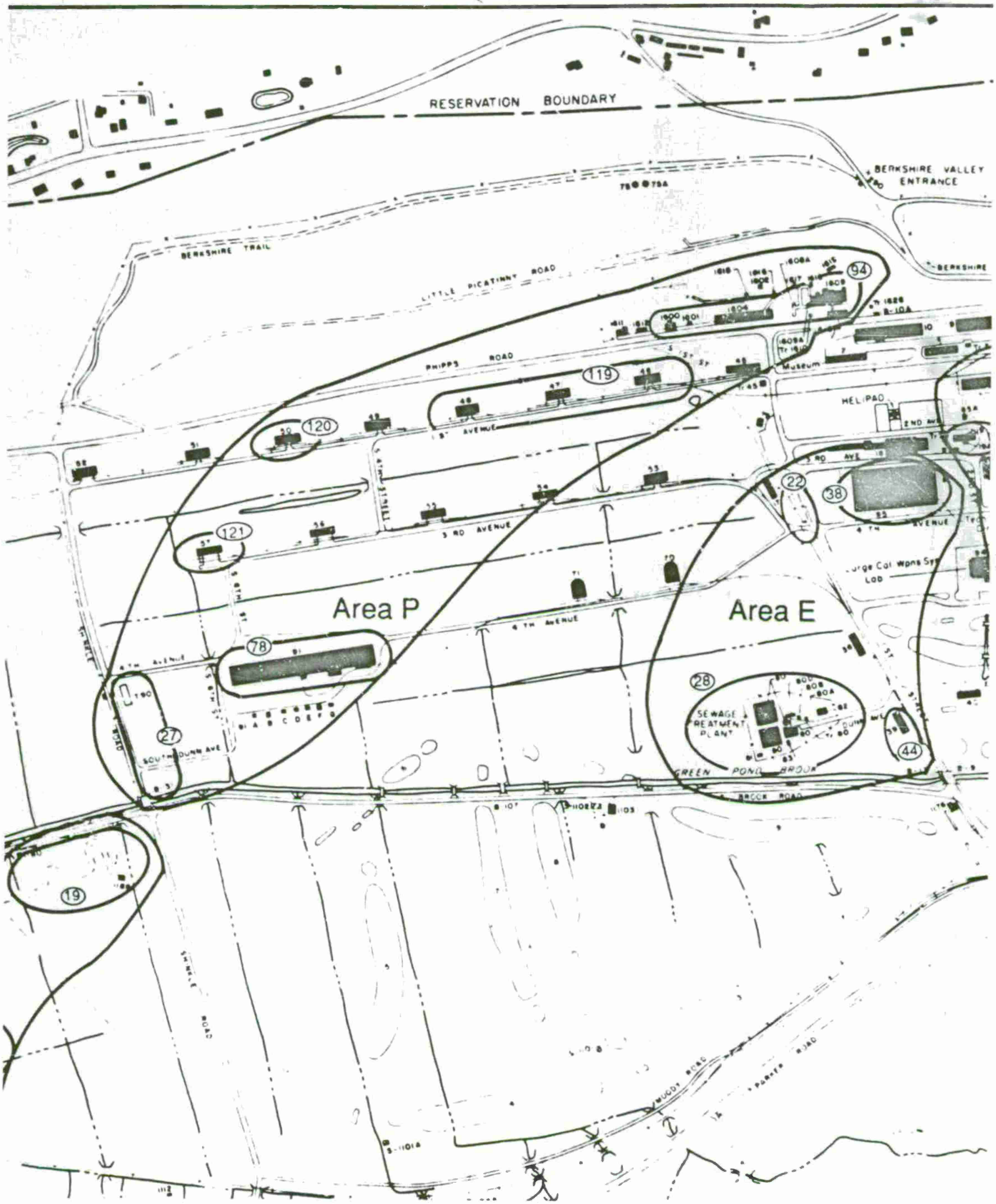
**TABLE C.7 Explosives and Propellants[a]**

| Explosives | |
|---|---|
| 13DNB | **Metals** |
| 135TNB | Chromium (+6) |
| 24DNB | Lead |
| 24DNT | |
| 26DNT | **Phthalates** |
| 246TNT | Di-n-butyl phthalate |
| HMX | Diethyl phthalate |
| RDX | Dioctyl phthalate |
| Tetryl | |
| NC | **Other** |
| NG | Diphenylamine |
| PETN | 2-Nitrodiphenylamine |
| | Nitrate |

[a]This table combines analytes from Tables C.2 and C.6.

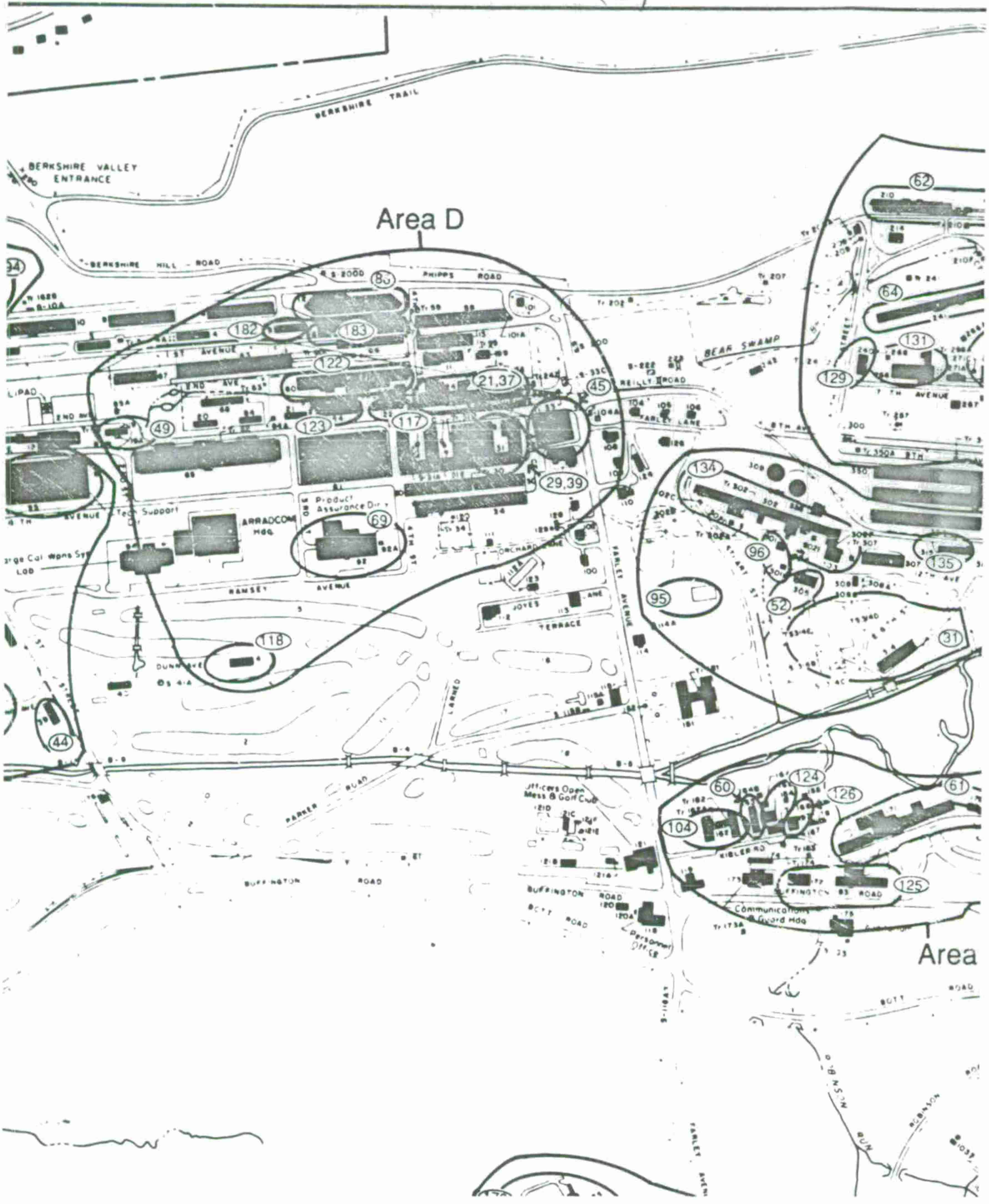
CORPS OF ENGINEERS (A)

(B)



RESERVATION BOUNDARY
BERKSHIRE VALLEY ENTRANCE
BERKSHIRE TRAIL
LITTLE PICATINNY ROAD
PHIPPS ROAD
1ST AVENUE
3RD AVENUE
4TH AVENUE
HELIPAD
Museum
94
119
120
121
22
38
Area P
Area E
78
27
28
44
19
SEWAGE TREATMENT PLANT
SOUTH DUNN AVE
GREEN POND BROOK

(C)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BERKSHIRE VALLEY ENTRANCE
BERKSHIRE HILL ROAD
PHIPPS ROAD
BEAR SWAMP
1ST AVENUE
REILLY ROAD
FARLEY LANE
Tech Support
ARRADCOM Hdq.
Product Assurance Dir.
RAMSEY AVENUE
ORCHARD LANE
JOYES LANE
TERRACE
FARLEY AVENUE
Officers Open Mess & Golf Club
PARKER ROAD
BUFFINGTON ROAD
BOTT ROAD
Personnel Office
KIBLER RD
Communications & Guard Hdq
Area
82
182
183
122
21,37
45
49
123
117
29,39
69
118
44
94
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95
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135
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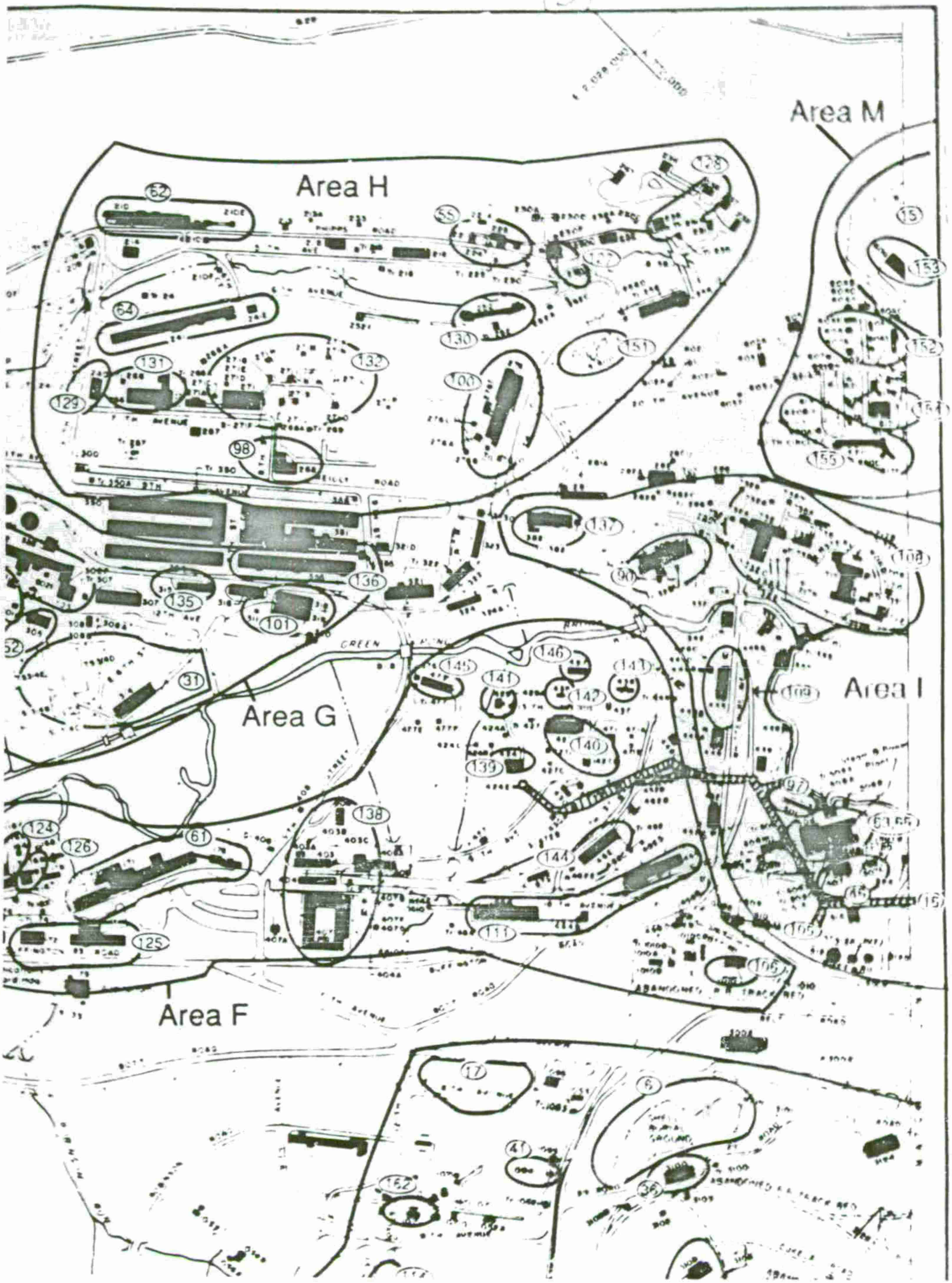
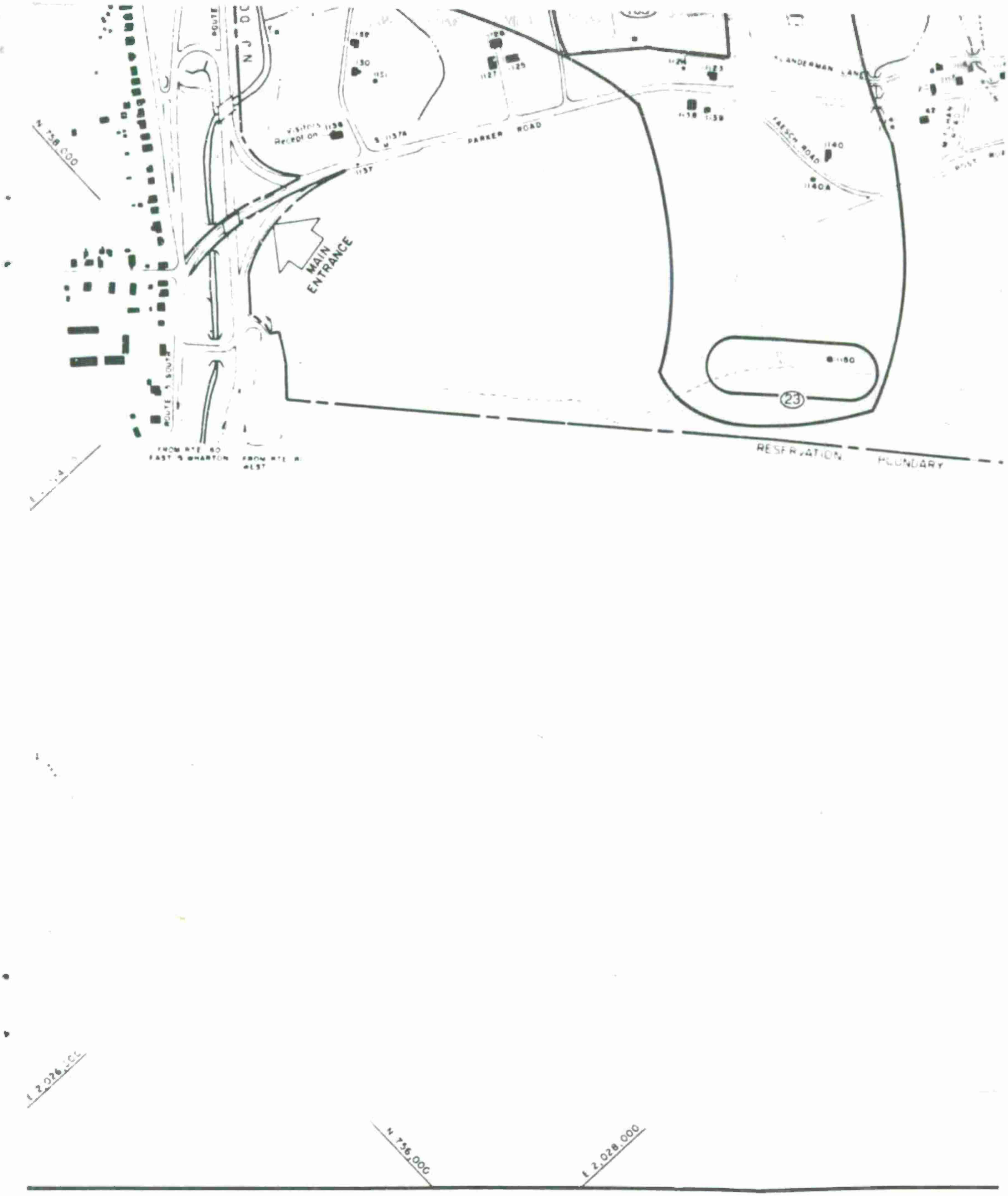
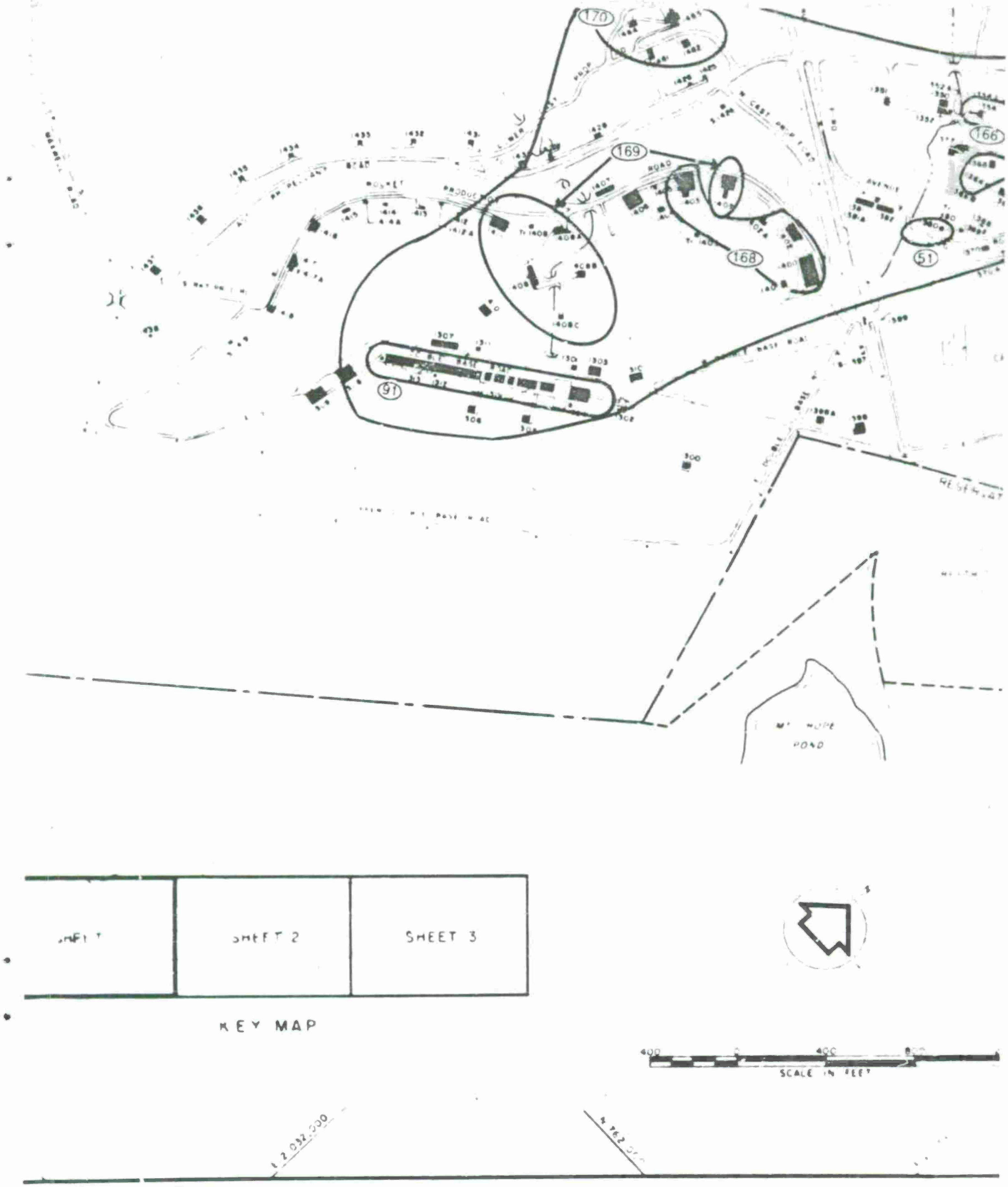
124
126
61
104
125

U. S. ARMY

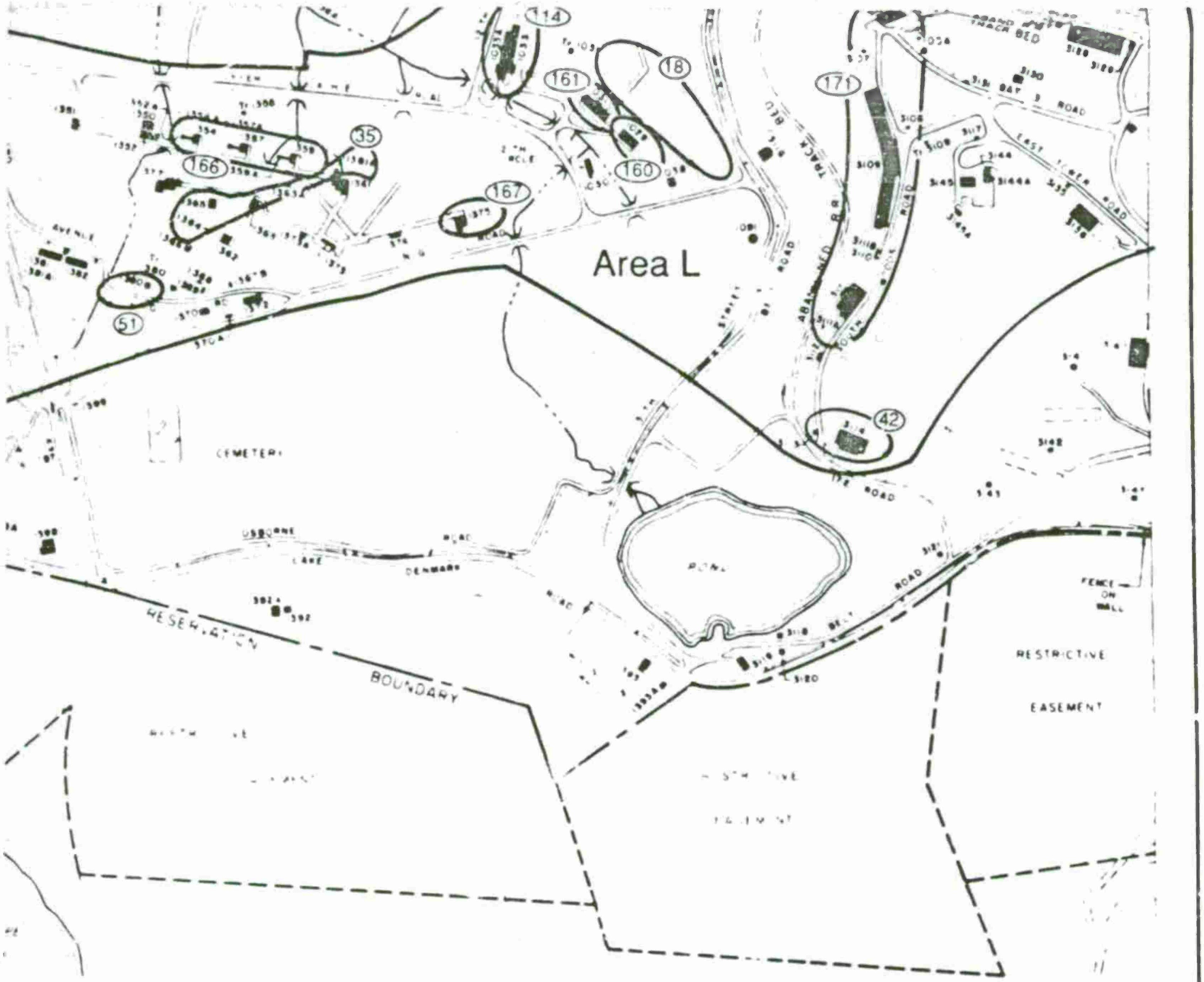



MAIN ENTRANCE
PARKER ROAD
Visitors Reception
RESERVATION BOUNDARY
FAESCH ROAD
ROUTE 15 SOUTH
FROM RTE. 80 EAST & WHARTON
23
N 758,000
N 756,000
E 2,026,000
E 2,028,000

POST ROAD
BOUNDARY
KEY



170
169
168
166
91
51
MT. HOPE
POND
SHEET 2
SHEET 3
KEY MAP
400
0
400
800
SCALE IN FEET




# PLATE 1.1

| | |
|---|---|
| ARCHITECT ENGINEER | CORPS OF ENGINEERS U.S. ARMY<br>OFFICE OF THE DISTRICT ENGINEER<br>NEW YORK DISTRICT NEW YORK NEW YORK |

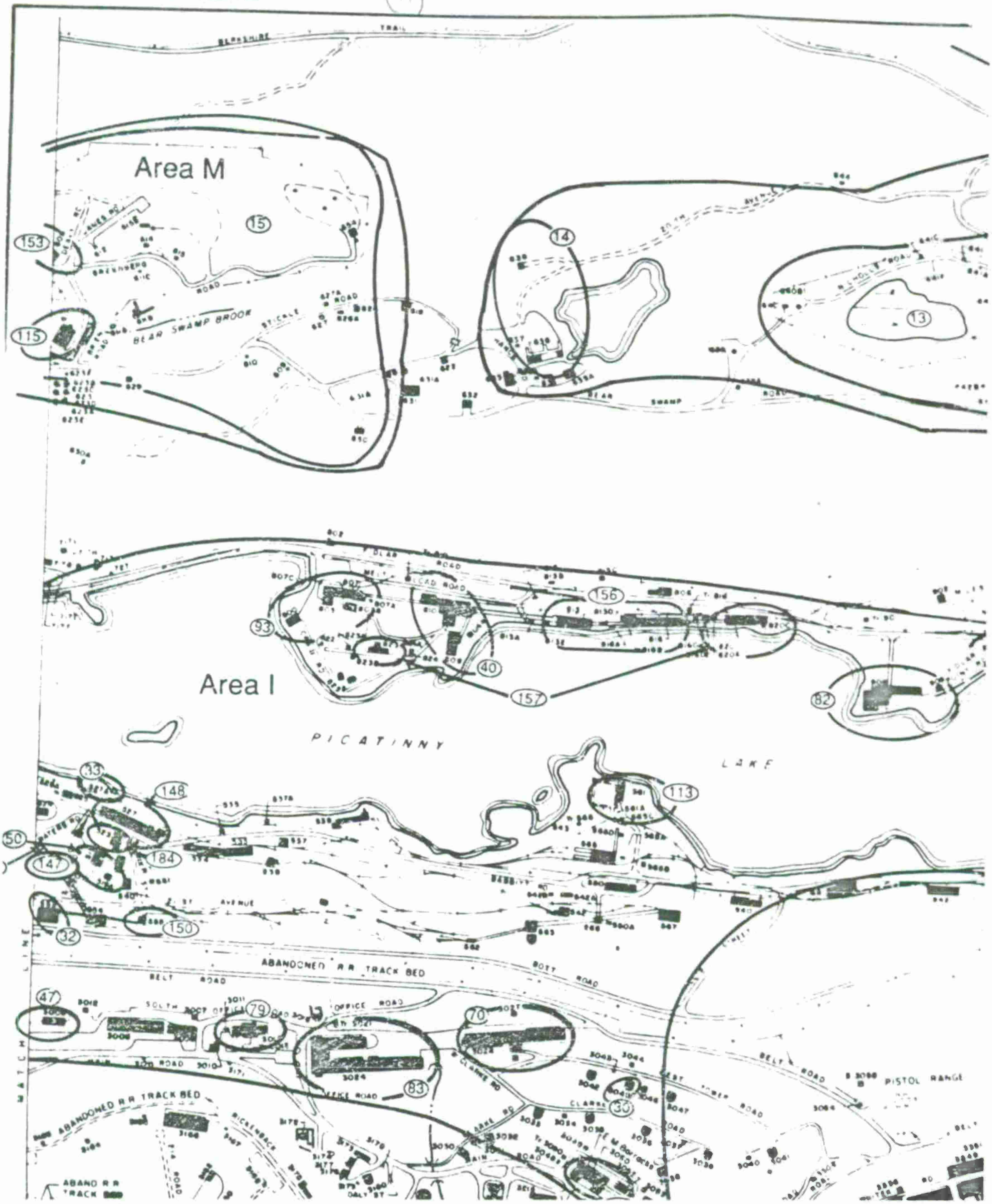
## MASTER PLAN MAP OF PICATINNY ARSENAL SHOWING REMEDIAL INVESTIGATION SITES (BOUNDARIES ARE APPROXIMATE)

RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL

DATE

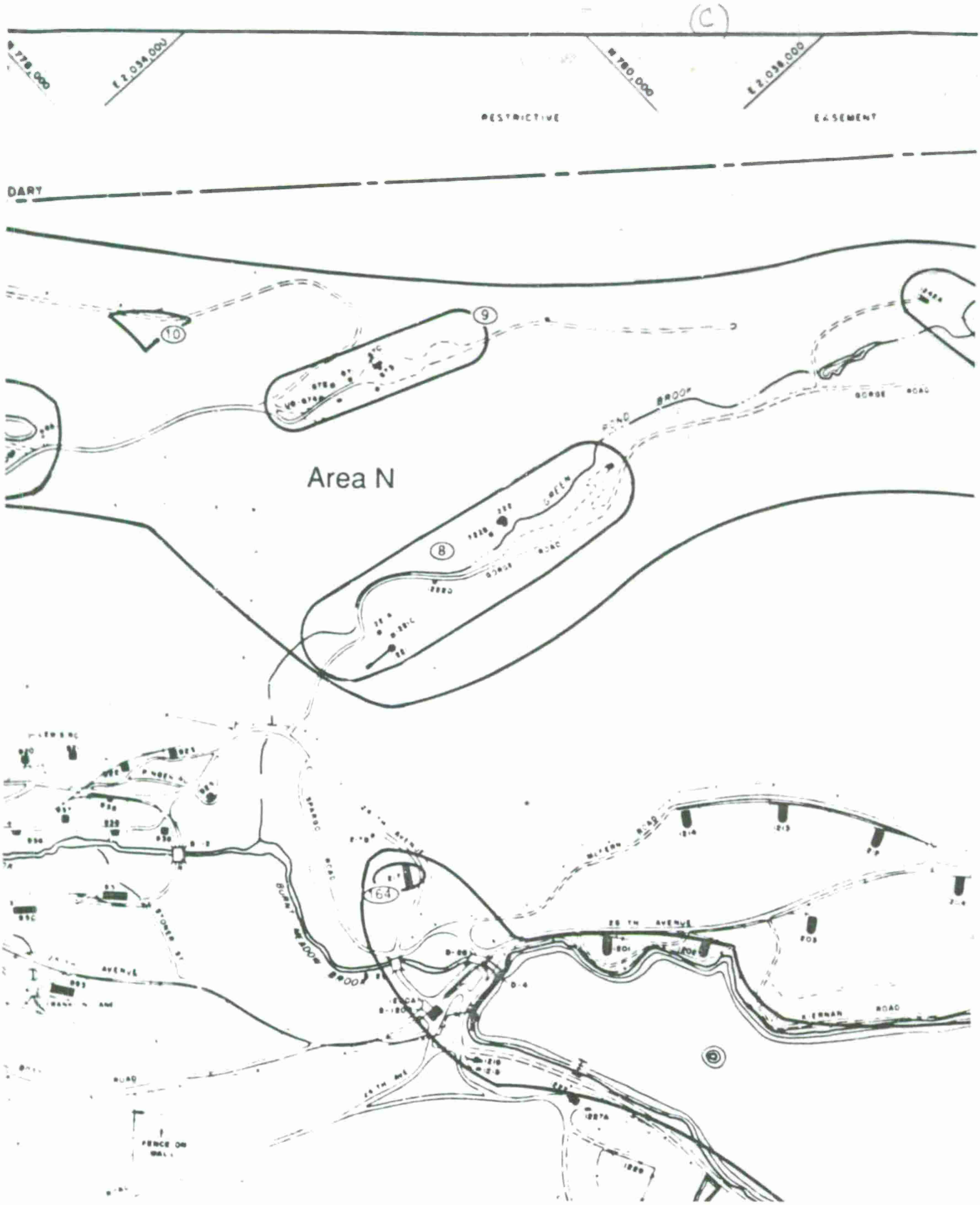
| REVIEWED & COMMENTED ON BY MAJOR COMMANDER & FORWARDED TO THE CHIEF OF ENGINEERS | DATE | DRAWING NO |
|---|---|---|
| DATE | SHEET NO 1 OF 2 | FILE NO |

CORPS OF ENGINEERS (A)



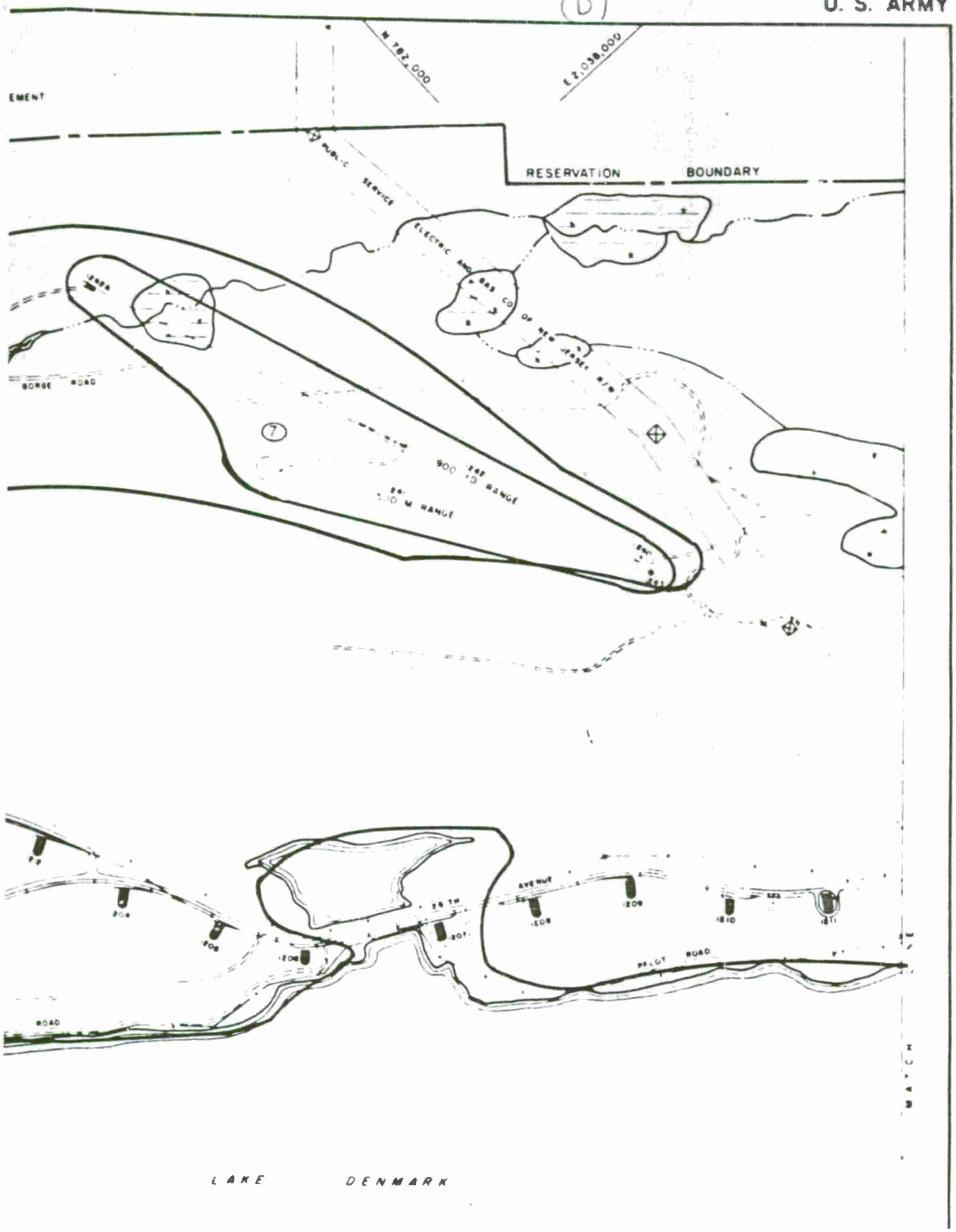
(B)

RESERVATION
BOUNDARY
E 2,034,000
N 778,000
12
13
11
10
BEAR SWAMP ROAD
MILES ROAD
NIXON ST
71
TRENBERTH TRIANGLE
158
159
THOMAS RD
HOURIGAN STREET
GREEN POND BROOK
GOLDSWORTHY LANE
PETERSON STREET
PISTOL RANGE
BELT ROAD
RICHARDS STREET
LOWER BELT RD
173
174

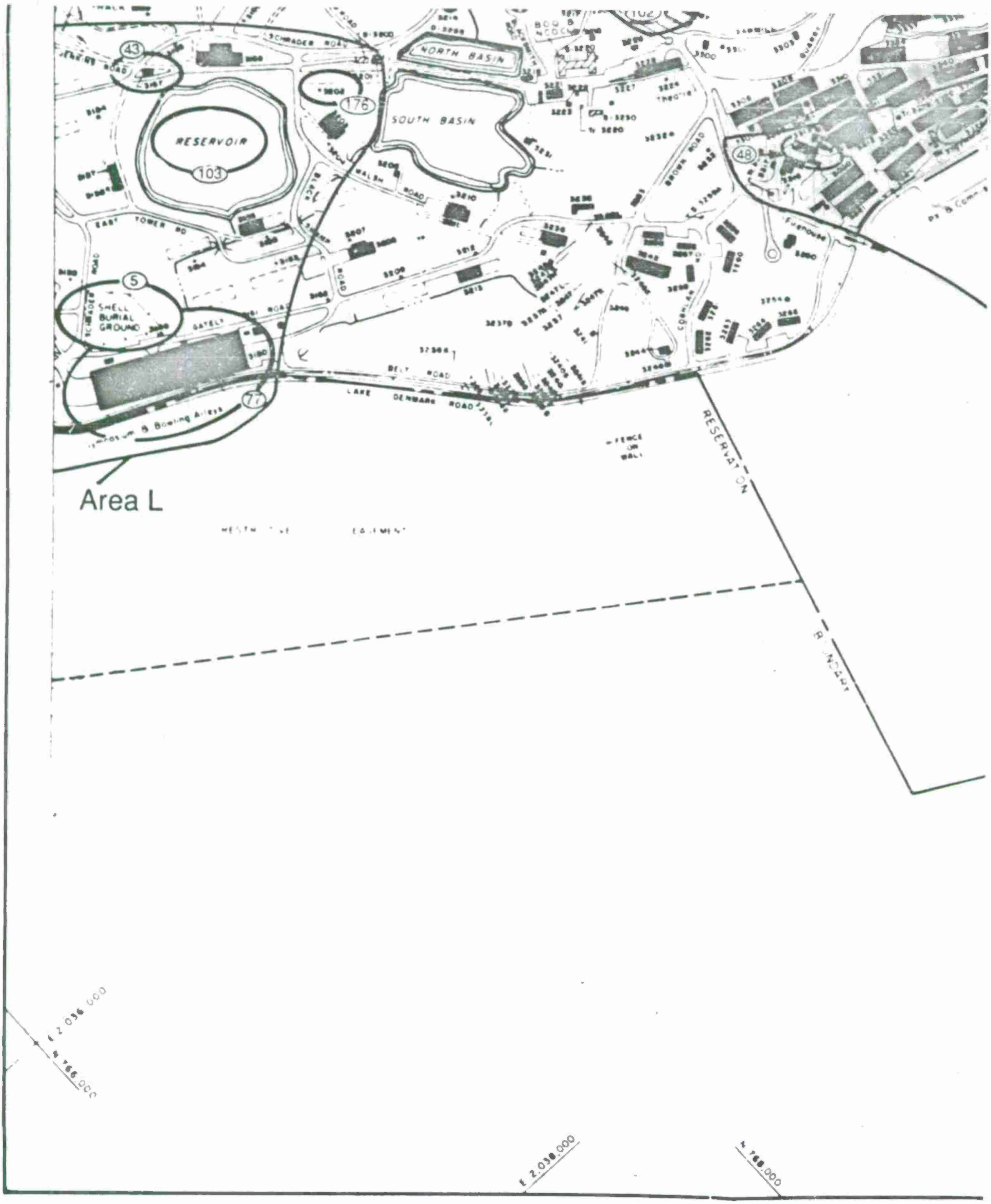

(C)
E 2,034,000
N 780,000
E 2,038,000
RESTRICTIVE
EASEMENT
DARY
10
9
8
164
Area N
GORGE ROAD
POND BROOK
25TH AVENUE
BURNT MEADOW BROOK
FENCE ON WALL

(D)

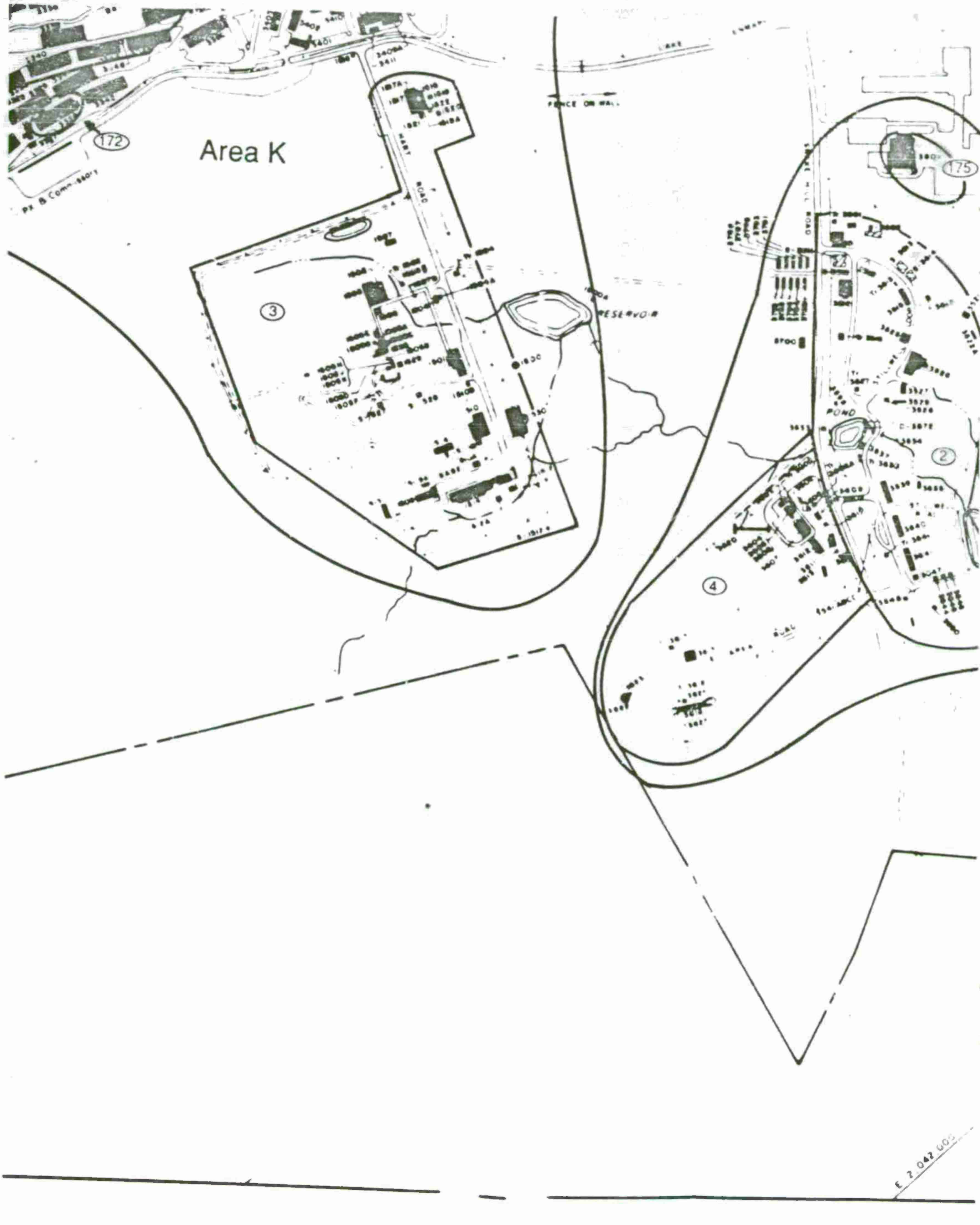
U. S. ARMY



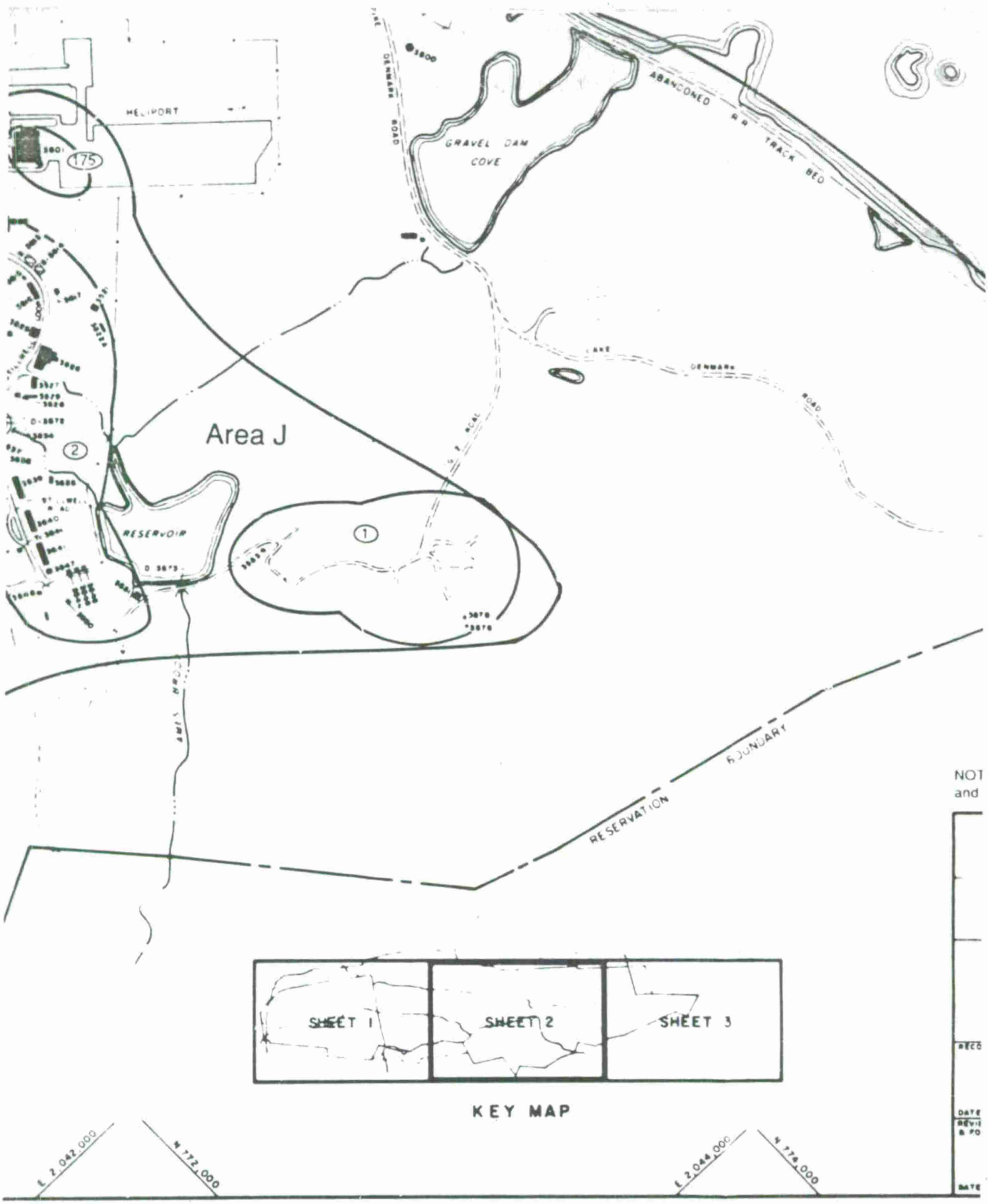
N 782,000
E 2,038,000
EMENT
RESERVATION BOUNDARY
PUBLIC SERVICE ELECTRIC AND GAS CO OF NEW JERSEY R/W
GORGE ROAD
7
900 YD RANGE
AVENUE
PFLOT ROAD
ROAD
LAKE DENMARK
MATCH

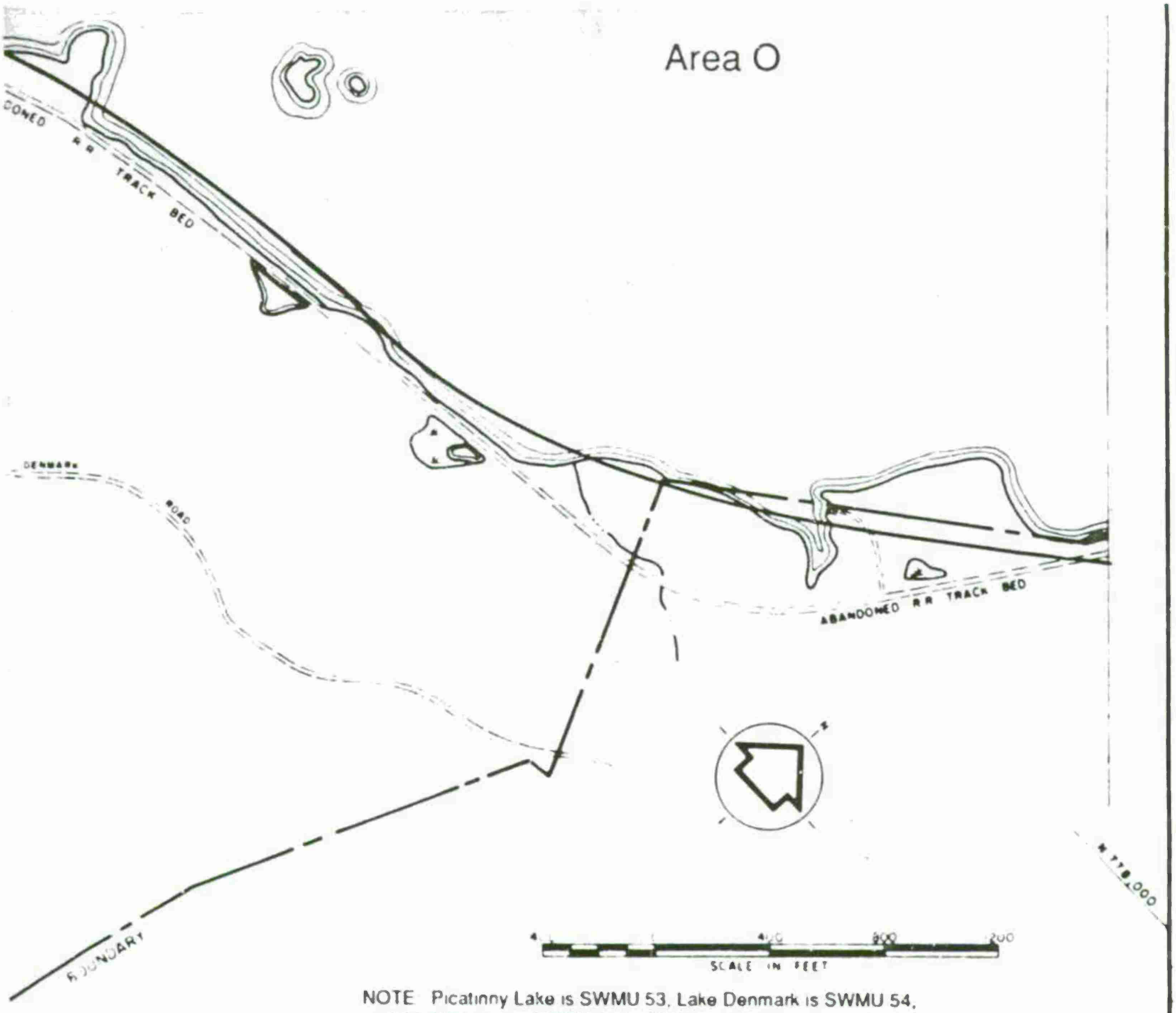


SCHRADER ROAD
NORTH BASIN
SOUTH BASIN
RESERVOIR
103
43
176
48
5
77
SHELL
BURIAL
GROUND
EAST TOWER RD
WALSH ROAD
BROWN ROAD
BELT ROAD
LAKE DENMARK ROAD
Firehouse
FENCE
OR
WALL
RESERVATION
Area L
E 2,038,000
N 768,000



Area K
172
175
3
2
4
RESERVOIR
POND
FENCE OR WALL
E 2 042 602


HELIPORT
175
GRAVEL DAM COVE
ABANDONED R.R. TRACK BED
DENMARK ROAD
LAKE DENMARK ROAD
Area J
1
2
RESERVOIR
RESERVATION BOUNDARY
NOT
and
SHEET 1
SHEET 2
SHEET 3
KEY MAP
E 2,042,000
N 772,000
E 2,044,000
N 774,000




NOTE: Picatinny Lake is SWMU 53, Lake Denmark is SWMU 54, and the 500 area is SWMU 110. SWMUs 177 and 178 are not shown.

# PLATE 1.1

| | |
|---|---|
| JOHN J. KASSNER & CO., INC.<br>ARCHITECT · ENGINEER<br>LAKE SUCCESS, NEW YORK | CORPS OF ENGINEERS · U.S. ARMY<br>OFFICE OF THE DISTRICT ENGINEER<br>NEW YORK DISTRICT · NEW YORK, NEW YORK |

## MASTER PLAN MAP OF PICATINNY ARSENAL SHOWING REMEDIAL INVESTIGATION SITES (CONTINUED)

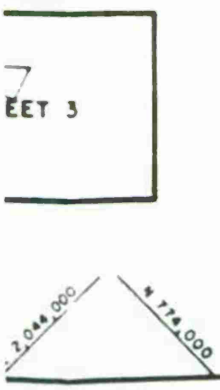
RECOMMENDED BY THE INSTALLATION PLANNING BOARD FOR APPROVAL

DATE

REVIEWED & COMMENTED ON BY MAJOR COMMANDER & FORWARDED TO THE CHIEF OF ENGINEERS

DATE

| DATE | DRAWING NO. |
|---|---|
| | |
| SHEET NO. | FILE NO. |
| 2 of 2 | |



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DATE: 7-91

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