U.S. ARMY ENGINEER DIVISION
HUNTSVILLE, ALABAMA

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FINAL

REMEDIAL INVESTIGATION REPORT AT THE OPEN BURNING (OB) GROUNDS

SEPTEMBER 1994

REMEDIAL INVESTIGATION REPORT
OPEN BURNING (OB) GROUNDS
SENECA ARMY DEPOT
ROMULUS, NEW YORK

Prepared For:

Seneca Army Depot
Romulus, New York

Prepared By:

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Prudential Center
Boston, Massachusetts

720446

March 1994

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DATA QUALIFIERS

EPA - defined qualifiers for Organic Analyses are as follows:

B -	This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action.
C -	This flag applies to pesticide results where the identification has been confirmed by GC/MS.
D -	This flag identifies all compounds identified in an analysis at a secondary dilution factor. If a sample or extract is re-analyzed at a higher dilution factor, as in the "E" flag above, the "DL" suffix is appended to the sample number for the diluted sample, and all concentration values reported are flagged with the "D" flag.
E -	This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis.
J -	Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data identification criteria but the result is less than the sample quantitation limit but greater than zero.
L -	The analyte is a suspected laboratory contaminant. It's presence in the sample is unlikely (applies to volatile and semi-volatile organic results).
S -	The compound was detected above instrument saturation levels (applies to semi-volatile organic results).
U -	Indicates compound was analyzed for but not detected.
X -	The reported result was derived from instrument response outside the calibration range (applies to pesticide/PCB results).
Y -	The reported result is below the specified reporting limit (applies to pesticide/PCB results).

EPA - qualifiers for inorganic analyses are as follows:

B - Concentration qualifier which indicates that the reported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

U - The analyte was analyzed for but not detected.

VALIDATED DATA QUALIFIERS

U	The analyte was not detected.
UJ	The analyte was not detected; however, the associated reporting limit is approximate.
J	The analyte was positively identified; however, QC results indicate that the reported concentration may not be accurate and is therefore an estimate.
R	The analyte was rejected due to laboratory QC deficiencies, sample preservation problems, or holding time exceedance. The presence or absence of the analyte cannot be determined.

1.0 INTRODUCTION

1.1 PURPOSE OF REPORT

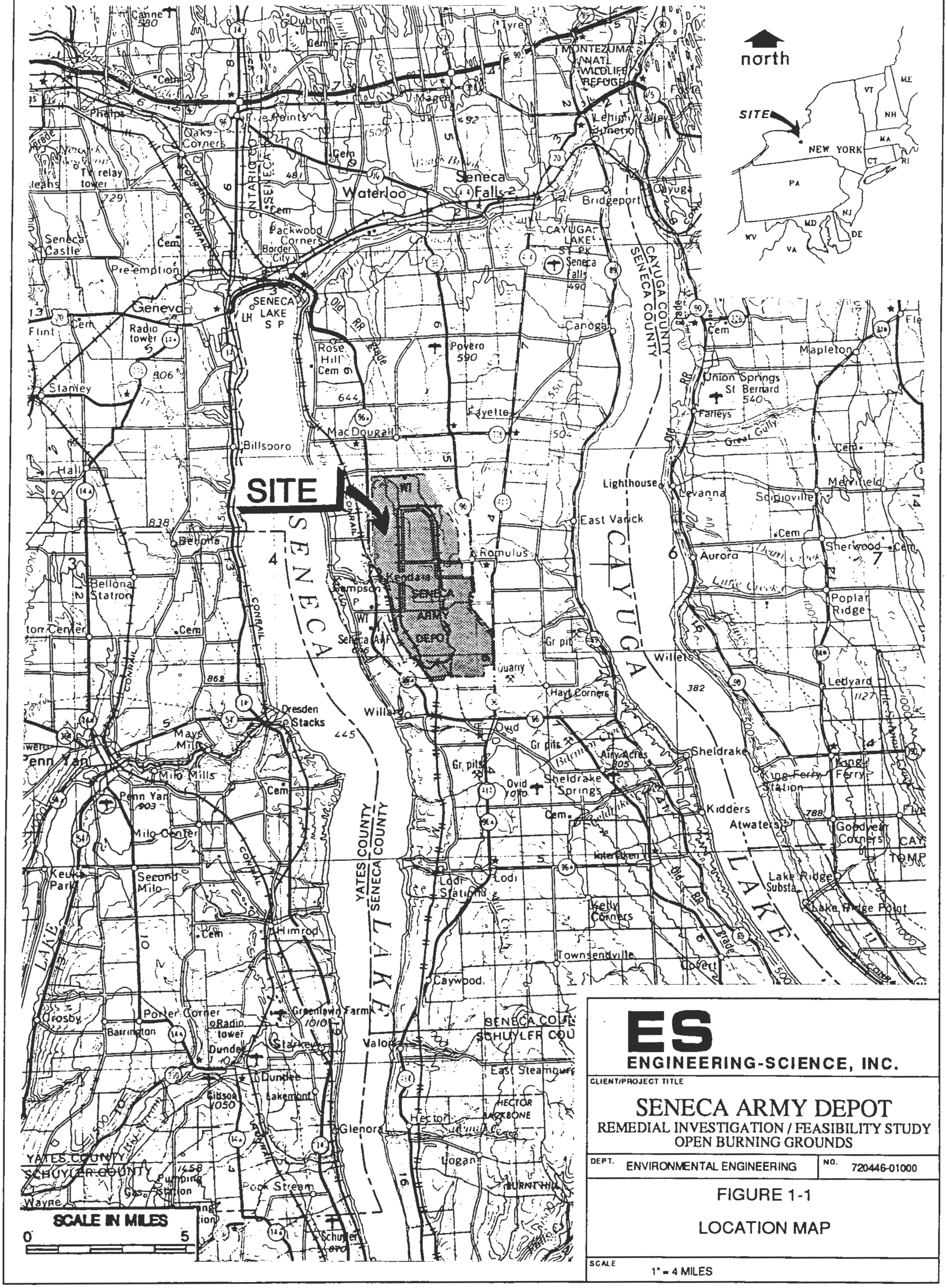
This report describes the Remedial Investigation (RI) activities at the Seneca Army Depot (SEDA) Open Burning (OB) grounds. Engineering-Science, Inc. (ES) has been retained by the United States Army Corps of Engineers (USACE) as part of their remedial response activities under the Comprehensive Environmental Responsibility, Compensation and Liability Act (CERCLA) to perform these activities. The purpose of this report is to discuss the physical characteristics of the site, present and interpret the analytical results from the investigation programs, identify sources of the potential contamination at the site and estimate the risk to human health and the environment. The OB ground site is included on the federal facilities National Priorities List (NPL) and has been listed since July 13, 1989.

1.2 SITE BACKGROUND

1.2.1 Site Description

Seneca Army Depot is an active military facility constructed in 1941. The site is located approximately 40 miles (mi) south of Lake Ontario, near Romulus, New York (Figure 1-1). The facility is located in an uplands area, at an elevation of approximately 600 feet Mean Sea Level (MSL), that forms a divide separating two of the New York Finger Lakes, Cayuga Lake on the east and Seneca Lake on the west. Sparsely populated farmland covers most of the surrounding area. New York State Highways 96 and 96A adjoin SEDA on the east and west boundaries, respectively. Since its inception in 1941 SEDA's primary mission has been the receipt, storage, maintenance, and supply of military items. This function includes the disposal of military ammunition and explosives by burning and detonation. The OB grounds are located in the northwestern portion of SEDA. Figure 1-2 presents a site plan of SEDA and identifies the location of the OB grounds.

The OB area is situated on gently sloping terrain, vegetated with grasses and brush. Drainage is generally to the east-northeast via a series of drainage ditches and culverts into Reeder Creek. There are several poor drainage areas where water collects at certain times of the year. Low surface gradients of less than 40 feet in 2,500 feet, and a high fine content in the surface soils and underlying glacial till deposits contribute to poor drainage conditions. Originally, open burning of munitions was conducted directly on the land surface. Due to the



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ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING

NO. 720446-01000

FIGURE 1-1

LOCATION MAP

SCALE 1" = 4 MILES

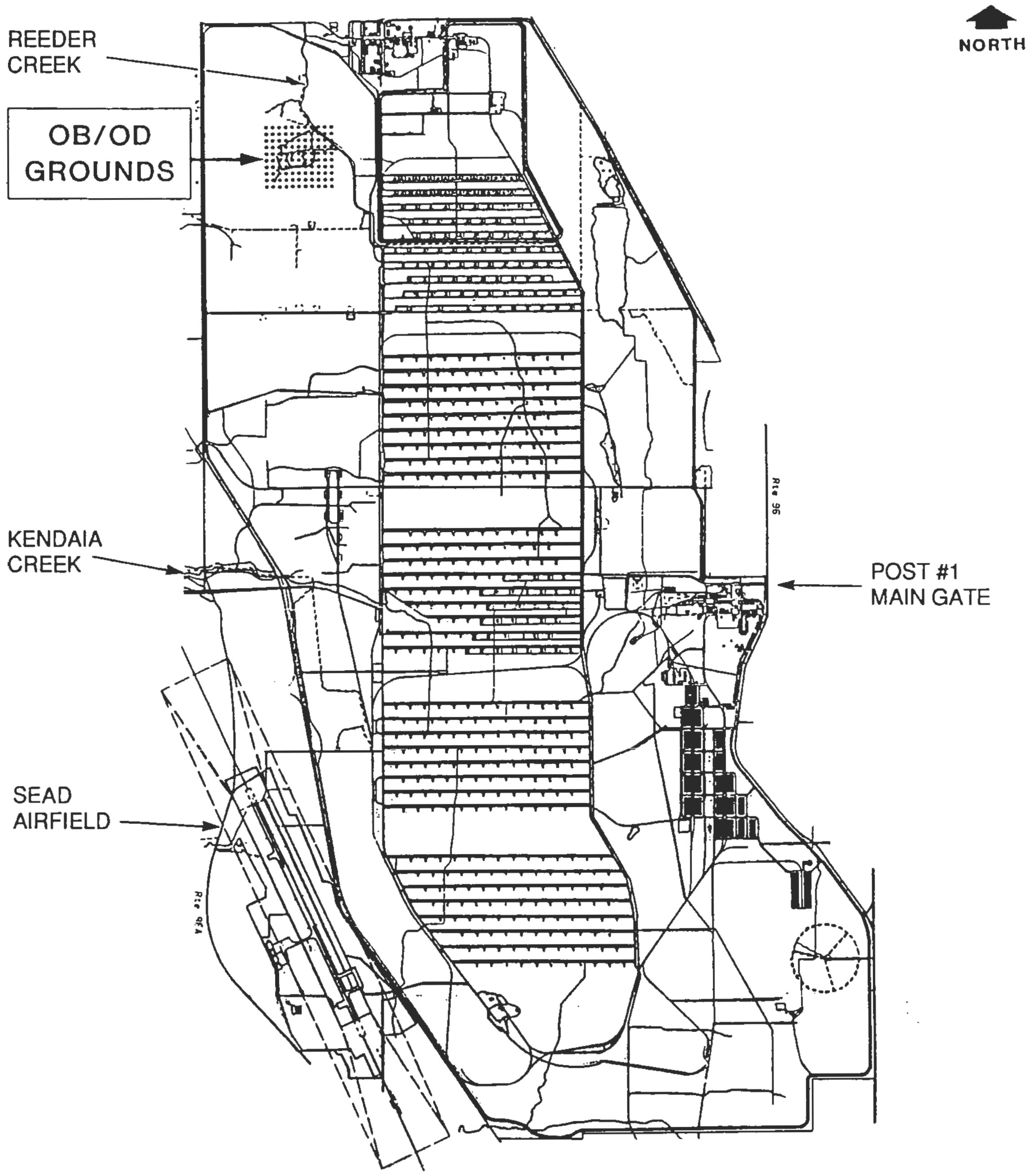

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FIGURE 1-2

SENECA ARMY DEPOT MAP

SCALE 1" = 5000' (APPROXIMATE)

SOURCE: Seneca Army Depot

poorly drained nature of the soils, the individual burn pads were later built up with crushed, broken shale to allow for a drier burn of the munition wastes.

1.2.1.1 Regional Geologic Setting

The Finger Lakes uplands area is underlain by a broad north-to-south trending series of rock terraces mantled by glacial till. As part of the Appalachian Plateau, the region is underlain by a tectonically undisturbed sequence of Paleozoic rocks consisting of shales, sandstones, conglomerates, limestones and dolostones. Figure 1-3 shows the regional geology of Seneca County. In the vicinity of SEDA, Devonian age (385 million years bp) rocks of the Hamilton group are monoclinally folded and dip gently to the south. No evidence of faulting or folding is present. The Hamilton Group is a sequence of limestones, calcareous shales, siltstones, and sandstones. These rocks were deposited in a shallow inland sea at the north end of the Appalachian Basin (Gray, 1991). Terrigenous sediments from topographic highs associated with the Acadian landmass of Western New England, eastern New York and Pennsylvania were transported to the west across a marine shelf (Gray, 1991). These sediments were deposited in a northeast-southwest trending trough whose central axis was near what is now the Finger Lakes (Gray, 1991).

The Hamilton Group, 600 to 1500 feet thick, is divided into four formations. They are, from oldest to youngest, the Marcellus, Skaneateles, Ludlowville, and Moscow formations. The western portion of SEDA is generally located in the Ludlowville Formation while the eastern portion is located in the younger Moscow Formation. The Ludlowville and Moscow formations are characterized by gray, calcareous shales and mudstones and thin limestones with numerous zones of abundant invertebrate fossils that form geographically widespread encrinites, coral-rich layers, and complex shell beds. The Ludlowville Formation is known to contain brachiopods, bivalves, trilobites, corals and bryozoans (Gray, 1991). In contrast, the lower two formations (Skaneateles and Marcellus) consist largely of black and dark gray sparsely fossiliferous shales (Brett et al, 1991). Locally, the shale is soft, gray, and fissile. Figure 1-4 displays the stratigraphic section of Paleozoic rocks of Central New York. The shale is extensively jointed and weathered at the contact with overlying tills. Joint spacings are 1 inch to 4 feet in surface exposures. Prominent joint directions are N 60° E, N 30° W, and N 20° E, with the joints being primarily vertical. Corings performed on the upper 5 to 8 feet of the bedrock revealed low Rock Quality Designations (RQD's), i.e., <5% with almost 100% recovery (Metcalf & Eddy, 1989), suggesting a high degree of weathering.

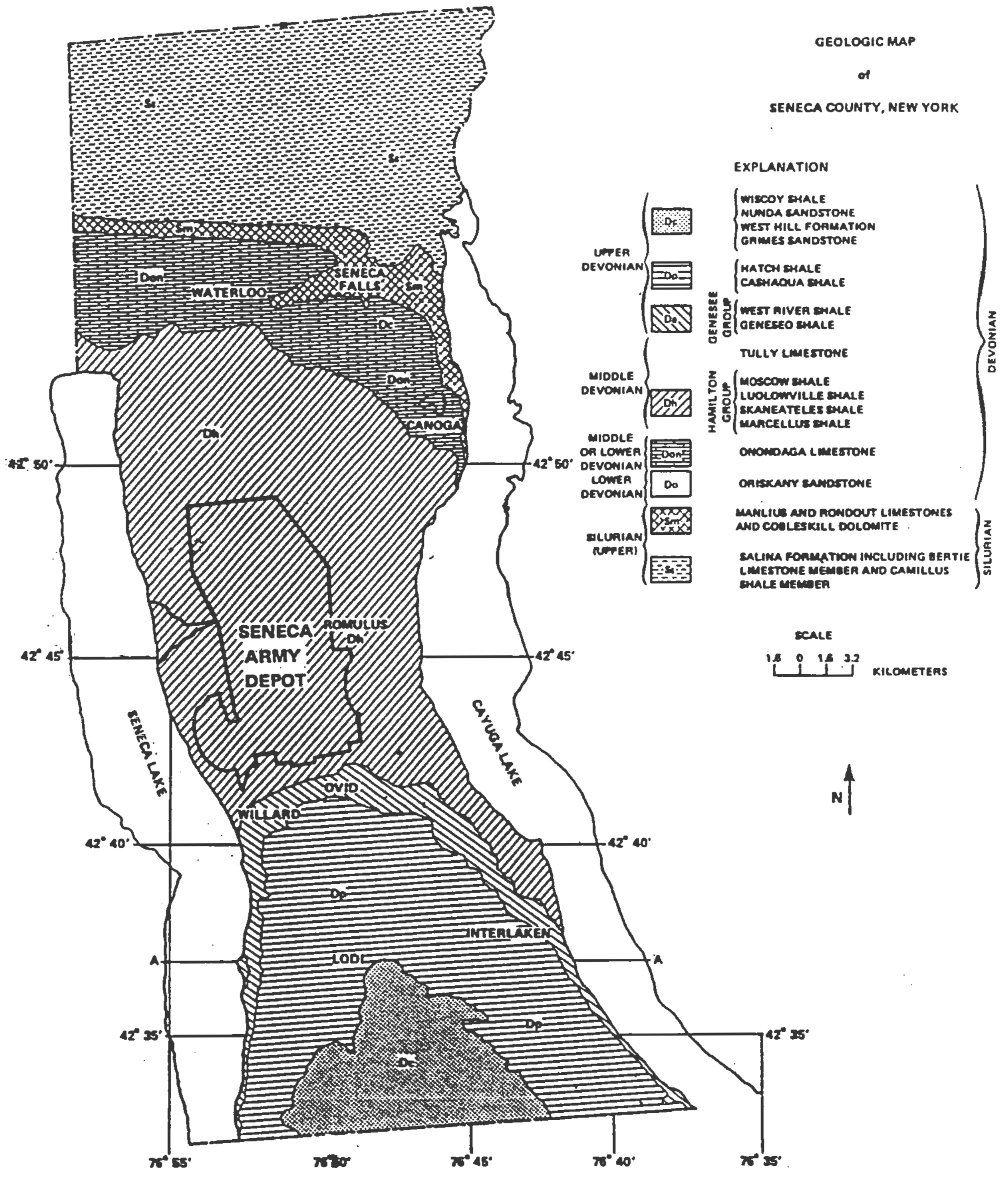

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FIGURE 1-3

GEOLOGIC MAP OF SENECA COUNTY

SCALE

MESOZOIC

Lower Cretaceous

MESOZOIC INTRUSIVES

Kimberlite and alnoite dikes and diatremes.

PALEOZOIC

Upper Devonian

CONNEAUT GROUP
600-1000 ft. (180-300 m.)

Germania Formation—shale, sandstone; Whitesville Formation—shale, sandstone; Hinsdale Sandstone; Wellsville Formation—shale, sandstone; Cuba Sandstone.

CANADAWAY GROUP
800-1200 ft. (240-370 m.)

Machias Formation—shale, siltstone; Rushford Sandstone; Caneadea, Canisteo, and Hume Shales; Canaseraga Sandstone; South Wales and Dunkirk Shales; In Pennsylvania: Towanda Formation—shale, sandstone.

JAVA GROUP
300-700 ft. (90-210 m.)

Wiscoy Formation—sandstone, shale; Hanover and Pipe Creek Shales.

WEST FALLS GROUP
1100-1600 ft. (340-490 m.)

Nunda Formation—sandstone, shale.

West Hill and Gardeau Formations—shale, siltstone;

Roricks Glen Shale; upper Beers Hill Shale; Grimes Siltstone.

lower Beers Hill Shale; Dunn Hill, Millport, and Moreland Shales.

Nunda Formation—sandstone, shale; West Hill Formation—shale, siltstone; Corning Shale.

"New Milford" Formation—sandstone, shale.

Gardeau Formation—shale,. siltstone; Roricks Glen Shale.

Slide Mountain Formation—sandstone, shale, conglomerate.

Beers Hill Shale; Grimes Siltstone; Dunn Hill, Millport, and Moreland Shales

SONYEA GROUP
200-1000 ft. (60-300 m.)

In west: Cashaqua and Middlesex Shales.

In east: Rye Point Shale; Rock Stream ("Enfield") Siltstone; Pulteney, Sawmill Creek, Johns Creek, and Montour Shales.

GENESEE GROUP AND TULLY LIMESTONE
200-1000 ft. (60-300 m.)

West River Shale; Genundewa Limestone; Penn Yan and Geneseo Shales; all except Geneseo replaced eastwardly by Ithaca Formation—shale, siltstone and Sherburne Siltstone.

Middle Devonian

Oneonta Formation—shale, sandstone.

Unadilla Formation—shale, siltstone.

Tully Limestone.

HAMILTON GROUP
600-1500 ft. (180-460 m.)

Moscow Formation—In west: Windom and Kashong Shales, Menteth Limestone Members; In east: Cooperstown Shale Member, Portland Point Limestone Member.

Ludlowville Formation—In west: Deep Run Shale, Tichenor Limestone, Wanakah and Ledyard Shale Members, Centerfield Limestone Member. In east: King Ferry Shale and other members, Stone Mill Sandstone Member.

Skaneateles Formation—In west: Levanna Shale and Stafford Limestone Members; In east: Butternut, Pompey, and Delphi Station Shale Members, Mottville Sandstone Member.

Marcellus Formation—In west: Oakta Creek Shale Member; In east: Cardiff and Chittenango Shale Members, Cherry Valley Limestone and Union Springs Shale Members.

Panther Mountain Formation—shale, siltstone, sandstone.

ONONDAGA LIMESTONE AND ORISKANY SANDSTONE
75-150 ft. (23-45 m.)

Onondaga Limestone—Seneca, Morehouse (cherty)

Lower Devonian

and Nedrow Limestone Members, Edgecliff cherty Limestone Member, local bioherms.

Oriskany Sandstone.

HELDERBERG GROUP
0-200 ft. (0-60 m.)

Coeymans and Manlius Limestones; Rondout Dolostone.

Upper Silurian

AKRON DOLOSTONE, COBLESKILL LIMESTONE, AND SALINA GROUP
700-1000 ft. (210-300 m.)

Akron Dolostone; Bertie Formation—dolostone, shale.

Camillus and Syracuse Formations—shale, dolostone, gypsum, salt.

Cobleskill Limestone; Bertie and Camillus Formations—dolostone, shale.

Syracuse Formation—dolostone, shale, gypsum, salt.

Vernon Formation—shale, dolostone.

LOCKPORT GROUP
80-175 ft. (25-55 m.)

Oak Orchard and Penfield Dolostones, both replaced eastwardly by Sconondoa Formation—limestone, dolostone.

CLINTON GROUP
150-325 ft. (40-~~100 m.)~~

Decew Dolostone; Rochester Shale.

Lower Silurian

Irondequoit Limestone; Williamson Shale; Wolcott Furnace Hematite; Wolcott Limestone; Sodus Shale; Bear Creek Shale; Wallington Limestone; Furnaceville Hematite; Maplewood Shale; Kodak Sandstone.

Herkimer Sandstone; Kirkland Hematite; Willowvale Shale; Westmoreland Hematite; Sauquoit Formation—sandstone, shale; Oneida Conglomerate.

MEDINA GROUP AND QUEENSTON FORMATION
0-900 ft. (0-270 m.)

Medina Group: Grimbsy Formation—sandstone, shale.

Queenston Formation—shale, siltstone.

Upper Ordovician

Undifferentiated Medina Group and Queenston Formation.

LORRAINE GROUP
700-900 ft. (210-270 m.)

Oswego Sandstone.

Pulaski and Whetstone Gulf Formations—siltstone, shale.

TRENTON GROUP
100-300 ft. (30-90 m.)

Middle Ordovician

Utica Shale.

Hamilton group	Moscow shale	43±	Lower two-thirds of section is a fossiliferous, soft gray calcareous shale; upper third highly friable but less calcareous and fossiliferous. Staining by iron oxide very common. Concretions present in greater abundance in lower beds, but irregular calcareous masses occur throughout section. Joints parallel, tightly sealed, trending N.65°E. and N.25°-30°W.
	Ludlowville shale	43±	Lower beds are thinly laminated, light-colored, fossiliferous, shaly passage beds; overlain by hard calcareous black shales 13 to 30 centimeters thick and rich in corals and brachiopods; hard layers responsible for falls and cascades. Middle beds are less fossiliferous, soft gray arenaceous shales, rich in concretions, calcareous lenses, and occasional thin sandstone layers. Upper beds (Tichenor limestone member) are thin, irregularly bedded gray shales becoming light blue gray upon exposure, calcareous, coarsely textured, and fossiliferous. Joints parallel 5 to 50 centimeters apart, well developed but tight.
	Skaneateles shale	56±	Basal beds composed of dark fissile shale. Upper shale more calcareous, grayish to bluish impure limestone layers. Joint pattern N.75°E. and N.30°W.; diagonal joints N.50°E. Joints sealed, parallel and spaced 15 centimeters to 1.2 meters apart.
	Marcellus shale	15	Black, slatelike, bituminous shale with occasional limestone layers in sequence, and containing zones rich in iron sulfides or calcareous concretions, often with septarian structures; very fissile, iron-stained and gray when weathered. Joint pattern N.25°W., N.65°E., 2.5 centimeters to 1.2 meters apart.

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FIGURE 1-4
BEDROCK STRATIGRAPHIC COLUMN

SCALE

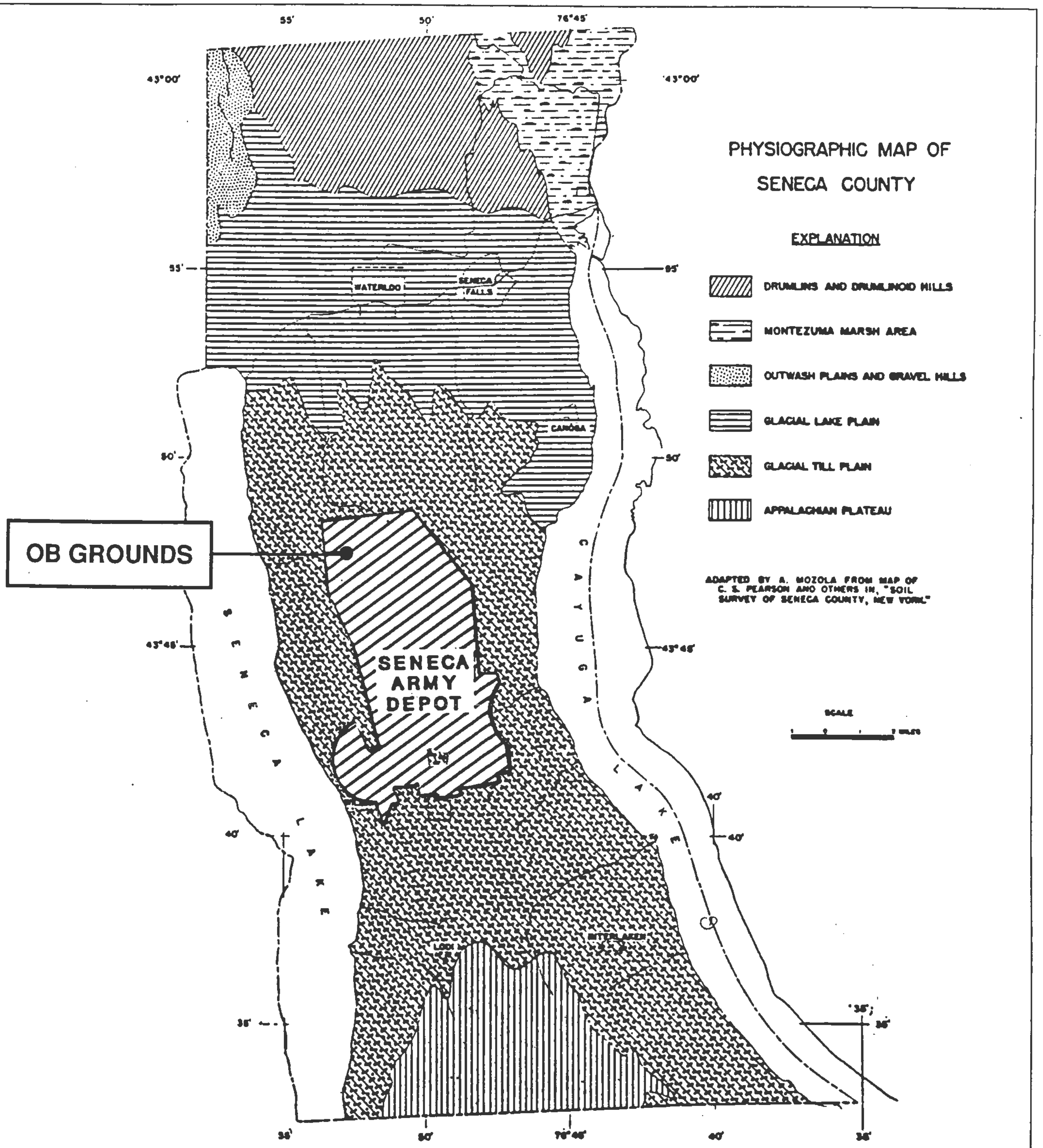
Pleistocene age (Wisconsin event, 20,000 bp) glacial till deposits overlie the shales. Figure 1-5, the physiography of Seneca County, presents an overview of the subsurface sediments present in the area. The site is shown on Figure 1-5 as lying on the western edge of a large glacial till plain between Seneca Lake and Cayuga Lake. The till matrix, the result of glaciation, varies locally but generally consists of horizons of unsorted silt, clay, sand, and gravel. The soils at the site contain varying amounts of inorganic clays, inorganic silts, and silty sands. In the central and eastern portions of SEDA the till is thin and bedrock is exposed or within 3 feet of the surface in some locations. Thickness of the glacial till deposits at SEDA generally range from 1 to 15 feet.

Darien silt-loam soils, 0 to 18 inches thick, have developed over Wisconsonian age glacial tills. These soils are developed on glacial till where they overlie the shale. In general, the topographic relief associated with these soils is 3-8%. Around the burning pads much of the topsoil has been disturbed or removed in association with construction of the berms that surround each of the pads. The burning pads themselves have a layer of broken shale fill at the surface that is as much as 2 feet thick in places. Figure 1-6 presents the U.S. Department of Agriculture General Soil map for Seneca County. Figure 1-7 presents the soil map for the area surrounding the OB/OD grounds.

Regional background elemental concentrations for soils from the Finger Lakes area of New York State are not available. However, elemental concentrations for soils from the eastern United States and in particular, New York State are available. Table 1-1 cites data on the eastern United States from a United States Geological Survey (USGS) professional paper (Schacklette and Boerngen, 1984) and data on the New York State Soils from a New York State Department of Environmental Conservation (NYSDEC) report.

1.2.1.2 Regional Hydrogeologic Setting

Regionally, four distinct hydrologic units have been identified within Seneca County (Mozola A.J., 1951). These include two distinct shale formations, a series of limestone units, and unconsolidated beds of Pleistocene glacial drift. Overall, the groundwater in the county is very hard, and therefore, the quality is minimally acceptable for use as potable water. Figure 1-8 shows the distribution of known private wells near the northwestern perimeter of SEDA based on information obtained from the Town of Romulus. Approximately 95 percent of the



SOURCE: The Groundwater Resources of Seneca County, New York; Mozola, A.J., Bulletin GW-26, Albany, NY, 1951

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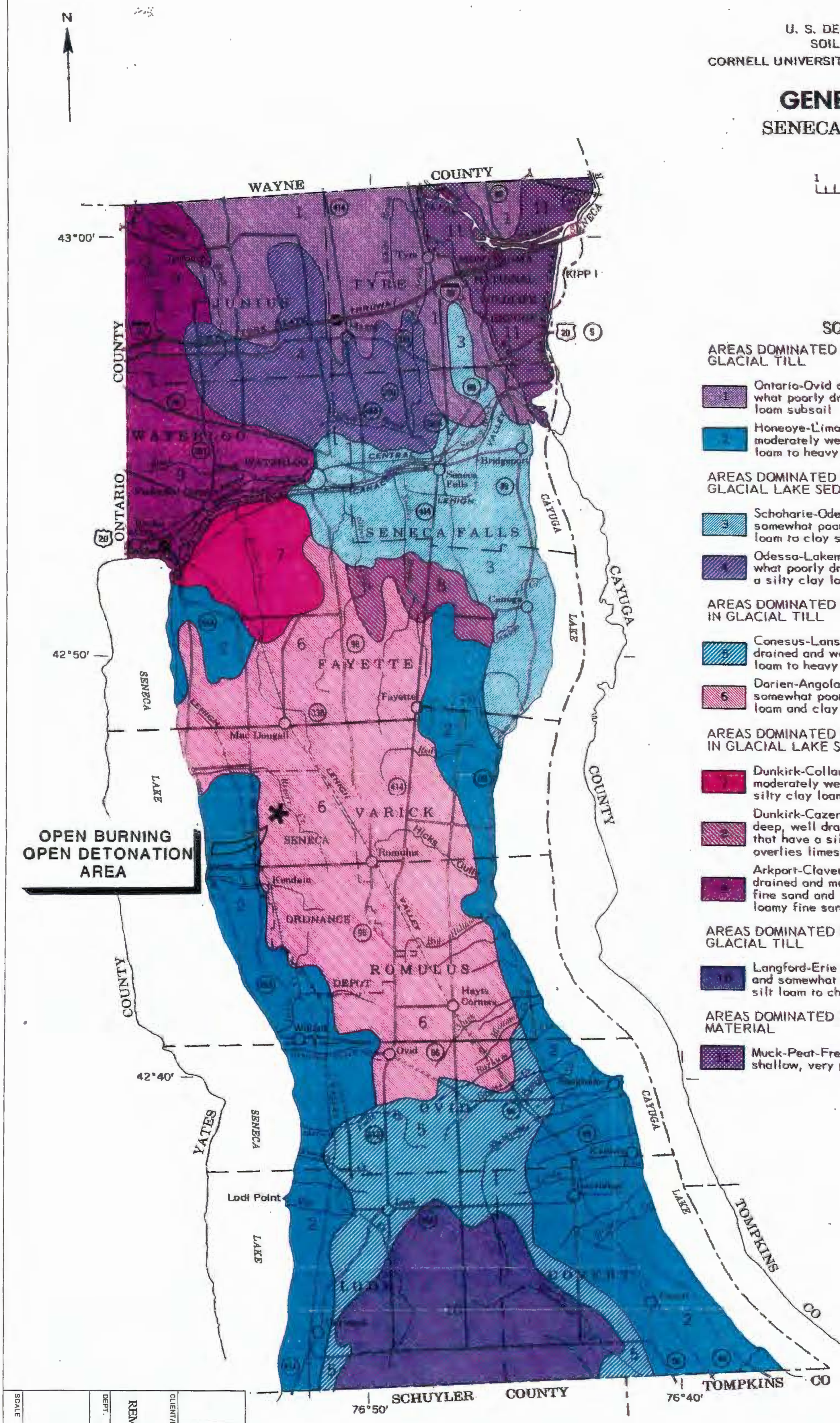
FIGURE 1-5

THE PHYSIOGRAPHIC MAP
OF SENECA COUNTY

SCALE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
CORNELL UNIVERSITY AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP
SENECA COUNTY, NEW YORK



SOIL ASSOCIATIONS

AREAS DOMINATED BY HIGH-LIME SOILS DEVELOPED IN GLACIAL TILL

- 1 Ontario-Ovid association: Deep, well-drained to somewhat poorly drained soils that have a loam to silty clay loam subsoil
- 2 Honeoye-Lima association: Deep, well drained and moderately well drained soils that have a heavy silt loam to heavy loam subsoil

AREAS DOMINATED BY HIGH-LIME SOILS DEVELOPED IN GLACIAL LAKE SEDIMENTS

- 3 Schoharie-Odessa association: Deep, well-drained to somewhat poorly drained soils that have a silty clay loam to clay subsoil
- 4 Odessa-Lakemont association: Deep, dominantly somewhat poorly drained and poorly drained soils that have a silty clay loam to silty clay subsoil

AREAS DOMINATED BY MEDIUM-LIME SOILS DEVELOPED IN GLACIAL TILL

- 5 Conesus-Lansing association: Deep, moderately well drained and well drained soils that have a heavy silt loam to heavy loam subsoil
- 6 Darien-Angola association: Deep and moderately deep, somewhat poorly drained soils that have a silty clay loam and clay loam subsoil

AREAS DOMINATED BY MEDIUM-LIME SOILS DEVELOPED IN GLACIAL LAKE SEDIMENTS

- 7 Dunkirk-Collamer association: Deep, well drained and moderately well drained soils that have a silt loam to silty clay loam subsoil
- 8 Dunkirk-Cazenovia association: Moderately deep and deep, well drained and moderately well drained soils that have a silt loam to silty clay loam subsoil that overlies limestone
- 9 Arkport-Claverack association: Deep, dominantly well drained and moderately well drained soils that are loamy fine sand and fine sandy loam throughout or that have a loamy fine sand subsoil over silty clay or clay

AREAS DOMINATED BY LOW-LIME SOILS DEVELOPED IN GLACIAL TILL

- 10 Langford-Erie association: Deep, moderately well drained and somewhat poorly drained soils that have a channery silt loam to channery loam fragipan

AREAS DOMINATED BY SOILS DEVELOPED IN ORGANIC MATERIAL

- 11 Muck-Peat-Fresh Water Marsh association: Deep to shallow, very poorly drained organic soils

February 1971

NOTE—
This map is intended for general planning. Each delineation may contain soils having ratings different from those shown on the map. Use detailed soil maps for operational planning.

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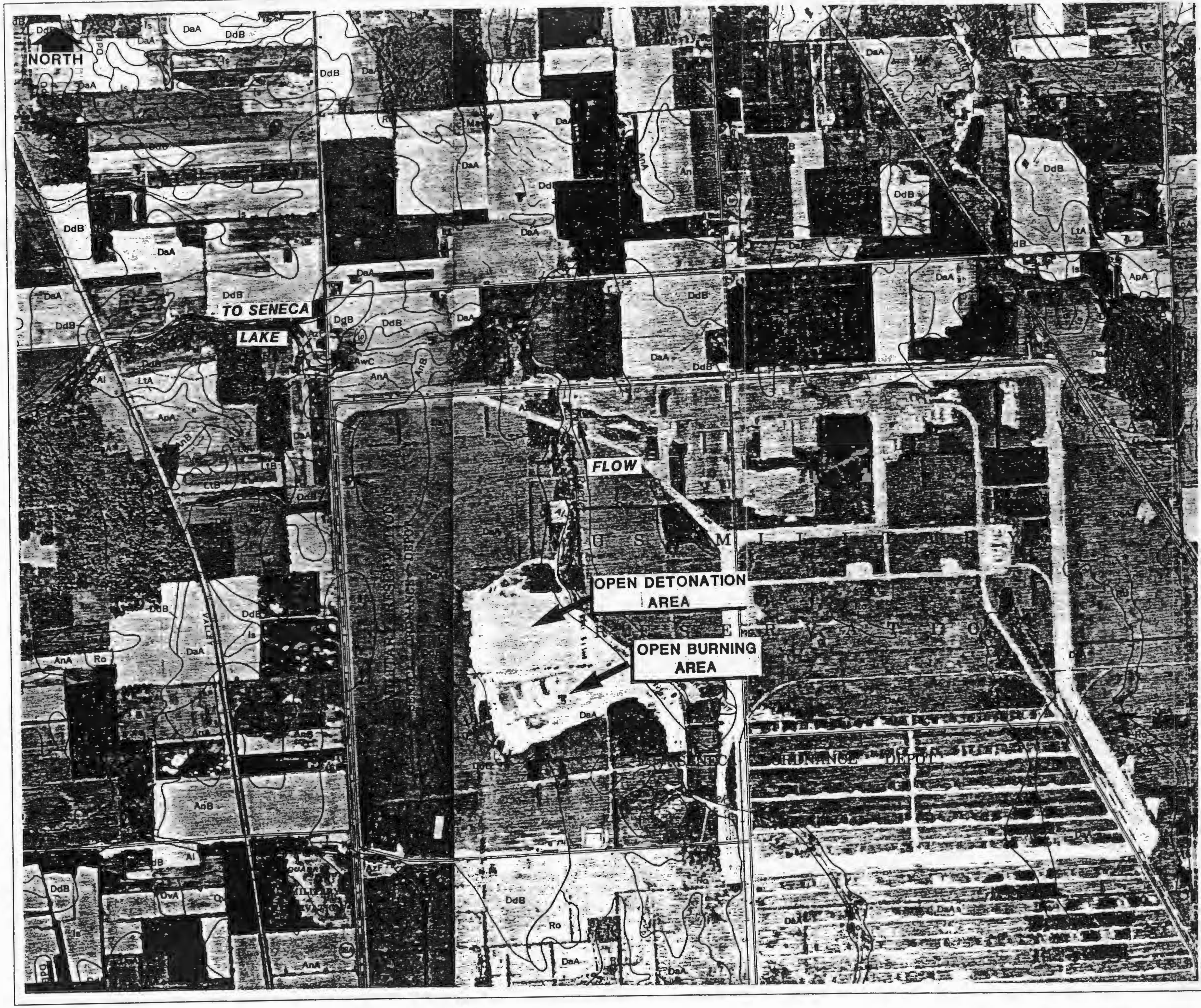
FIGURE 1-6
GENERAL SOIL MAP
SENECA COUNTY, NEW YORK
SCALE



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, A, B, C, D, E, or F, is a general guide to the slope class. Symbols without a slope letter are for those miscellaneous land types or soils where slope is not significant to use and management. A final number, 3, in the symbol shows that the soil is eroded.

SYMBOL	NAME
Ac	Alden mucky silt loam
Ad	Alden mucky silt loam, till substratum
Al	Alluvial land
AnA	Angola silt loam, 0 to 3 percent slopes
AnB	Angola silt loam, 3 to 8 percent slopes
AoA	Appleton gravelly silt loam, 0 to 3 percent slopes
AoB	Appleton gravelly silt loam, 3 to 8 percent slopes
ApA	Appleton silt loam, 0 to 3 percent slopes
ApB	Appleton silt loam, 3 to 8 percent slopes
ArB	Arkport loamy fine sand, 1 to 6 percent slopes
ArC	Arkport loamy fine sand, 6 to 12 percent slopes
ArD	Arkport loamy fine sand, 12 to 20 percent slopes
AuD	Arnot channery silt loam, 15 to 25 percent slopes
AwB	Aurora silt loam, 3 to 8 percent slopes
AwC	Aurora silt loam, 8 to 15 percent slopes
AwD	Aurora silt loam, 15 to 25 percent slopes
AzF	Aurora and Farmington soils, 25 to 75 percent slopes
Co	Canandaigua silt loam
CeB	Cazenovia silt loam, 3 to 8 percent slopes
CeB3	Cazenovia silt loam, 3 to 8 percent slopes, eroded
CeC	Cazenovia silt loam, 8 to 15 percent slopes
CeC3	Cazenovia silt loam, 8 to 15 percent slopes, eroded
ChD	Cazenovia soils, 15 to 25 percent slopes
ChE	Cazenovia soils, 25 to 40 percent slopes
CkA	Claverack loamy fine sand, 0 to 2 percent slopes
CkB	Claverack loamy fine sand, 2 to 6 percent slopes
ClA	Collamer silt loam, 0 to 2 percent slopes
ClB	Collamer silt loam, 2 to 6 percent slopes
ClC	Collamer silt loam, 6 to 12 percent slopes
CoA	Collamer silt loam, moderately shallow variant, 0 to 2 percent slopes
CoB	Collamer silt loam, moderately shallow variant, 2 to 6 percent slopes
CsA	Conesus gravelly silt loam, 0 to 3 percent slopes
CsB	Conesus gravelly silt loam, 3 to 8 percent slopes
Cu	Cosad loamy fine sand
DaA	Darien silt loam, 0 to 3 percent slopes
DdB	Darien-Danley-Cazenovia silt loams, 3 to 8 percent slopes
DuB	Dunkirk silt loam, 1 to 6 percent slopes
DuC3	Dunkirk silt loam, 6 to 12 percent slopes, eroded
DuD	Dunkirk silt loam, 12 to 20 percent slopes
DwB	Dunkirk silt loam, limestone substratum, 1 to 6 percent slopes

SOURCE:

U.S. DEPT. OF AGRICULTURE SOIL SURVEY,
SENECA COUNTY , NEW YORK
APRIL , 1972

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FIGURE 1-7

SURFACE SOIL MAP
FOR OB/OD GROUNDS

SCALE

TABLE 1 – 1

BACKGROUND CONCENTRATIONS OF ELEMENTS IN SOILS OF THE EASTERN UNITED STATES WITH SPECIFIC DATA FOR NEW YORK STATE

SENECA ARMY DEPOT
OB GROUNDS

ELEMENT	CONCENTRATION RANGE (ppm)	GEOGRAPHIC LOCATION
Aluminum	7,000 – 100,000	Eastern U.S. (2)
	1,000 – 25,000	Albany Area (1)
Arsenic	< 0.1 – 73	Eastern U.S. (2)
	3 – 12	New York State (1)
	< 0.1 – 6.5	Albany Area (1)
Barium	10 – 1,500	Eastern U.S. (2)
	15 – 600	New York State (1)
	250 –350	Albany Area (1)
Beryllium	1 – 7	Eastern U.S. (2)
	0 – 1.75	New York State (1)
	0 – 0.9	Albany Area (1)
Cadmium	Not Available	Eastern U.S. (2)
	0.0001 – 1.0	No Region Specified (1)
Calcium	100 – 280,000	Eastern U.S. (2)
	130 – 35,000	New York State (1)
	150 – 5,000	Albany Area (1)
	2,900 – 6,500	Albany Area (1)
Chromium	1 – 1,000	Eastern U.S. (2)
	1.5 – 40	New York State (1)
	1.5 – 25	Albany Area (1)
Cobalt	< 0.3 – 70	Eastern U.S. (2)
	2.5 – 60	New York State (1)
	2.5 – 6	Albany Area (1)
Copper	< 1 – 700	Eastern U.S. (2)
	< 1 – 15	Albany Area (1)
Iron	100 – 100,000	Eastern U.S. (2)
	17,000 – 25,000	Albany Area (1)
Lead	> 10 – 300	Eastern U.S. (2)
	1 – 12.5	Albany Area (1)
Magnesium	50 – 50,000	Eastern U.S. (2)
	2,500 – 6,000	New York State (1)
	1,700 – 4,000	Albany Area (1)
Manganese	> 2 – 7,000	Eastern U.S. (2)
	50 – 5,000	New York State (1)
	400 – 600	Albany Area (1)
Mercury	0.01 – 3.4	Eastern U.S. (2)
	0.042 – 0.066	Albany Area (1)

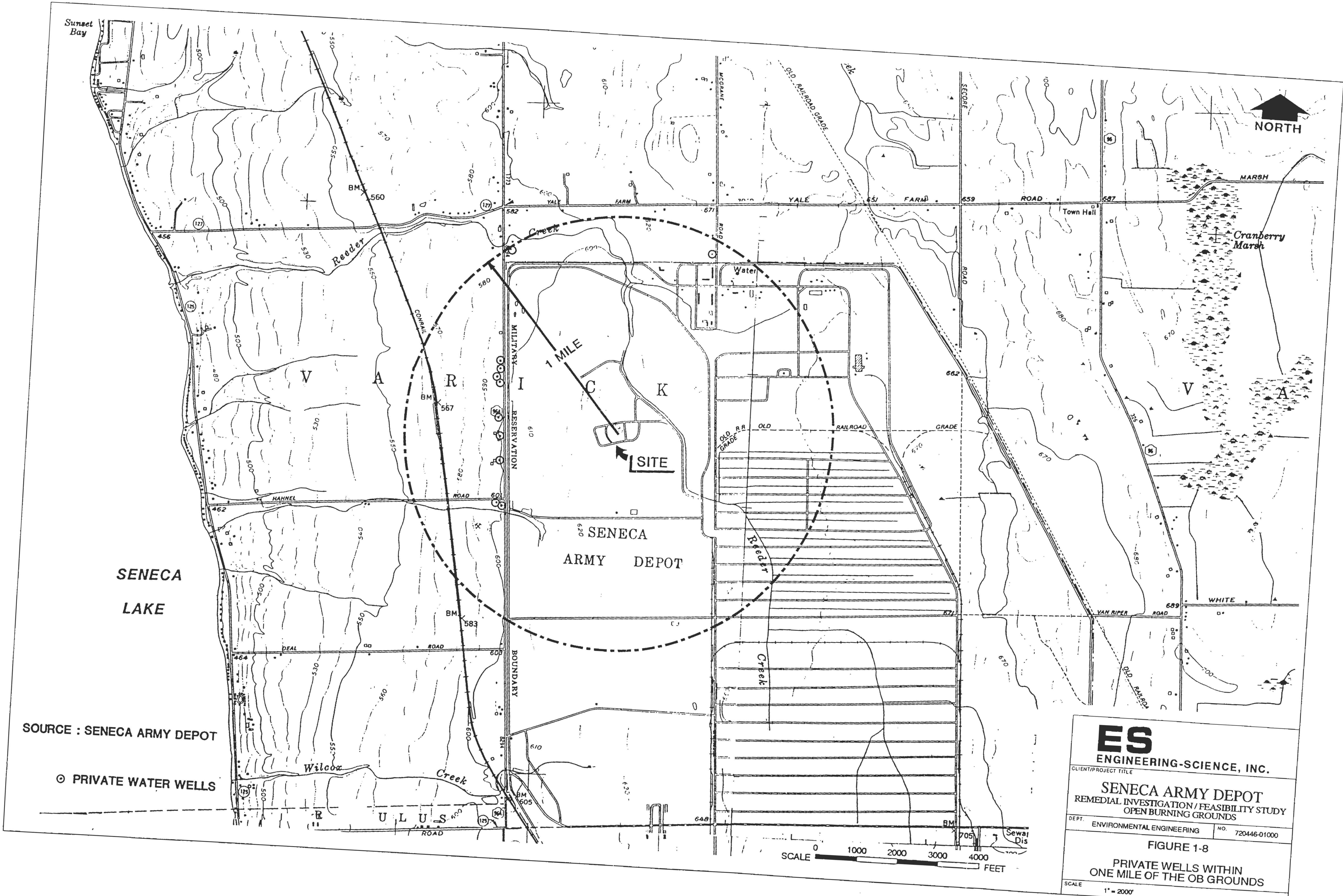
TABLE 1 – 1

BACKGROUND CONCENTRATIONS OF ELEMENTS IN SOILS OF THE EASTERN UNITED STATES WITH SPECIFIC DATA FOR NEW YORK STATE

SENECA ARMY DEPOT
OB GROUNDS

ELEMENT	CONCENTRATION RANGE (ppm)	GEOGRAPHIC LOCATION
Nickel	< 5 – 700 19.5 (mean)	Eastern U.S. (2) New York State (1) (no range available)
Potassium	50 – 37,000 47.5 – 117.5	Eastern U.S. (2) New York State (1)
Selenium	> 0.1 – 3.9 Not Available	Eastern U.S. (2) No New York State Data Given (1)
Sodium	500 – 50,000 Not Available	Eastern U.S. (2) No New York State Data Given (1)
Vanadium	> 7 – 300 Not Available	Eastern U.S. (2) No New York State Data Given (1)
Zinc	> 5 – 2,900 37 – 60	Eastern U.S. (2) Albany Area (1)

Notes:
1. (1) Source: McGovern, Carol E., Background Concentrations of 20 Elements in Soils with Special Regard for New York State, Wildlife Resources Center, New York Department of Environmental Conservation, Delmar, New York 12054, No Date.
2. (2) Source: Shacklette, H.T. and Boerngen, J.G., 1984, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S.G.S. Prof Paper 1270, Washington.
3. The data are for areas where surficial materials are thought to be uncontaminated, undisturbed, or areas far from pollution sources.
4. ppm = parts per million.



SOURCE : SENECA ARMY DEPOT

⊙ PRIVATE WATER WELLS

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REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING

NO. 720446-01000

FIGURE 1-8

PRIVATE WELLS WITHIN
ONE MILE OF THE OB GROUNDS

SCALE 1" = 2000'

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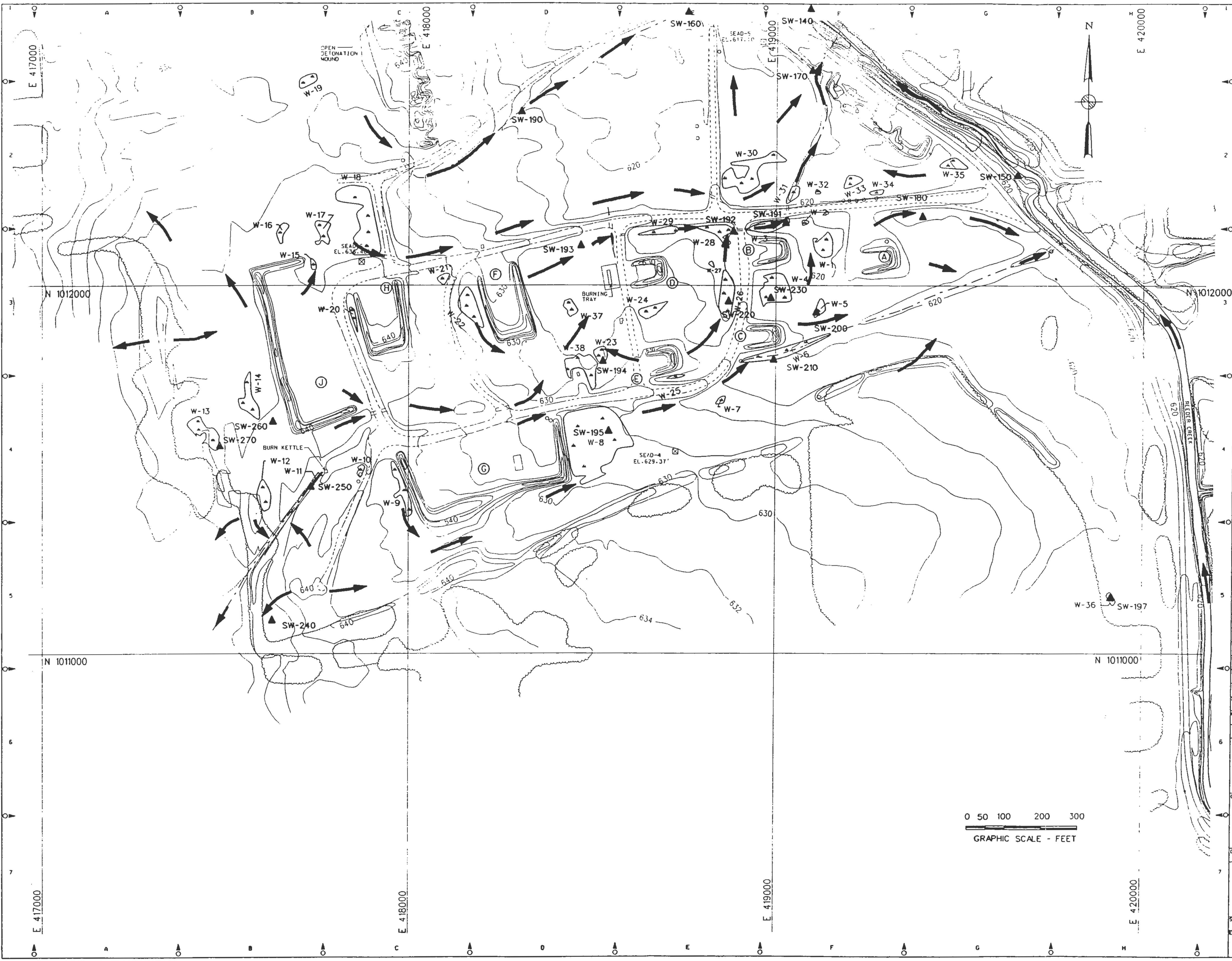

LEGEND:

PAVED ROAD

DIRT ROAD

650 GROUND CONTOUR AND ELEVATION

UTILITY POLE

TREE

BRUSH

W-1 WETLAND & DESIGNATION

RUNOFF SWALE

Ⓓ BURNING PAD DESIGNATION

CULVERT

☒ MONUMENT AND DESIGNATION
SEAD-4
EL.629.37'

SURFACE WATER RUNOFF DIRECTION

▲ SW-197 SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION

REV	DATE	DESCRIPTION
B	7/2/93	PRE-DRAFT PHASE II- RI/FS
A	3/22/93	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN BY E.SCHACHT
CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAELIN
RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. M.E.BAKER
MGR. OF ENGR. J.P.CHAPLICK
PROJECT MANAGER M.N.DUCHESNEAU
MGR. OF PROJECTS J.P.CHAPLICK
IN CHARGE W.D.PATTERSON

DRAWN | CHECKED | DES.SUPV. | RESP.ENGR. | CH.DISC.ENG. | PROJ. MGR.

ES
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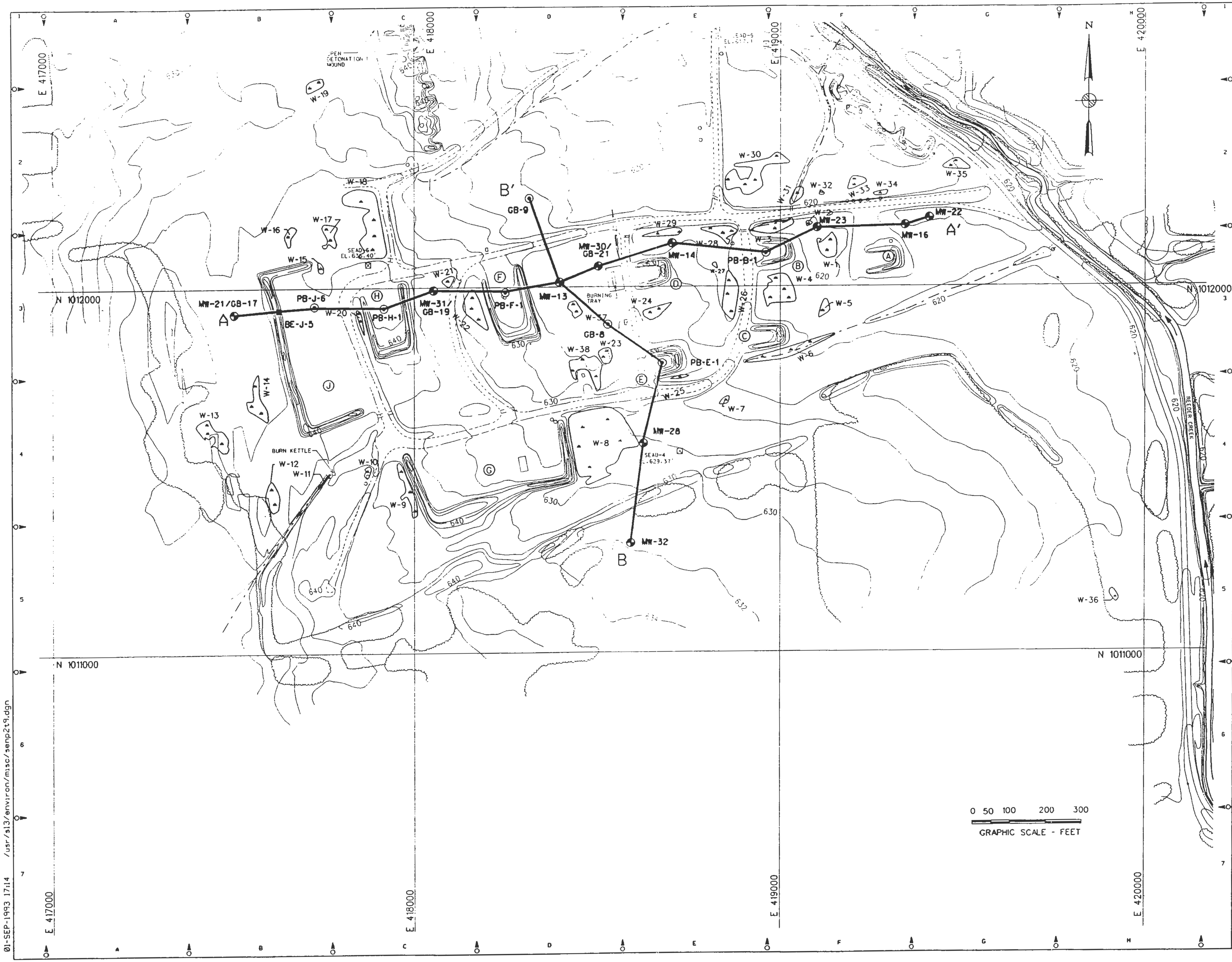
CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/ FEASIBILITY STUDY OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01200

FIGURE 3-5
SURFACE WATER
RUNOFF DIRECTIONS

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-3-5
REV B



LEGEND:

- MW-32 — MONITORING WELL & DESIGNATION (A GB LABEL AT A WELL INDICATES THAT A GRID BORING IS AT THE SAME LOCATION AS THE WELL)
- PAVED ROAD
- DIRT ROAD
- 650 — GROUND CONTOUR AND ELEVATION
- UTILITY POLE
- TREE
- BRUSH
- W-1 — WETLAND & DESIGNATION
- RUNOFF SWALE
- Ⓓ — BURNING PAD DESIGNATION
- CULVERT
- ☒ SEAD-4 EL.629.37' — MONUMENT AND DESIGNATION
- A' — LOCATION OF CROSS SECTION & DESIGNATION
- ⊙ PB-C-1 GB-12 — BORING & DESIGNATION

REV	DATE	DESCRIPTION
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
B	[illegible]	PRE-DRAFT PHASE II- RI/FS
A	[illegible]	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN | CHECKED | DES.SUPV. | RESP.ENGR. | CH.DISC.ENG. | PROJ.MGR.

DRAWN BY E.SCHACHT	CHECKED BY W.E.BAKER
DESIGN SUPV. G.A.KAELIN	RESP. ENGR. W.N.DUCHESNEAU
CHIEF DISC. ENGR. W.E.BAKER	MGR. OF ENGR. J.P.CHAPLICK

PROJECT MANAGER
W.N.DUCHESNEAU

MGR. OF PROJECTS
J.P.CHAPLICK

IN CHARGE
W.D.PATTERSON

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/ FEASIBILITY STUDY OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING NO. 720446-01000

FIGURE 3-6
LOCATION OF
GEOLOGIC CROSS SECTIONS

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-3-6 REV B

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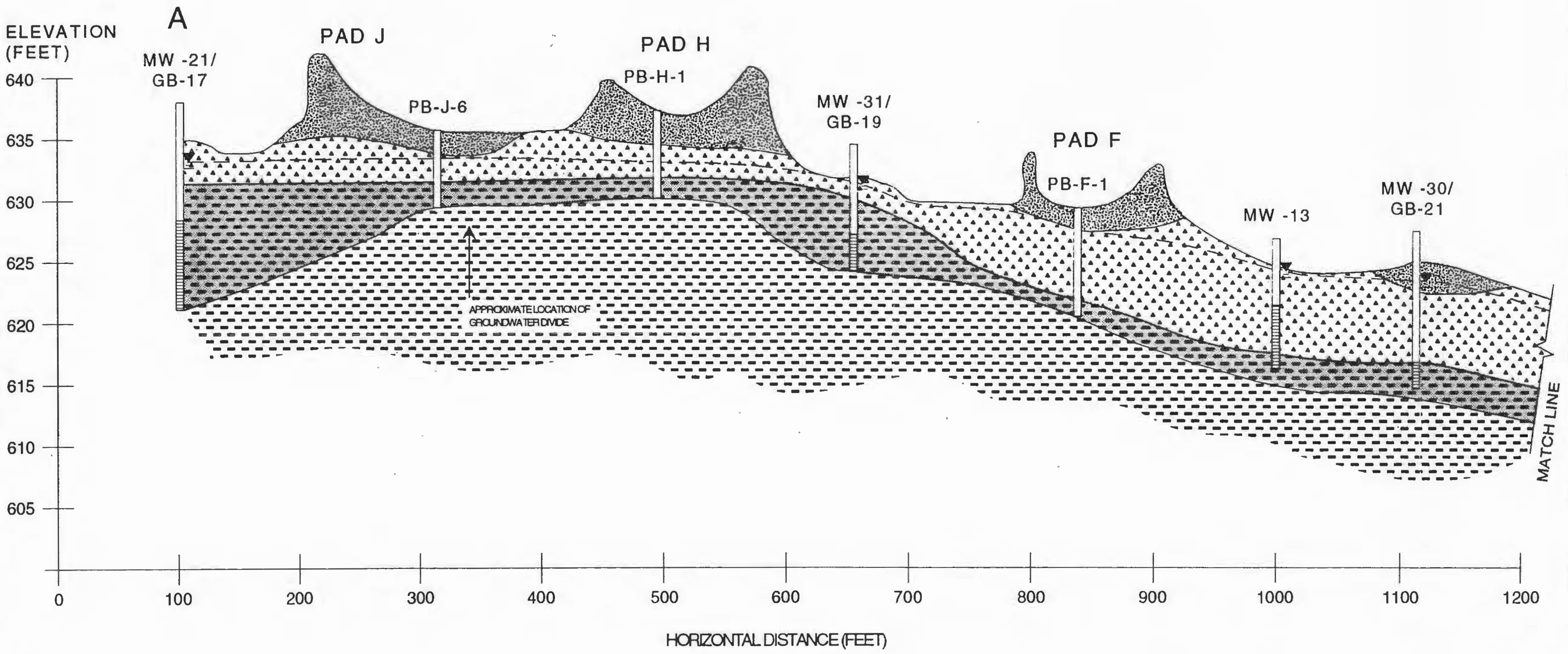
CROSS SECTION A - A'



LEGEND:

▩ FILL

▵ TILL

▨ WEATHERED SHALE

▤ COMPETENT SHALE

— ▼ — GROUNDWATER TABLE

NOTES:

1. Lithologic units are based on descriptions supplied by Engineering-Science, Inc. Interpretations are based on extrapolations between widely spaced boreholes, actual conditions may vary.
2. Groundwater table based on depth to water measurements made in January 1992.

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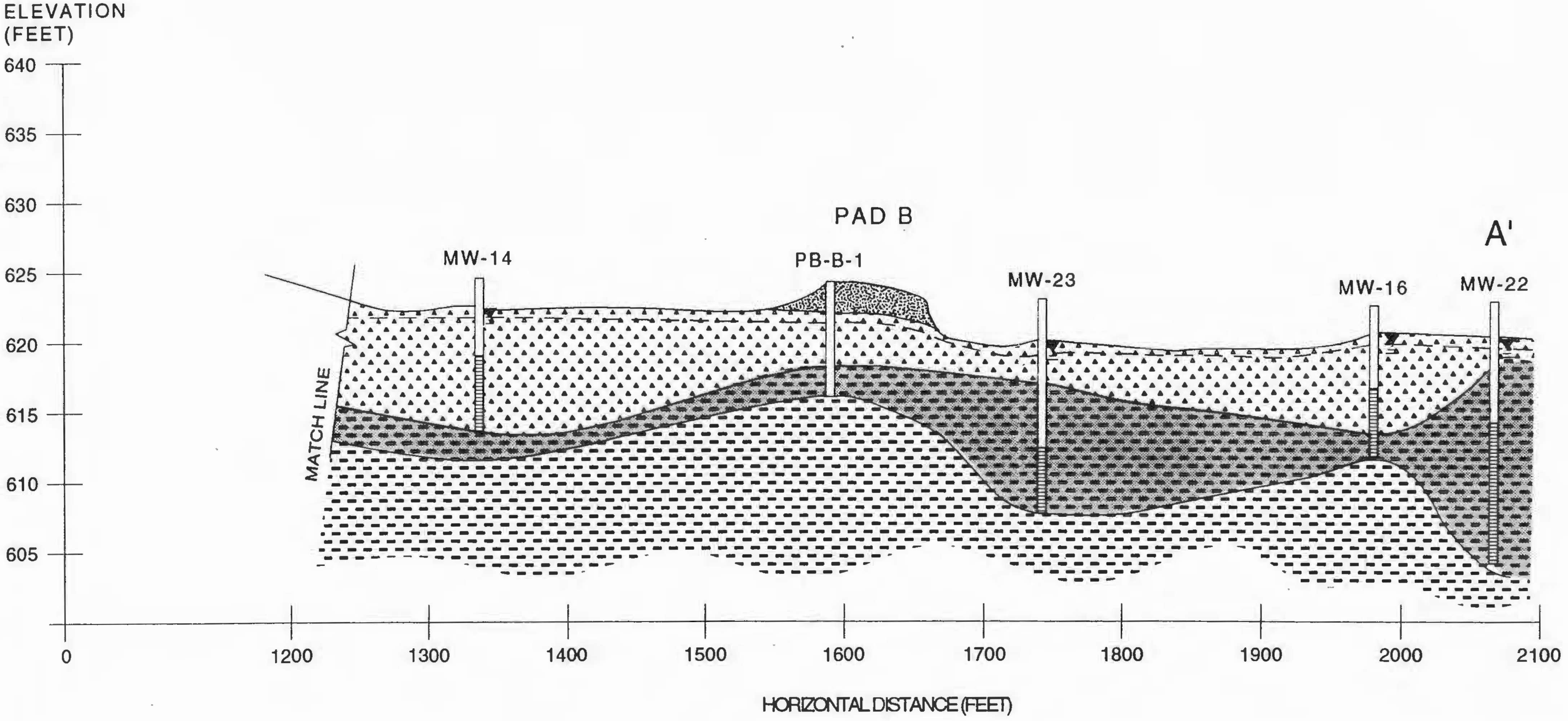
CLIENT/PROJECT TITLE	SENECA ARMY DEPOT REMEDIAL INVESTIGATION / FEASIBILITY STUDY OPEN BURNING GROUNDS
DEPT. ENVIRONMENTAL ENGINEERING	NO. 720446-01000
	FIGURE 3-7 CROSS-SECTION A - A'
SCALE	HORIZONTAL: 1" = 100' VERTICAL: 1" = 10'
ES'S DWG NO. 720446-01000-C6	REV. A

CROSS SECTION A - A' (continued)



LEGEND:

▨ FILL

▨ TILL

▨ WEATHERED SHALE

▨ COMPETENT SHALE

— ▼ — GROUNDWATER TABLE

NOTES:

1. Lithologic units are based on descriptions supplied by Engineering-Science, Inc. Interpretations are based on extrapolations between widely spaced boreholes, actual conditions may vary.
2. Groundwater table based on depth to water measurements made in January 1992.

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REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING NO 720446-01000

FIGURE 3-8
CROSS-SECTION A - A' (continued)

SCALE HORIZONTAL: 1" = 100' VERTICAL: 1" = 10'

ES'S DWG NO. 720446-01000-C6 REV A

wells in the county are used for domestic or farm supply and the average daily withdrawal is approximately 500 gallons (0.35 gpm). About five percent of the wells in the County are used for commercial, industrial, or municipal purposes. Seneca Falls and Waterloo, the two largest communities in the County, are in the hydrogeologic region which is most favorable for the development of a groundwater supply. However, because the hardness of the groundwater is objectionable to the industrial and commercial establishments operating within the villages, both villages utilize surface water (Cayuga Lake and Seneca River, respectively) as their municipal supplies. The villages of Ovid and Interlaken, both of which are without substantial industrial establishments, utilize groundwater as their public water supplies. Ovid obtains its supply from two shallow gravel-packed wells, and Interlaken is served by a developed seepage-spring area.

Regionally, the water table aquifer of the unconsolidated surficial glacial deposits of the region would be expected to flow in a direction consistent with the ground surface elevations. Geologic cross-sections from Seneca Lake and Cayuga Lake have been constructed by the State of New York, (Mozola, A.J., 1951, and Crain, L.J., 1974). This information suggests that a groundwater divide exists approximately half way between the two finger lakes. SEDA is located on the western slope of this divide and therefore regional surficial groundwater flow is expected to be westward toward Seneca Lake.

A substantial amount of information concerning the hydrogeology in the area has been compiled by the State of New York, (Mozola, A.J., 1951). These reports have been reviewed in order to better understand the hydrogeology of the area surrounding SEDA. The data indicates that within a four (4) mile radius of the site a number wells exist from which geologic and hydrogeologic information has been obtained. This information includes: 1) the depth; 2) the yield; and 3) the geological strata the wells were drilled through. Although the information was compiled in the 1950s, these data are useful in providing an understanding and hydrogeologic characteristics of the aquifers present within the area surrounding SEDA.

A review of this information suggests that three geologic units have been used to produce water for both domestic and agricultural purposes. These units include: 1) a bedrock aquifer, which in this area is predominantly shale; 2) an overburden aquifer, which includes Pleistocene deposits (glacial till); and 3) a deep aquifer present within beds of limestone interlying the underlying shale. The occurrence of water derived from limestone is considered to be unusual for this area and is more commonplace to the north of this area. The limestone aquifer in this area is between 100 to 700 feet deep. As of 1957, twenty-five wells utilized water from the shale aquifer, six wells tapped the overburden aquifer, and one used the deep limestone as a source of water.

For the six wells which utilized groundwater extracted from the overburden, the average yield was approximately 7.5 gpm. The average depth of these wells was 36 feet. The geologic material which comprises this aquifer is generally Pleistocene till, with the exception of one well located to the northeast of the site. This one well had penetrated an outwash sand and gravel deposit. The yields from these overburden wells ranged from 4 to 15 gpm. The well located in the outwash sand and gravel deposit, drilled to 60 feet, yielded only 5 gpm. A 20 foot hand dug well, located southeasterly from the outwash well, yielded 10 gpm.

The geologic information reviewed indicates that the upper portions of the shale formation would be expected to yield small, yet adequate, supplies of water for domestic use. For mid-Devonian shales such as those of the Hamilton group, the average yields, which are, less than 15 gpm, are consistent with what would be expected for shales (LaSala, 1968). The deeper portions of the bedrock, (i.e., at depths greater than 235 feet) have provided yields up to 150 gpm. At these depths the high well yields can be attributed to the effect of solutioning on the Onondaga limestone, which is at the base of the Hamilton Group. Based on well yield data, the degree of solutioning is affected by the type and thickness of overlying material (Mozola, 1951). Solution effects on limestones (and on shales which contain gypsum) in the Erie-Niagara have been reported by LaSala (1968). This source of water is considered to comprise a separate source of groundwater for the area. Very few wells in the region adjacent to SEDA utilize the limestone as a source of water, which may be due to the drilling depths required to intercept this water.

The geologic study of the area by Mozola determined three reasons for the lack of hydrologic interconnection between the groundwater near the surface and the deeper aquifers. First, the shales in this region are relatively impermeable, i.e., absorbing, transmitting, and yielding water very slowly. Joints and other openings in the shales are generally very narrow or are filled with fine silt and clay. This impermeability tends to inhibit downward seepage of water from the surficial deposits. Second, the slope of the bedrock and the land surfaces toward the Finger Lakes favors rapid drainage of surface water. Third, the overlying glacial drift is considered too thin to hold large quantities of water for gradual recharge of the bedrock.

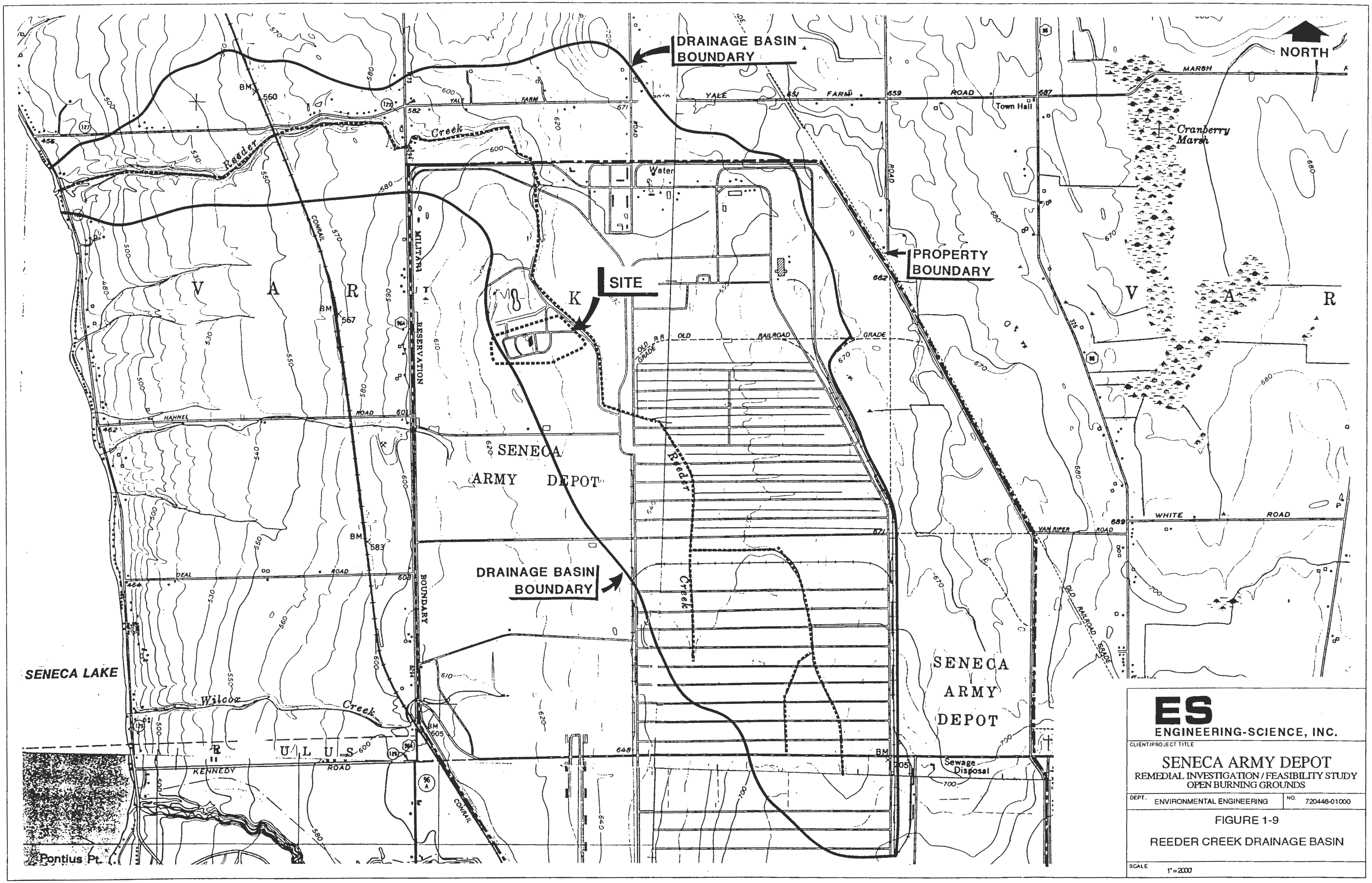
1.2.1.3 Local Hydrogeology

The previous studies at the OB grounds have focused upon evaluating groundwater from the unconfined till. These studies have assumed that any groundwater in the till and the underlying fractured/weathered shales are essentially the same aquifer. The water table for the shallow aquifer is 3 to 6 feet deep, while the shale/till contact is from 3 to 15 feet below the ground surface. Recharge to these shallow aquifers is via percolation associated with local precipitation which averages 29.4 inches per year.

Surface water and shallow groundwater flow at the OB grounds site are directed northeast into Reeder Creek which is in a sub-basin within the main Seneca Lake drainage basin. Figure 1-9 provides an indication of surface drainage patterns at the site. Reeder Creek is located approximately 1,000 feet northeast of Burning Pad A and flows north through the Demolition Grounds and then turns west and discharges into Seneca Lake, approximately three miles away.

On-site hydraulic conductivity determinations were performed by M&E (1989) on monitoring wells MW-8 through MW-17. These wells are all screened within the glacial till unit. The data were analyzed according to a procedure described by Hvorslev (1951). The average hydraulic conductivity measured for the ten monitoring wells was $5.0\text{x}10^{-1}$ ft/day ($1.8\text{x}10^{-4}$ cm/sec). The hydraulic conductivities ranged from $2.02 \text{ x } 10^{-2}$ ft/day ($7.06\text{x}10^{-6}$ cm/sec) to 1.47 ft/day ($5.19\text{x}10^{-4}$ cm/sec). These hydraulic conductivity measurements were within an order of magnitude agreement with previous results reported by O'Brien and Gere (1984). O'Brien and Gere determined the average hydraulic conductivity of the till material to be approximately $2.8\text{x}10^{-1}$ ft/day ($9.9\text{x}10^{-5}$cm/sec). A comparison of the measured values with the typical range of hydraulic conductivities for glacial tills indicates that the glacial till at the site exists along the more permeable end of typical glacial till values.

Soils samples were collected during the 1984 U.S. Army Environmental Hygiene Agency (USAEHA) Phase IV investigation of the burning ground to characterize the permeability of the burning pad soils. Soil permeabilities were measured by recompacting the soil in a mold to 95% standard proctor density. The average permeability for five (5) measurements was $1.01\text{x}10^{-3}$ ft/day ($3.56\text{x}10^{-7}$ cm/sec). The typical range of glacial tills described by Freeze and Cherry (1979), is between $3\text{x}10^{-1}$ ft/day ($1\text{x}10^{-4}$ cm/sec) and $3\text{x}10^{-7}$ ft/day ($1\text{x}10^{-10}$ cm/sec).



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REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 1-9

REEDER CREEK DRAINAGE BASIN

SCALE 1"=2000'

Based upon water level measurements made in monitoring wells MW-8 through MW-17, M&E generated a groundwater elevation map for the OB grounds. This map indicates that groundwater, within the glacial till deposits, flows primarily northeast, towards Reeder Creek. The change in elevation of the groundwater surface generally follows the drop in elevation of the land surface towards Reeder Creek. Much of this groundwater is expected to recharge Reeder Creek.

1.2.2 Site History

Open burning-open detonation operations have been conducted for more than forty years in the 90 acre munitions destruction area. The OB grounds occupy an area of approximately 30 acres within the southern portion of the munitions destruction area (Figure 1-2). Originally open burning was conducted directly upon the clay ground surface. Due to the seasonally wet nature of the local soils the individual burn pads were subsequently built up with shale to provide a drier environment in which to perform the munitions burning. The berms around the burn pads were formed by bulldozing of the surrounding soils, including those soils containing residues of the burning process. The base material of the pads is composed of crushed shale which was quarried from a nearby area on SEDA and placed over the till with shale to provide a solid base with good drainage. The burning of munitions has been performed at the nine burning pads labeled A through H and J. Of the nine burn pads, there are five small pads, A,B,C,D and E, two intermediate pads, F and H and two large pads G and J. The small pads each encompass an area approximately 70' x 100', the intermediate pads each encompass an area approximately 120' x 210' and the large pads each encompass an area 200' x 460'. According to an Installation Assessment of Seneca Army Depot, Report No. 157 (USATHAMA, 1980), the burning area pads were in use from the early 1960s until the late 1980s. During this time items burned possibly included explosive trash from an old washout plant, fuzes containing lead compounds, and projectiles containing TNT. The open burning procedure described below is from the Interim Final Report, Groundwater Contamination Survey No. 38-26-0868-88, Evaluation of Solid Waste Management Units (USAEHA, July 1987). The burning process was performed by preparing combustible beds of pallets and wooden boxes on the pads and placing the ammunition or components to be destroyed on the beds. A trail of propellant approximately 5 feet long, 6 inches wide and 3 inches deep was placed on the ground leading to the combustible bed. Electric squib was placed in the propellant trail and connected to firing wires. The operator initiated the burn by firing the circuits from an office a safe distance away.

According to USAEHA Hazardous Waste Study No. 37-26-0778-86, closure of Open Burning/Open Detonation Ground Burning Pads (January 1986), Pads A and J were the first to be abandoned for open burning. Also, according to this report, Pads I and J were only used for trash and rubbish, while Pads B, C, D, E, F, G and H were used for projectiles, explosives and propellants. The practice of open burning on these pads was discontinued in 1987. At present the burning of munitions is done within an open air, steel enclosure located immediately west of burning Pad D.

An elongate, low hill is located in the southern portion of the open burning area. The low hill is mostly covered by brush and trees and forms a pseudo barrier in this portion of the site. Based on the vegetation which covers the hill and on its geographic location relative to the burn pad berms (i.e., it is far from access roads and the most recent open burning activity), the formation of the low hill is believed to be time equivalent to the berms around the nine burn pads. According to SEDA personnel, the hill was formed during clearing activities early in the history of the open burning area, however, a definitive description of its development is not available. The clearing of surface vegetation and some soil was performed as a safety measure to prevent high grass from causing a potential fire hazard in the burn pad areas. There may have been more than one clearing event over the lifetime of the OB grounds area.

A burn kettle is located between Pads G and J. The burn kettle is a small rectangular-shaped building which housed a furnace to burn small caliber arms.

1.2.3 Previous Investigations

A substantial volume of data is available for the Open Burning grounds. Soil sampling, monitoring well installation, and groundwater sampling have all been performed under various investigative programs conducted at the OB grounds. Information is available on the overburden conditions and the direction of groundwater flow at the site with a level of detail sufficient to initially characterize the physical setting of the OB Grounds.

The following reports have provided data on the OB\OD grounds:

1. Installation Assessment of Seneca Army Depot, Report No. 157, AMXTH-IR-A-157, January 1980; Conducted by the U.S. Army Toxic and Hazardous Materials Agency, (USATHAMA).

2. Phase 2, Hazardous Waste Management Special Study: No. 39-26-0147-83, US Army Material Development and Readiness Command (DARCOM) Open-Burning/Open Detonation Grounds Evaluation, 1983.

3. O'Brien and Gere Engineers, Burning Pads B and H Closure, 1985.

4. Phase 4 Evaluation of the Opening Burning/Open Detonation Grounds. Investigation of Soil Contamination, 1984; Conducted by the US Army Environmental Hygiene Agency, (USAEHA).

5. Closure of Open-Burning/Open Detonation Ground Burning Pads Seneca Army Depot, Hazardous Waste Study No. 37-26-0778-86, 1986; conducted by USAEHA.

6. Evaluation of Solid Waste Management Units, Seneca Army Depot, Interim Final Report, Groundwater Contamination Survey No. 38-26-0868-88, 1988; Conducted by USAEHA.

7. Update of the Initial Installation Assessment of Seneca Army Depot prepared for SEDA and USATHAMA August 1988; prepared by Environmental Science and Engineering, Inc.

8. Metcalf & Eddy, Criteria Development Report for Closure of Nine Burning Pads, 1989.

The complete list of references is given in the reference section of this document. The results of these various investigations are briefly summarized below.

USATHAMA conducted an evaluation of the Seneca Army Depot beginning in May of 1979. This study concluded: 1) geological conditions are such that contaminants, if present, could migrate in surface or subsurface waters; and 2) the demolition/burning ground is potentially contaminated with heavy metals and explosives. No chemical analyses specific to the Open Burning grounds were conducted for this study.

Following the depot assessment, conducted by USATHAMA, a four phased DARCOM Open Burning/Open Detonation ground evaluation was begun in 1981. Monitoring wells MW-1 through MW-7 were installed in 1981. Six of the monitoring wells were installed along the perimeter of the site while monitoring well MW-1 was located between the detonation ground and the burn pads. The wells were screened in the glacial till at, or just above, the till-shale (bedrock) contact. Groundwater monitoring began in January, 1982. Groundwater sampling for metals and explosives has been done on a regular basis since 1982.

The United States Army Environmental Hygiene Agency (USAEHA) conducted a Phase 2 study of the Open Burning/Open Detonation grounds in 1982 in order to characterize the environmental hazards associated with the OB/OD area. This study concentrated on attempting to determine total explosive and EP toxicity extracts of the metal content in soils and residues. The portion of the study relevant to the Open Burning grounds consisted of the collection of 24 surface soil samples from seven burn pads. Two soil samples from Burn Pad H contained EP toxicity extract concentrations of lead at 6.3 and 24.6 mg/L. Barium was found in two samples from Burn Pad B at EP toxicity extract concentrations of 246 and 508 mg/L. Total RDX was detected in 18 of 24 samples at concentrations between 1.0 and 4.0 ug/g. The highest concentration of an explosive was found at Burn Pad F (9,270 ug/g of 2,4,6-TNT). The explosive 2,4-DNT was detected in five of 24 soil samples at concentrations between 1.8 and 45 ug/g. The compound 2,6-DNT was detected in four of the samples that also contained 2,4-DNT. Tetryl was detected in only one sample at a concentration of 2.7 ug/g. No HMX was detected in any of the 24 samples. The data are presented in Table 1-2. Table 1-3 presents a summary of this data. The Phase 2 report concluded that the areas were not hazardous for EP Toxicity for heavy metals, although two of three samples from Pad B exceeded the barium standard and two of the three Pad H samples exceeded lead standards. This study recommended that no additional studies be conducted.

Based on the data from the Phase 2 investigation, O'Brien & Gere Engineers, Inc. was contracted in 1984 to review previous studies and recommend procedures for the environmentally sound closure of Burning Pads B and H following RCRA guidelines. The report was prepared under Contract DAC87-84-C-0077, dated November 1984 and was based on analytical data from previous studies and limited geophysical surveys of the two pads. O'Brien and Gere's recommended closure procedure was excavation, on-site treatment, and removal of contaminated material to a permitted and secure off-site landfill, with subsequent capping of the site. There were no recommendations made regarding the remaining seven pads as they were not included in this study. No chemical analyses were performed as part of this closure report.

During 1984, in a study nearly coincident with the O'Brien and Gere study, USAEHA conducted an additional investigation of the soils at Burn Pads B, F, and H (Phase 4

TABLE 1–2

HISTORICAL ANALYTICAL RESULTS FOR SOIL SAMPLES FROM BURN PADS
USAEHA PHASE 2 STUDY – 1982

SENECA ARMY DEPOT
OB GROUNDS

			EP Toxicity (mg/L)								Explosives (μg/g)					
Sample Number	Location	Depth	As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6–TNT	2,6–DNT	2,4–DNT
4727–009	Burn Area H	0–6 inches	ND	ND	ND	ND	ND	24.6	ND	ND	ND	1.1	ND	ND	1.6	21.0
4727–010	Burn Area H	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9	ND	ND	1.5	6.0
4727–011	Burn Area H	0–6 inches	ND	ND	ND	ND	ND	6.3	ND	ND	ND	4.7	ND	ND	1.6	6.6
4727–012	Burn Area F	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.2	ND	24.0	ND	1.8
4727–013	Burn Area F	0–6 inches	ND	ND	0.12	ND	ND	ND	ND	ND	ND	2.7	ND	46.0	ND	ND
4727–014	Burn Area F	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.0	ND	9270	23.0	45.0
4727–015	Burn Area D	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.5	ND	7.4	ND	ND
4727–016	Burn Area D	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND
4727–017	Burn Area D	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND	ND	ND
4727–018	Burn Area E	0–6 inches	ND	ND	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4727–019	Burn Area E	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND	ND	ND	ND
4727–020	Burn Area E	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	ND	ND	ND	ND
4727–021	Burn Area G	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	ND	ND	ND	ND
4727–022	Burn Area G	0–6 inches	ND	ND	0.14	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND
4727–023	Burn Area G	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND
4727–024	Burn Area G	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND
4727–025	Burn Area G	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND
4727–026	Burn Area G	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7	ND	6.7	ND	ND
4727–027	Burn Area C	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4727–028	Burn Area C	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	ND	ND	ND	ND
4727–029	Burn Area C	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4727–030	Burn Area B	0–6 inches	ND	508	ND	ND	ND	ND	ND	ND	ND	1.7	ND	ND	ND	ND
4727–031	Burn Area B	0–6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.6	ND	ND	ND	ND
4727–032	Burn Area B	0–6 inches	ND	246	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DETECTION LIMITS			0.5	10	0.1	0.5	0.02	0.5	0.1	0.5	1.0	1.0	1.0	1.0	1.0	1.0

Notes:

1) ND = not detected

2) Source: Phase 2 Hazardous Waste Management Special Study No. 39–26–0147–83, DARCOM Open Burning/Open–Detonation Grounds Evaluation, Seneca Army Depot, Seneca, New York, 2–13 May 1982.

TABLE 1 – 3

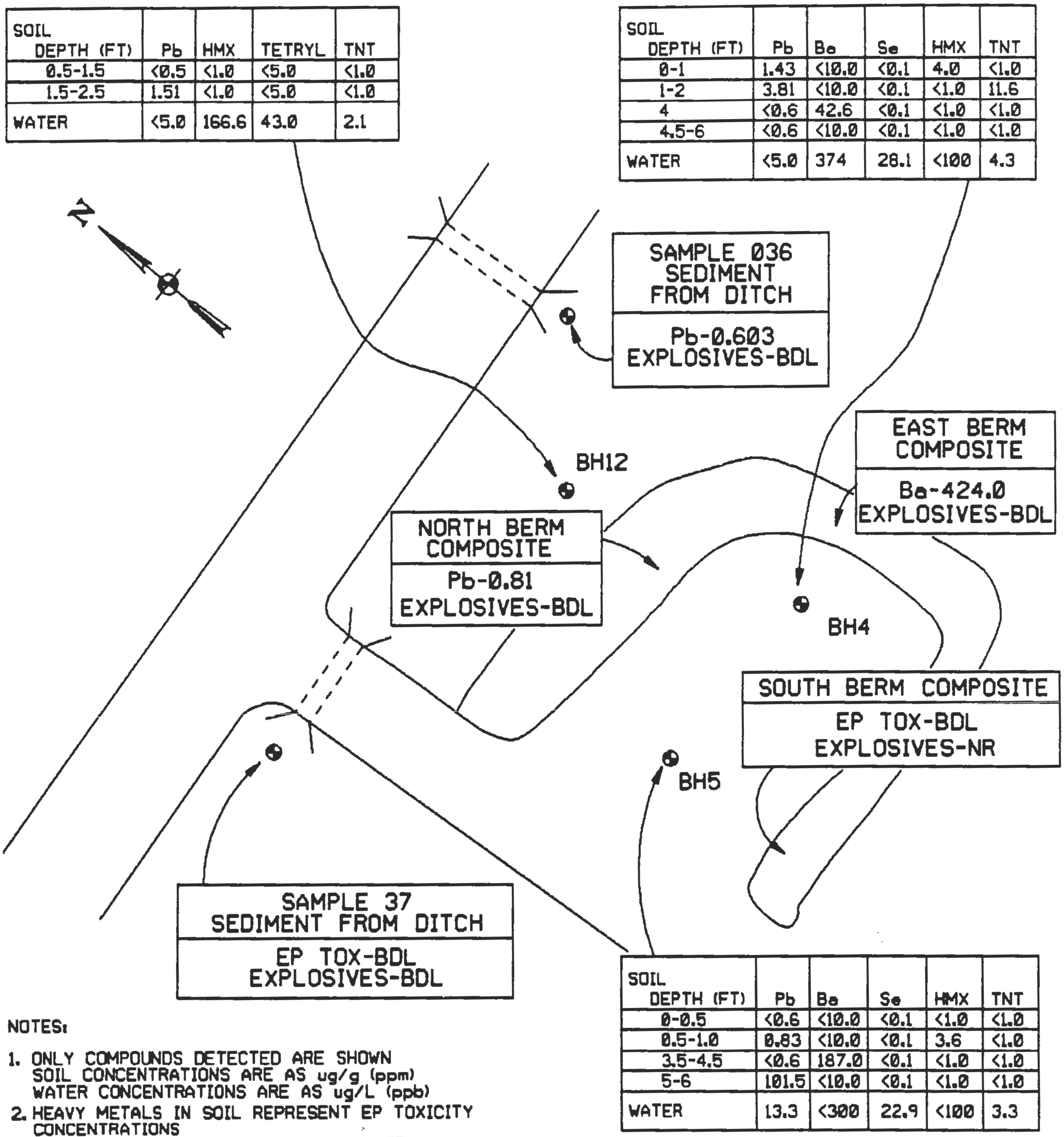
SUMMARY OF SOIL ANALYSES DATA FROM THE USAEHA PHASE 2 (1982) REPORT FOR THE BURN PADS B THROUGH G

SENECA ARMY DEPOT
OB GROUNDS

CHEMICAL	EP TOXICITY LIMIT (mg/l)	DETECTION LIMIT (mg/l)	RANGE DETECTED (mg/l)	TOTAL NUMBER OF SAMPLES	NUMBER OF SAMPLES EXCEEDING DETECTION LIMIT	NUMBER OF SAMPLES EXCEEDING TOXICITY LIMIT	NUMBER OF PADS IN EXCESS OF DETECTION LIMIT	NUMBER OF PADS IN EXCESS OF EP TOXICITY
Inorganics								
As	5	0.5	ND	24	0	0	0	0
Ba	100	10	ND – 508	24	2	2	All from B	B
Cd	1	0.1	ND – 0.17	24	3	0	F, E, G	0
Cr	5	0.5	ND	24	0	0	0	0
Hg	0.2	0.02	ND	24	0	0	0	0
Pb	5	0.5	ND – 24.6	24	2	2	All from H	H
Se	1	0.1	ND	24	0	0	0	0
Ag	5	0.5	ND	24	0	0	0	0
Explosives								
HMX	NA	1	ND	24	0	NA	0	NA
RDX	NA	1	ND – 7	24	18	NA	B, C, D, E, F, G, H	NA
Tetryl	NA	1	ND – 2.7	24	1	NA	D	NA
2,4,6–TNT	NA	1	ND – 9270	24	6	NA	F, D, G	NA
2,6–DNT	NA	1	ND – 23.0	24	4	NA	F, H	NA
2,4–DNT	NA	1	ND – 45.0	24	5	NA	F, H	NA

Notes:

1. NA = Not Available
2. ND = Not Detected
3. All samples were collected from 0 – 6"
4. Toxicity Characteristic Leaching Procedure (TCLP) has replaced EP Toxicity, however, the allowable limits have remained the same.



SOIL DEPTH (FT)	Pb	HMX	TETRYL	TNT
0.5-1.5	<0.5	<1.0	<5.0	<1.0
1.5-2.5	1.51	<1.0	<5.0	<1.0
WATER	<5.0	166.6	43.0	2.1

SOIL DEPTH (FT)	Pb	Ba	Se	HMX	TNT
0-1	1.43	<10.0	<0.1	4.0	<1.0
1-2	3.81	<10.0	<0.1	<1.0	11.6
4	<0.6	42.6	<0.1	<1.0	<1.0
4.5-6	<0.6	<10.0	<0.1	<1.0	<1.0
WATER	<5.0	374	28.1	<100	4.3

SAMPLE 036
SEDIMENT
FROM DITCH

Pb-0.603
EXPLOSIVES-BDL

EAST BERM
COMPOSITE

Ba-424.0
EXPLOSIVES-BDL

NORTH BERM
COMPOSITE

Pb-0.81
EXPLOSIVES-BDL

SOUTH BERM COMPOSITE

EP TOX-BDL
EXPLOSIVES-NR

SAMPLE 37
SEDIMENT FROM DITCH

EP TOX-BDL
EXPLOSIVES-BDL

SOIL DEPTH (FT)	Pb	Ba	Se	HMX	TNT
0-0.5	<0.6	<10.0	<0.1	<1.0	<1.0
0.5-1.0	0.83	<10.0	<0.1	3.6	<1.0
3.5-4.5	<0.6	187.0	<0.1	<1.0	<1.0
5-6	101.5	<10.0	<0.1	<1.0	<1.0
WATER	13.3	<300	22.9	<100	3.3

NOTES:

1. ONLY COMPOUNDS DETECTED ARE SHOWN
   SOIL CONCENTRATIONS ARE AS ug/g (ppm)
   WATER CONCENTRATIONS ARE AS ug/L (ppb)
2. HEAVY METALS IN SOIL REPRESENT EP TOXICITY CONCENTRATIONS
3. HEAVY METALS IN WATER ARE DISSOLVED (FILTERED SAMPLES)
4. WATER WAS OBTAINED FROM BOREHOLES USING TEMPORARY WELLS WHICH ARE CURRENTLY NON-EXISTANT
5. BDL - BELOW DETECTABLE LIMITS
6. NR - NOT REPORTED BY LABORATORY

REF: HAZARDOUS WASTE STUDY NO. 37-26-0479-85
PHASE 4 OF AMC OPEN BURNING/
OPEN-DETONATION GROUNDS
EVALUATION INVESTIGATION OF SOIL
CONTAMINATION AT THE OPEN BURNING GROUNDS

SENECA ARMY DEPOT, ROMULUS, NEW YORK
AUGUST 13-19, 1984.

ES
ENGINEERING-SCIENCE, INC.

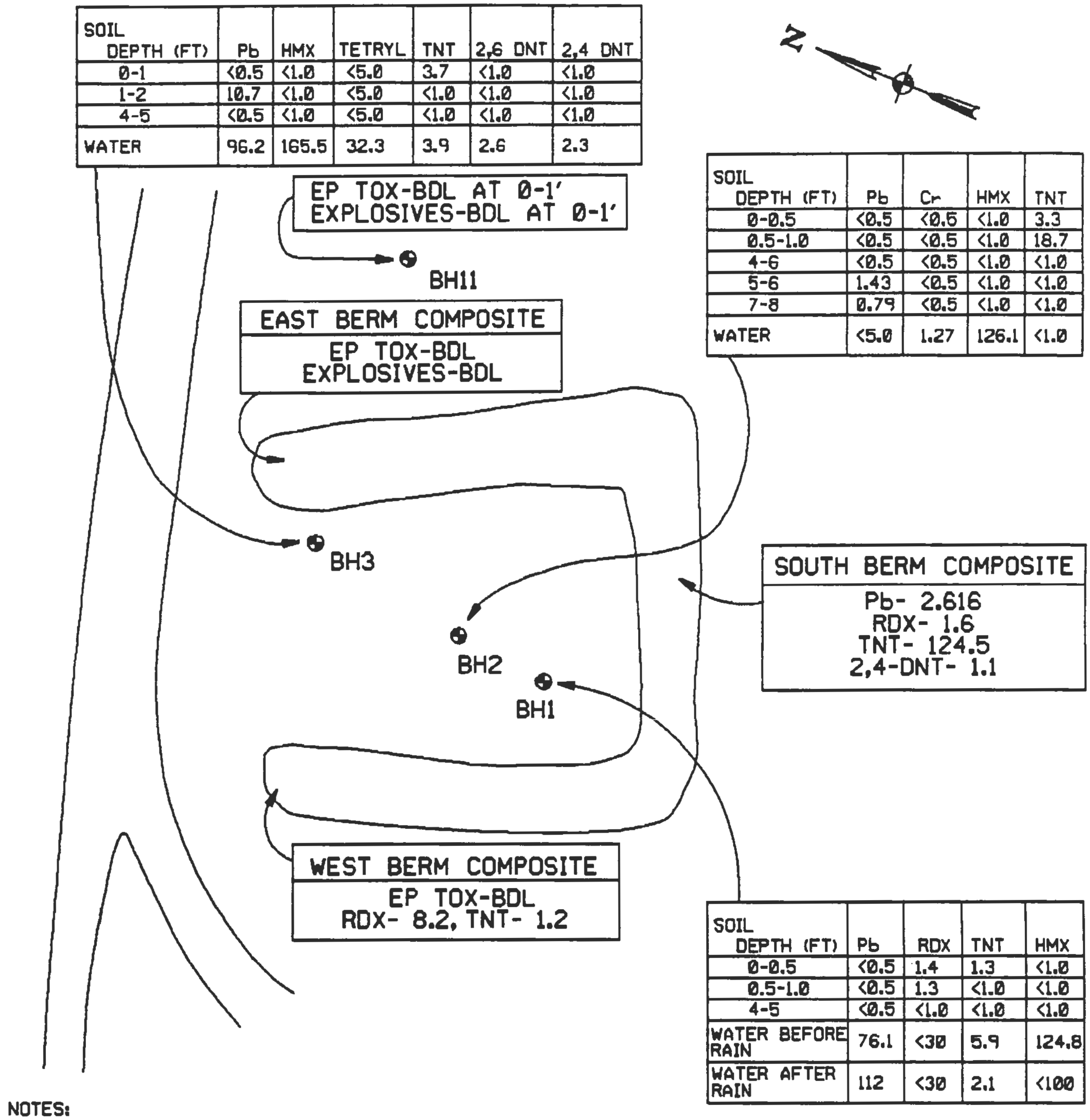
CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 1-10

SOIL AND GROUND WATER DATA
FROM BURNING PAD B

SCALE 1" = 40' (APPROXIMATE)



SOIL DEPTH (FT)	Pb	HMX	TETRYL	TNT	2,6 DNT	2,4 DNT
0-1	<0.5	<1.0	<5.0	3.7	<1.0	<1.0
1-2	10.7	<1.0	<5.0	<1.0	<1.0	<1.0
4-5	<0.5	<1.0	<5.0	<1.0	<1.0	<1.0
WATER	96.2	165.5	32.3	3.9	2.6	2.3

EP TOX-BDL AT 0-1′
EXPLOSIVES-BDL AT 0-1′

SOIL DEPTH (FT)	Pb	Cr	HMX	TNT
0-0.5	<0.5	<0.5	<1.0	3.3
0.5-1.0	<0.5	<0.5	<1.0	18.7
4-6	<0.5	<0.5	<1.0	<1.0
5-6	1.43	<0.5	<1.0	<1.0
7-8	0.79	<0.5	<1.0	<1.0
WATER	<5.0	1.27	126.1	<1.0

EAST BERM COMPOSITE
EP TOX-BDL
EXPLOSIVES-BDL

SOUTH BERM COMPOSITE
Pb- 2.616
RDX- 1.6
TNT- 124.5
2,4-DNT- 1.1

WEST BERM COMPOSITE
EP TOX-BDL
RDX- 8.2, TNT- 1.2

SOIL DEPTH (FT)	Pb	RDX	TNT	HMX
0-0.5	<0.5	1.4	1.3	<1.0
0.5-1.0	<0.5	1.3	<1.0	<1.0
4-5	<0.5	<1.0	<1.0	<1.0
WATER BEFORE RAIN	76.1	<30	5.9	124.8
WATER AFTER RAIN	112	<30	2.1	<100

NOTES:

1. ONLY COMPOUNDS DETECTED ARE SHOWN
   SOIL CONCENTRATIONS ARE AS ug/g (ppm)
   WATER CONCENTRATIONS ARE AS ug/L (ppb)
2. HEAVY METALS IN SOIL REPRESENT EP TOXICITY CONCENTRATIONS
3. HEAVY METALS IN WATER ARE DISSOLVED (FILTERED SAMPLES)
4. WATER WAS OBTAINED FROM BOREHOLES USING TEMPORARY WELLS WHICH ARE CURRENTLY NON-EXISTANT
5. BDL - BELOW DETECTABLE LIMITS
6. NR - NOT REPORTED BY LABORATORY

REF: HAZARDOUS WASTE STUDY NO. 37-26-0479-85
PHASE 4 OF AMC OPEN BURNING/
OPEN-DETONATION GROUNDS
EVALUATION INVESTIGATION OF SOIL
CONTAMINATION AT THE OPEN BURNING GROUNDS

SENECA ARMY DEPOT, ROMULUS, NEW YORK
AUGUST 13-19, 1984.

ES
ENGINEERING-SCIENCE, INC.

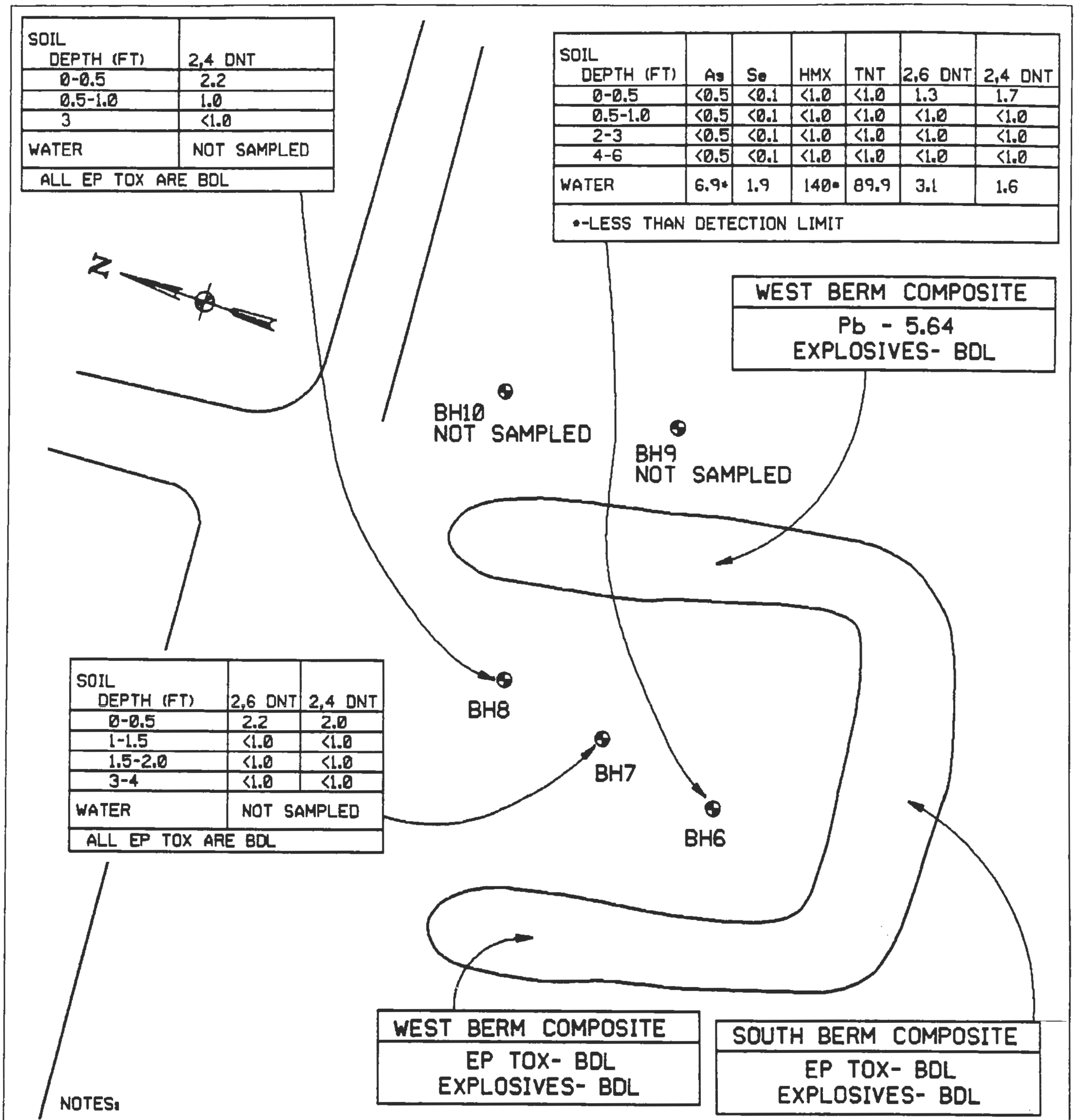
CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 1-11

SOIL AND GROUND WATER DATA FROM BURNING PAD F

SCALE 1" = 40' (APPROXIMATE)



SOIL DEPTH (FT)	2,4 DNT
0-0.5	2.2
0.5-1.0	1.0
3	<1.0
WATER	NOT SAMPLED

ALL EP TOX ARE BDL

SOIL DEPTH (FT)	As	Se	HMX	TNT	2,6 DNT	2,4 DNT
0-0.5	<0.5	<0.1	<1.0	<1.0	1.3	1.7
0.5-1.0	<0.5	<0.1	<1.0	<1.0	<1.0	<1.0
2-3	<0.5	<0.1	<1.0	<1.0	<1.0	<1.0
4-6	<0.5	<0.1	<1.0	<1.0	<1.0	<1.0
WATER	6.9*	1.9	140*	89.9	3.1	1.6

*-LESS THAN DETECTION LIMIT

WEST BERM COMPOSITE

Pb - 5.64
EXPLOSIVES- BDL

SOIL DEPTH (FT)	2,6 DNT	2,4 DNT
0-0.5	2.2	2.0
1-1.5	<1.0	<1.0
1.5-2.0	<1.0	<1.0
3-4	<1.0	<1.0
WATER	NOT SAMPLED	

ALL EP TOX ARE BDL

WEST BERM COMPOSITE

EP TOX- BDL
EXPLOSIVES- BDL

SOUTH BERM COMPOSITE

EP TOX- BDL
EXPLOSIVES- BDL

NOTES:

1. ONLY COMPOUNDS DETECTED ARE SHOWN
   SOIL CONCENTRATIONS ARE AS ug/g (ppm)
   WATER CONCENTRATIONS ARE AS ug/L (ppb)
2. HEAVY METALS IN SOIL REPRESENT EP TOXICITY CONCENTRATIONS
3. HEAVY METALS IN WATER ARE DISSOLVED (FILTERED SAMPLES)
4. WATER WAS OBTAINED FROM BOREHOLES USING TEMPORARY WELLS WHICH ARE CURRENTLY NON-EXISTANT
5. BDL - BELOW DETECTABLE LIMITS
6. NR - NOT REPORTED BY LABORATORY

REF: HAZARDOUS WASTE STUDY NO. 37-26-0479-85
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SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO 720446-01000

FIGURE 1-12

SOIL AND GROUND WATER DATA
FROM BURNING PAD H

SCALE 1" = 40' (APPROXIMATE)

TABLE 1-4

HISTORICAL ANALYTICAL RESULTS FOR SOIL AND WATER SAMPLES FROM IN AND NEAR BURN PADS

SENECA ARMY DEPOT
OB GROUNDS

BURN PAD F

			EP Toxicity (mg/L)								Explosives (µg/g)					
Sample Number	**Location**	**Depth**	**As**	**Ba**	**Cd**	**Cr**	**Hg**	**Pb**	**Se**	**Ag**	**HMX**	**RDX**	**Tetryl**	**2,4,6-TNT**	**2,6-DNT**	**2,4-DNT**
0479-001	Bore Hole 1	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	1.3	ND	ND
0479-002	Bore Hole 1	6-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	ND	ND	ND	ND
0479-003	Bore Hole 1	4-5 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-004	Bore Hole 2	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.3	ND	ND
0479-005	Bore Hole 2	6-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	18.7	ND	ND
0479-006	Bore Hole 2	4-5 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-007	Bore Hole 2	5-6 feet	ND	ND	ND	ND	ND	1.430	ND	ND	ND	ND	ND	ND	ND	ND
0479-008	Bore Hole 2	7-8 feet	ND	ND	ND	ND	ND	0.79	ND	ND	ND	ND	ND	ND	ND	ND
0479-009	Bore Hole 3	0-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.7	ND	ND
0479-010	Bore Hole 3	1-2 feet	ND	ND	ND	ND	ND	10.7	ND	ND	ND	ND	ND	ND	ND	ND
0479-011	Bore Hole 3	4-5 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-042	East Berm	Composite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-043	South Berm	Composite	ND	ND	ND	ND	ND	2.616	ND	ND	ND	1.6	ND	124.5	ND	1.1
0479-044	West Berm	Composite	ND	ND	ND	ND	ND	ND	ND	ND	ND	8.2	ND	1.2	ND	ND
DETECTION LIMIT			0.500	10.000	0.100	0.500	0.020	0.500	0.100	0.500	1.0	1.0	5.0	1.0	1.0	1.0
TCLP LIMITS			5	100	1	5	0.2	5	1	5	NA	NA	NA	NA	NA	NA

BURN PAD B

			EP Toxicity (mg/L)								Explosives (µg/g)					
Sample Number	**Location**	**Depth**	**As**	**Ba**	**Cd**	**Cr**	**Hg**	**Pb**	**Se**	**Ag**	**HMX**	**RDX**	**Tetryl**	**2,4,6-TNT**	**2,6-DNT**	**2,4-DNT**
0479-012	Bore Hole 4	0-12 inches	ND	ND	ND	ND	ND	1.43	ND	ND	4.0	ND	ND	ND	ND	ND
0479-013	Bore Hole 4	1-2 feet	ND	ND	ND	ND	ND	3.81	ND	ND	ND	ND	ND	11.6	ND	ND
0479-014	Bore Hole 4	4 feet	ND	42.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-015	Bore Hole 4	4.5-6 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-016	Bore Hole 5	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-017	Bore Hole 5	6-12 inches	ND	ND	ND	ND	ND	0.830	ND	ND	3.6	ND	ND	ND	ND	ND
0479-018	Bore Hole 5	3.5-4.5 feet	ND	187.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-019	Bore Hole 5	5-6 feet	ND	ND	ND	ND	ND	101.5	ND	ND	ND	ND	ND	ND	ND	ND
0479-045	North Berm	Composite	ND	ND	ND	ND	ND	0.81	ND	ND	ND	ND	ND	ND	ND	ND
0479-046	East Berm	Composite	ND	424.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-047	South Berm	Composite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DETECTION LIMIT			0.500	10.000	0.100	0.500	0.020	0.500	0.100	0.500	1.0	1.0	5.0	1.0	1.0	1.0
TCLP LIMITS			5	100	1	5	0.2	5	1	5	NA	NA	NA	NA	NA	NA

TABLE 1-4

HISTORICAL ANALYTICAL RESULTS FOR SOIL AND WATER SAMPLES FROM IN AND NEAR BURN PADS

SENECA ARMY DEPOT
OB GROUNDS

BURN PAD H

Sample Number	Location	Depth	EP Toxicity (mg/L)								Explosives (µg/g)					
			As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
0479-020	Bore Hole 6	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.3	1.7
0479-021	Bore Hole 6	6-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-022	Bore Hole 6	2-3 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-023	Bore Hole 6	4-5 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-024	Bore Hole 7	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.2	2.0
0479-025	Bore Hole 7	6-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-026	Bore Hole 7	18-24 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-027	Bore Hole 7	3-4 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-028	Bore Hole 8	0-6 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.2
0479-029	Bore Hole 8	6-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0
0479-030	Bore Hole 8	3 feet	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-039	East Berm	Composite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-040	South Berm	Composite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-041	West Berm	Composite	ND	ND	ND	ND	ND	5.64	ND	ND	ND	ND	ND	ND	ND	ND
DETECTION LIMIT			0.500	10.000	0.100	0.500	0.020	0.500	0.100	0.500	1.0	1.0	5.0	1.0	1.0	1.0
TCLP LIMITS			5	100	1	5	0.2	5	1	5	NA	NA	NA	NA	NA	NA

ADJACENT TO BURN PADS B, D, F, and H

Sample Number	Location	Depth	EP Toxicity (mg/L)								Explosives (µg/g)					
			As	Ba	Cd	Cr	Hg	Pb	Se	Ag	HMX	RDX	Tetryl	2,4,6-TNT	2,6-DNT	2,4-DNT
0479-031	BH-10, E Pad F	0-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-032	Sample Destroyed	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
0479-033	BH-17, E Pad F	0-12 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-034	BH-12, N Pad B	8-18 inches	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-036	BH-12, N Pad B	18-30 inches	ND	ND	ND	ND	ND	1.510	ND	ND	ND	ND	ND	ND	ND	ND
0479-036	Ditch Adj. Pad B	NA	ND	ND	ND	ND	ND	0.693	ND	ND	ND	ND	ND	ND	ND	ND
0479-037	Ditch Adj. Pads H & F	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0479-038	Ditch Adj. Pad D	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
DETECTION LIMIT			0.500	10.000	0.100	0.500	0.020	0.500	0.100	0.500	1.0	1.0	5.0	1.0	1.0	1.0
TCLP LIMITS			5	100	1	5	0.2	5	1	5	NA	NA	NA	NA	NA	NA

TABLE 1-4

HISTORICAL ANALYTICAL RESULTS FOR SOIL AND WATER SAMPLES FROM IN AND NEAR BURN PADS

SENECA ARMY DEPOT
OB GROUNDS

WATER SAMPLES

			EP Toxicity (mg/L)								Explosives (µg/g)					
Sample Number	**Location**	**Depth**	**As**	**Ba**	**Cd**	**Cr**	**Hg**	**Pb**	**Se**	**Ag**	**HMX**	**RDX**	**Tetryl**	**2,4,6-TNT**	**2,6-DNT**	**2,4-DNT**
0479-101	Bore Hole 1, Pad F	NA	ND	ND	ND	ND	NA	76.1	ND	ND	124.8	ND	ND	5.9	ND	ND
0479-102	Bore Hole 1, Pad F	NA	ND	ND	ND	ND	NA	112	ND	ND	ND	ND	ND	2.1	ND	ND
0479-103	Bore Hole 2, Pad F	NA	ND	ND	ND	1.27	NA	ND	ND	ND	126.1*	ND	ND	ND	ND	ND
0479-104	Bore Hole 3, Pad F	NA	ND	ND	ND	ND	NA	96.2	ND	ND	165.5	ND	32.3	8.9	8.5	2.3
0479-105	Bore Hole 4, Pad B	NA	ND	374	ND	ND	NA	ND	28.1	ND	ND	ND	ND	ND	ND	ND
0479-106	Bore Hole 5, Pad H	NA	6.9^	ND	ND	ND	NA	ND	7.86	ND	139.9*	ND	ND	89.9	3.1	1.6
0479-107	Bore Hole 6, Pad B	NA	ND	ND	ND	ND	NA	13.3	22.9	ND	ND	ND	ND	3.3	ND	4.2
0479-108	Bore Hole 11, E Pad F	NA	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND	ND	4.3	ND	ND
0479-109	Bore Hole 12, N Pad B	NA	ND	ND	ND	ND	NA	ND	ND	ND	166.6*	ND	43.0	2.1	ND	ND
DETECTION LIMIT			10	300	1.00	1.00	NA	5.00	5.00	255	100	<30	10	1	1	1
TCLP LIMITS			5	100	1	5	0.2	5	1	5	NA	NA	NA	NA	NA	NA

<u>Notes;</u>

1) ND = not detected
2) Source: Phase 4 of AMC Open Burning/Open-Detonation Grounds Evaluation Investigation of Soil Contamination at the Open Burning Grounds,
   Seneca Army Depot, Seneca, New York, 2-13 May 1982.
3) NA = Not Available
4) * = Interference; may not be HMX
5) ^ = The validity of this data is questionable because the reported value is below the detection limit.
5) EP Toxicity has been replaced by TCLP, however, the limit values remained the same.

Evaluation, Hazardous Waste Study No. 37-26-0479-85, USAEHA). Sample locations and data results from the Phase 4 program for Burning Pads B, F and H are summarized in Figures 1-10 through 1-12, respectively. Soils at Pad B were found to contain extract concentrations of lead (101 mg/l) and barium (424 mg/l) at levels that exceeded the EP Toxicity limits of 5 mg/l and 100 mg/l, respectively. Pads F and H both had one soil sample that exceeded the standards for lead, (5 mg/l), while the Pad H soil sample also showed small amounts of 2,6-DNT and 2,4-DNT. Groundwater samples collected from temporary borehole wells contained lead concentrations up to 112 ug/L at Pad F which exceeded the 25 ug/L New York State groundwater standards for lead. The New New York State groundwater standard for lead is 15 ug/L. The analytical results of this investigation are presented in Table 1-4.

In 1986 USAEHA conducted a Closure Report for the Open Burning/Open Detonation grounds burning pads (Hazardous Waste No. 37-26-0778-86). The report concluded that the area used to burn propellants should be closed in an environmentally safe manner. Specifically, the report recommended that all of the pads used for projectile, explosive, and propellant burning be covered using either a natural clay or synthetic cap.

In 1987, an Interim Final Report, Groundwater Contamination Survey No. 38-26-0888-88, Evaluation of Solid Waste Management Units was prepared by USAEHA. This report presents an evaluation of the Open Burning/Open Detonation grounds and includes analytical data from monitoring wells. Historical chemical analyses for monitoring wells MW-1 through MW-7 are presented in Table 1-5 and Table 1-6 and in Appendix A. The last five quarters of sampling data are included within this Appendix to provide data on the chemical constituents present within the groundwater. The full set of historical chemical analyses indicate that throughout the six-year period of sampling no explosive components were detected within the groundwater. In addition, only iron and manganese exceeded the New York state groundwater standards. No EP Toxicity metals or explosives were detected in the 27 samples analyzed in the first year. Monitoring of these original wells continued on an annual basis through 1987 for explosives, metals, total organic carbon (TOC), total organic halides (TOX), pH, pesticides, nitrates, and specific conductivity.

In 1988, all previous work at the site was summarized in an update of the Initial Installation Assessment of Seneca Army Depot. No chemical analyses were performed for this project.

In 1989 Metcalf and Eddy Engineers (M&E) was contracted to evaluate previous studies, conduct further investigations as necessary, and develop a closure plan at the Open Burning site. Their investigation included: a limited geophysical investigation to assist in locating monitoring wells, the installation of ten additional monitoring wells, and sampling and analyses of the ten new wells and six of the seven existing wells.

TABLE 1-5

HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES FROM SEVEN WELLS

SENECA ARMY DEPOT
OB GROUNDS

Parameter	Sampling Date	Detection Limit	Units	Well Numbers W-1	W-2	W-3	W-4	W-5	W-6	W-7
Arsenic	05-Jan-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Arsenic	13-Apr-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Arsenic	29-Jun-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Arsenic	28-Sep-82	0.010	mg/l	ND	ND	ND	NA	ND	ND	NA
Barium	05-Jan-82	0.10	mg/l	ND	ND	ND	ND	ND	ND	ND
Barium	13-Apr-82	0.10	mg/l	ND	ND	ND	ND	ND	ND	ND
Barium	29-Jun-82	0.10	mg/l	ND	ND	ND	ND	ND	ND	ND
Barium	28-Sep-82	0.10	mg/l	ND	ND	ND	ND	ND	ND	NA
Cadmium	05-Jan-82	5.000	ug/l	ND	ND	ND	ND	ND	ND	ND
Cadmium	13-Apr-82	5.000	ug/l	ND	ND	ND	ND	ND	ND	ND
Cadmium	29-Jun-82	5.000	ug/l	ND	ND	ND	ND	ND	ND	ND
Cadmium	28-Sep-82	5.000	ug/l	ND	ND	ND	ND	ND	ND	NA
Chromium	05-Jan-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Chromium	13-Apr-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Chromium	29-Jun-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Chromium	28-Sep-82	0.010	mg/l	ND	ND	ND	NA	ND	ND	NA
Fluoride	05-Jan-82	0.10	mg/l	0.10	0.10	0.20	0.20	0.30	0.30	0.30
Fluoride	13-Apr-82	0.10	mg/l	0.20	0.10	0.20	0.20	0.30	0.20	0.20
Fluoride	29-Jun-82	0.10	mg/l	0.20	0.20	0.20	0.20	0.40	0.20	0.30
Fluoride	28-Sep-82	0.10	mg/l	0.20	0.20	0.20	0.20	0.30	0.20	NA
Lead	05-Jan-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Lead	13-Apr-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Lead	29-Jun-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Lead	28-Sep-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
Mercury	05-Jan-82	0.2	ug/l	ND	ND	ND	ND	ND	ND	ND
Mercury	13-Apr-82	0.2	ug/l	ND	ND	ND	ND	ND	ND	ND
Mercury	29-Jun-82	0.2	ug/l	ND	ND	ND	ND	ND	ND	ND
Mercury	28-Sep-82	0.2	ug/l	ND	ND	ND	ND	ND	ND	NA
Selenium	05-Jan-82	0.005	mg/l	ND	ND	ND	ND	ND	ND	ND
Selenium	13-Apr-82	0.005	mg/l	ND	ND	ND	ND	ND	ND	ND
Selenium	29-Jun-82	0.005	mg/l	ND	ND	ND	ND	ND	ND	ND
Selenium	28-Sep-82	0.005	mg/l	ND	ND	ND	NA	ND	ND	NA
Silver	05-Jan-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Silver	13-Apr-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Silver	29-Jun-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Silver	28-Sep-82	0.010	mg/l	ND	ND	ND	NA	ND	ND	NA
Iron	05-Jan-82	0.02	mg/l	0.15	0.10	0.19	0.15	0.13	0.27	0.14
Iron	13-Apr-82	0.03	mg/l	0.10	0.02	0.10	0.08	ND	0.09	0.10
Iron	29-Jun-82	0.03	mg/l	0.44	0.09	0.06	0.24	ND	0.26	0.70
Iron	28-Sep-82	0.02	mg/l	0.19	0.09	0.23	NA	0.12	0.24	NA
Iron	08-Feb-83	0.02	mg/l	0.09	0.06	0.07	0.10	0.13	0.15	0.08
Iron	09-Aug-83	0.02	mg/l	NA	0.12	0.07	0.16	0.09	0.25	NA
Iron	14-Feb-84	0.10	mg/l	ND	ND	ND	0.11	0.15	ND	1.02
Iron	20-Mar-85	0.10	mg/l	ND	ND	ND	ND	NA	ND	ND
Iron	18-Mar-86	0.03	mg/l	ND	ND	ND	ND	ND	0.03	ND
Iron	17-Mar-87	0.10	mg/l	ND	ND	ND	ND	ND	ND	ND
Manganese	05-Jan-82	0.010	mg/l	ND	0.07	ND	0.04	0.27	0.30	0.09
Manganese	13-Apr-82	0.010	mg/l	0.02	0.05	ND	0.06	0.10	0.04	0.03
Manganese	29-Jun-82	0.001	mg/l	0.02	0.13	0.03	0.05	0.21	0.02	0.01
Manganese	28-Sep-82	0.010	mg/l	ND	0.16	0.04		ND	ND	NA
Manganese	08-Feb-83	0.010	mg/l	ND	0.01	ND	0.12	0.02	0.02	0.01
Manganese	09-Aug-83	0.001	mg/l	NA	0.21	0.02	0.32	0.12	0.01	NA
Manganese	14-Feb-84	0.030	mg/l	ND	ND	ND	ND	ND	0.04	ND
Manganese	20-Mar-85	0.030	mg/l	ND	0.04	ND	0.09		0.05	ND
Manganese	18-Mar-86	0.010	mg/l	ND	ND	ND	0.12	ND	ND	ND
Manganese	17-Mar-87	0.030	mg/l	ND	ND	ND	0.28	0.08	ND	ND

TABLE 1-5

HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES FROM SEVEN WELLS

SENECA ARMY DEPOT
OB GROUNDS

Parameter	Sampling Date	Detection Limit	Units	Well Numbers W-1	W-2	W-3	W-4	W-5	W-6	W-7
Sodium	05-Jan-82	1.0	mg/l	15.00	22.00	14.00	28.00	15.00	20.00	12.00
Sodium	13-Apr-82	1.0	mg/l	11.00	21.00	15.00	37.00	10.00	8.00	10.00
Sodium	29-Jun-82	1.0	mg/l	15.00	24.00	20.00	11.00	12.00	9.00	8.00
Sodium	28-Sep-82	1.0	mg/l	8.00	16.00	10.00	NA	12.00	9.00	NA
Sodium	08-Feb-83	1.0	mg/l	12.00	15.00	8.00	37.00	21.00	11.00	7.00
Sodium	09-Aug-83	1.0	mg/l	NA	15.00	9.00	36.00	16.00	11.00	NA
Sodium	14-Feb-84	1.0	mg/l	5.00	14.00	4.00	7.00	7.00	16.00	3.00
Sodium	20-Mar-85	1.0	mg/l	9.00	9.00	7.00	23.00	NA	24.00	2.00
Sodium	18-Mar-86	1.0	mg/l	7.00	6.00	5.00	20.00	8.00	30.00	4.00
Sodium	17-Mar-87	1.0	mg/l	11.00	9.00	6.00	30.00	8.00	14.00	4.00
2,4,6-TNT	27-Jun-84	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4,6-TNT	18-Sep-84	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4,6-TNT	20-Mar-85	0.001	mg/l	ND	ND	ND	ND	NA	ND	ND
2,4,6-TNT	13-Sep-85	0.001	mg/l	ND	ND	ND	NA	ND	ND	NA
2,4,6-TNT	18-Mar-86	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4,6-TNT	16-Sep-86	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4,6-TNT	17-Mar-87	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	27-Jun-84	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	18-Sep-84	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	20-Mar-85	0.001	mg/l	ND	ND	ND	ND	NA	ND	ND
2,4-DNT	13-Sep-85	0.001	mg/l	ND	ND	ND	NA	ND	ND	NA
2,4-DNT	18-Mar-86	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	16-Sep-86	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,4-DNT	17-Mar-87	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	27-Jun-84	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	18-Sep-84	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	20-Mar-85	0.001	mg/l	ND	ND	ND	ND	NA	ND	ND
2,6-DNT	13-Sep-85	0.001	mg/l	ND	ND	ND	NA	ND	ND	NA
2,6-DNT	18-Mar-86	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	16-Sep-86	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
2,6-DNT	17-Mar-87	0.001	mg/l	ND	ND	ND	ND	ND	ND	ND
RDX	27-Jun-84	0.030	mg/l	ND	ND	ND	ND	ND	ND	ND
RDX	18-Sep-84	0.030	mg/l	ND	ND	ND	ND	ND	ND	ND
RDX	20-Mar-85	0.030	mg/l	ND	ND	ND	ND	NA	ND	ND
RDX	13-Sep-85	0.030	mg/l	ND	ND	ND	NA	ND	ND	NA
RDX	18-Mar-86	0.030	mg/l	ND	ND	ND	ND	ND	ND	ND
RDX	16-Sep-86	0.030	mg/l	ND	ND	ND	ND	ND	ND	ND
RDX	17-Mar-87	0.030	mg/l	ND	ND	ND	ND	ND	ND	ND
HMX	27-Jun-84	0.100	mg/l	ND	ND	ND	ND	ND	ND	ND
HMX	18-Sep-84	0.100	mg/l	ND	ND	ND	ND	ND	ND	ND
HMX	20-Mar-85	0.100	mg/l	ND	ND	ND	ND	NA	ND	ND
HMX	13-Sep-85	0.100	mg/l	ND	ND	ND	NA	ND	ND	NA
HMX	18-Mar-86	0.100	mg/l	ND	ND	ND	ND	ND	ND	ND
HMX	16-Sep-86	0.100	mg/l	ND	ND	ND	ND	ND	ND	ND
HMX	17-Mar-87	0.100	mg/l	ND	ND	ND	ND	ND	ND	ND
Tetryl	27-Jun-84	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Tetryl	18-Sep-84	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Tetryl	20-Mar-85	0.010	mg/l	ND	ND	ND	ND	NA	ND	ND
Tetryl	13-Sep-85	0.010	mg/l	ND	ND	ND	NA	ND	ND	NA
Tetryl	18-Mar-86	0.005	mg/l	ND	ND	ND	ND	ND	ND	ND
Tetryl	16-Sep-86	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Tetryl	17-Mar-87	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
Endrin	05-Jan-82	0.04	ug/l	ND	ND	ND	ND	ND	ND	ND
Endrin	13-Apr-82	40.00	ug/l	ND	ND	ND	ND	ND	ND	ND
Endrin	29-Jun-82	0.04	ug/l	ND	ND	ND	ND	ND	ND	ND
Endrin	28-Sep-82	0.04	ug/l	ND	ND	ND	NA	ND	ND	NA
Lindane	05-Jan-82	0.08	ug/l	ND	ND	ND	ND	ND	ND	ND
Lindane	13-Apr-82	0.08	ug/l	ND	ND	ND	ND	ND	ND	ND
Lindane	29-Jun-82	0.08	ug/l	ND	ND	ND	ND	ND	ND	ND
Lindane	28-Sep-82	0.08	ug/l	ND	ND	ND	NA	ND	ND	NA

TABLE 1-5

HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES FROM SEVEN WELLS

SENECA ARMY DEPOT
OB GROUNDS

Parameter	Sampling Date	Detection Limit	Units	Well Numbers						
				W-1	W-2	W-3	W-4	W-5	W-6	W-7
Toxaphene	05-Jan-82	1.6	ug/l	ND	ND	ND	ND	ND	ND	ND
Toxaphene	13-Apr-82	1.6	ug/l	ND	ND	ND	ND	ND	ND	ND
Toxaphene	29-Jun-82	1.6	ug/l	ND	ND	ND	ND	ND	ND	ND
Toxaphene	28-Sep-82	1.6	ug/l	ND	ND	ND	NA	ND	ND	NA
Methoxychlor	05-Jan-82	1.6	ug/l	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	13-Apr-82	1.6	ug/l	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	29-Jun-82	1.6	ug/l	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	28-Sep-82	1.6	ug/l	ND	ND	ND	NA	ND	ND	NA
2,4-D	05-Jan-82	3.8	ug/l	ND	ND	ND	ND	ND	ND	ND
2,4-D	13-Apr-82	3.8	ug/l	ND	ND	ND	ND	ND	ND	ND
2,4-D	29-Jun-82	3.8	ug/l	ND	ND	ND	ND	ND	ND	ND
2,4-D	28-Sep-82	3.8	ug/l	ND	ND	ND	ND	ND	ND	NA
Silvex	05-Jan-82	0.5	ug/l	ND	ND	ND	ND	ND	ND	ND
Silvex	13-Apr-82	0.5	ug/l	ND	ND	ND	ND	ND	ND	ND
Silvex	29-Jun-82	0.5	ug/l	ND	ND	ND	ND	ND	ND	ND
Silvex	28-Sep-82	0.5	ug/l	ND	ND	ND	NA	ND	ND	NA
Gross Alpha	05-Jan-82	4.61	pic/l	ND	4.14	ND	ND	ND	ND	ND
Gross Alpha	13-Apr-82	3.37	pic/l	2.30	3.39	3.64	ND	3.33	2.63	ND
Gross Alpha	29-Jun-82	6.49	pic/l	ND	9.04	12.60	4.26	4.81	5.99	3.87
Gross Alpha	28-Sep-82	5.20	pic/l	ND	NA	ND	NA	ND	ND	NA
Radium-226	28-Jun-82	0.24	pic/l	0.27	ND	ND	NA	NA	ND	NA
Radium-226	28-Sep-82	0.18	pic/l	NA	NA	NA	NA	ND	NA	NA
Gross Beta	05-Jan-82	1.52	pic/l	2.31	2.12	2.91	3.01	2.02	2.06	ND
Gross Beta	13-Apr-82	1.64	pic/l	2.05	ND	2.08	1.60	ND	ND	ND
Gross Beta	29-Jun-82	1.86	pic/l	1.62	1.99	1.96	3.34	1.59	ND	ND
Gross Beta	28-Sep-82	1.76	pic/l	1.85	NA	3.14	NA	ND	1.22	NA
Phenol	05-Jan-82	0.01	mg/l	ND	ND	ND	ND	ND	ND	ND
Phenol	13-Apr-82	0.01	mg/l	ND	ND	ND	ND	ND	ND	ND
Phenol	29-Jun-82	0.01	mg/l	0.01	ND	ND	ND	ND	ND	ND
Phenol	28-Sep-82	0.01	mg/l	0.02	0.01	ND	0.01	0.01	ND	NA
Phenol	08-Feb-83	0.01	mg/l	ND	ND	ND	ND	ND	ND	ND
Phenol	09-Aug-83	0.01	mg/l	NA	ND	ND	ND	ND	ND	NA
Phenol	14-Feb-84	0.01	mg/l	ND	ND	ND	ND	ND	ND	ND
Phenol	20-Mar-85	0.01	mg/l	ND	ND	ND	ND	NA	ND	ND
Phenol	18-Mar-86	0.01	mg/l	ND	ND	ND	ND	ND	ND	ND
Phenol	17-Mar-87	0.01	mg/l	ND	ND	ND	ND	ND	ND	ND
NO2+NO3 as N	05-Jan-82	0.05	mg/l	1.60	ND	0.08	0.71	6.70	1.20	0.22
NO2+NO3 as N	13-Apr-82	0.05	mg/l	1.00	ND	0.13	0.49	5.00	1.00	0.38
NO2+NO3 as N	29-Jun-82	0.05	mg/l	2.00	ND	0.06	0.52	6.00	2.00	0.30
NO2+NO3 as N	28-Sep-82	0.05	mg/l	2.00	ND	0.08	0.12	10.00	3.00	NA
Chloride	05-Jan-82	1.0	mg/l	7.90	5.80	28.50	10.00	4.60	17.60	3.50
Chloride	13-Apr-82	1.0	mg/l	7.00	4.90	46.00	9.00	4.00	3.00	2.00
Chloride	29-Jun-82	1.0	mg/l	12.00	10.00	51.00	9.00	9.00	11.00	7.00
Chloride	28-Sep-82	1.0	mg/l	3.00	6.00	11.20	ND	1.00	ND	NA
Chloride	08-Feb-83	1.0	mg/l	6.00	3.00	9.00	6.00	2.00	7.00	2.00
Chloride	09-Aug-83	1.0	mg/l	NA	4.00	15.00	5.00	3.00	3.00	NA
Chloride	14-Feb-84	2.0	mg/l	2.30	ND	4.00	8.70	ND	20.00	ND
Chloride	20-Mar-85	1.0	mg/l	7.00	4.00	15.00	6.00	NA	12.00	3.00
Chloride	18-Mar-86	1.0	mg/l	5.00	3.00	6.00	5.00	3.00	4.00	2.00
Chloride	17-Mar-87	1.0	mg/l	6.00	3.00	5.00	4.00	2.00	4.00	1.00
Sulfate	05-Jan-82	2.0	mg/l	233.00	225.00	147.00	327.00	57.50	38.00	77.00
Sulfate	13-Apr-82	2.0	mg/l	220.00	263.00	210.00	330.00	110.00	100.00	84.00
Sulfate	29-Jun-82	2.0	mg/l	260.00	293.00	220.00	150.00	110.00	100.00	70.00
Sulfate	28-Sep-82	2.0	mg/l	180.00	280.00	194.00	81.00	130.00	88.00	NA
Sulfate	08-Feb-83	2.0	mg/l	210.00	200.00	180.00	600.00	93.00	110.00	74.00
Sulfate	09-Aug-83	2.0	mg/l	NA	203.00	215.00	333.00	129.00	106.00	NA
Sulfate	14-Feb-84	2.0	mg/l	119.00	108.00	148.00	117.00	51.00	130.00	7.30
Sulfate	20-Mar-85	2.0	mg/l	231.00	180.00	194.00	306.00	NA	231.00	47.00
Sulfate	18-Mar-86	2.0	mg/l	248.00	117.00	148.00	283.00	77.00	63.00	57.00
Sulfate	17-Mar-87	2.0	mg/l	160.00	6.00	56.00	255.00	24.00	67.00	27.00
TDS	29-Jun-82	1.0	mg/l	672.00	698.00	704.00	431.00	465.00	406.00	389.00

TABLE 1-5

HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES FROM SEVEN WELLS

SENECA ARMY DEPOT
OB GROUNDS

	Sampling	Detection		Well Numbers						
Parameter	Date	Limit	Units	W-1	W-2	W-3	W-4	W-5	W-6	W-7
TOC	05-Jan-82	0.1	mg/l	1.00	1.00	4.00	1.00	1.00	1.00	1.00
TOC	05-Jan-82	0.1	mg/l	1.00	1.00	4.00	1.00	1.00	1.00	1.00
TOC	05-Jan-82	0.1	mg/l	1.00	1.00	4.00	1.00	1.00	1.00	1.00
TOC	05-Jan-82	0.1	mg/l	1.00	1.00	4.00	1.00	1.00	1.00	1.00
TOC	13-Apr-82	0.1	mg/l	37.00	44.00	48.00	54.00	39.00	40.00	40.00
TOC	13-Apr-82	0.1	mg/l	37.00	44.00	47.00	54.00	39.00	40.00	40.00
TOC	13-Apr-82	0.1	mg/l	37.00	44.00	47.00	54.00	40.00	42.00	40.00
TOC	13-Apr-82	0.1	mg/l	37.00	44.00	48.00	55.00	39.00	43.00	40.00
TOC	29-Jun-82	0.1	mg/l	42.00	42.00	53.00	30.00	43.00	43.00	38.00
TOC	29-Jun-82	0.1	mg/l	40.00	42.00	53.00	30.00	42.00	41.00	39.00
TOC	29-Jun-82	0.1	mg/l	40.00	41.00	54.00	30.00	42.00	43.00	40.00
TOC	29-Jun-82	0.1	mg/l	42.00	43.00	54.00	30.00	42.00	43.00	38.00
TOC	28-Sep-82	0.1	mg/l	21.00	4.00	44.00	28.00	37.00	39.00	NA
TOC	28-Sep-82	0.1	mg/l	23.00	4.00	43.00	29.00	38.00	39.00	NA
TOC	28-Sep-82	0.1	mg/l	22.00	4.00	43.00	27.00	37.00	39.00	NA
TOC	28-Sep-82	0.1	mg/l	22.00	4.00	43.00	28.00	38.00	39.00	NA
TOC	08-Feb-83	0.1	mg/l	22.00	25.00	27.00	32.00	23.00	26.00	26.00
TOC	08-Feb-83	0.1	mg/l	22.00	25.00	26.00	33.00	23.00	27.00	26.00
TOC	08-Feb-83	0.1	mg/l	22.00	25.00	27.00	32.00	24.00	27.00	26.00
TOC	08-Feb-83	0.1	mg/l	22.00	25.00	27.00	33.00	23.00	27.00	26.00
TOC	09-Aug-83	0.1	mg/l	NA	23.00	74.00	47.00	53.00	46.00	NA
TOC	09-Aug-83	0.1	mg/l	NA	22.00	74.00	47.00	53.00	47.00	NA
TOC	09-Aug-83	0.1	mg/l	NA	21.00	74.00	46.00	54.00	45.00	NA
TOC	09-Aug-83	0.1	mg/l	NA	22.00	74.00	46.00	53.00	46.00	NA
TOC	14-Feb-84	0.1	mg/l	24.00	29.00	29.00	35.00	24.00	32.00	12.00
TOC	14-Feb-84	0.1	mg/l	24.00	29.00	29.00	36.00	23.00	33.00	11.00
TOC	14-Feb-84	0.1	mg/l	24.00	30.00	29.00	36.00	23.00	33.00	11.00
TOC	14-Feb-84	0.1	mg/l	24.00	29.00	29.00	35.00	24.00	32.00	11.00
TOC	18-Sep-84	0.1	mg/l	3.00	3.00	4.00	3.00	3.00	3.00	3.00
TOC	18-Sep-84	0.1	mg/l	3.00	3.00	4.00	4.00	3.00	3.00	4.00
TOC	18-Sep-84	0.1	mg/l	3.00	3.00	4.00	4.00	3.00	3.00	2.00
TOC	18-Sep-84	0.1	mg/l	3.00	4.00	5.00	4.00	3.00	3.00	3.00
TOC	20-Mar-85	0.1	mg/l	5.90	4.10	6.00	5.90	NA	8.80	9.50
TOC	20-Mar-85	0.1	mg/l	6.10	4.00	6.00	5.70	NA	8.80	9.60
TOC	20-Mar-85	0.1	mg/l	5.80	4.10	6.00	5.80	NA	8.70	9.40
TOC	20-Mar-85	0.1	mg/l	5.90	4.10	6.00	5.70	NA	8.80	9.50
TOC	13-Sep-85	0.1	mg/l	2.70	3.10	3.30	NA	3.40	3.00	NA
TOC	13-Sep-85	0.1	mg/l	2.50	3.30	3.20	NA	3.40	2.70	NA
TOC	13-Sep-85	0.1	mg/l	2.60	3.10	3.30	NA	3.40	2.80	NA
TOC	13-Sep-85	0.1	mg/l	2.50	3.50	3.30	NA	3.40	2.90	NA
TOC	18-Mar-86	0.1	mg/l	5.00	3.50	5.40	3.60	3.40	6.30	4.20
TOC	18-Mar-86	0.1	mg/l	5.00	3.50	5.10	3.50	3.40	6.30	4.20
TOC	18-Mar-86	0.1	mg/l	5.00	3.40	5.10	3.50	3.40	6.40	4.20
TOC	18-Mar-86	0.1	mg/l	5.20	3.60	5.20	3.50	3.40	6.20	4.20
TOC	16-Sep-86	0.1	mg/l	5.20	4.70	6.20	4.70	5.10	5.30	5.20
TOC	16-Sep-86	0.1	mg/l	5.40	4.90	6.20	4.70	5.00	5.40	5.10
TOC	16-Sep-86	0.1	mg/l	5.40	4.70	6.30	4.80	5.00	5.40	5.10
TOC	16-Sep-86	0.1	mg/l	5.40	4.80	6.20	4.80	4.90	5.50	5.20
TOC	17-Mar-87	0.1	mg/l	2.30	4.00	5.60	3.80	5.00	3.70	3.60
TOC	17-Mar-87	0.1	mg/l	2.20	4.00	5.50	3.70	5.00	3.80	3.60
TOC	17-Mar-87	0.1	mg/l	2.20	3.90	5.50	3.60	4.90	3.70	3.50
TOC	17-Mar-87	0.1	mg/l	2.10	4.00	5.60	3.70	5.00	3.80	3.50

TABLE 1-5

HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES FROM SEVEN WELLS

SENECA ARMY DEPOT
OB GROUNDS

Parameter	Sampling Date	Detection Limit	Units	Well Numbers W-1	W-2	W-3	W-4	W-5	W-6	W-7
TOX	05-Jan-82	0.010	mg/l	0.02	0.05	0.06	0.06	ND	0.03	0.02
TOX	05-Jan-82	0.010	mg/l	ND	0.06	0.04	0.05	ND	0.03	0.04
TOX	05-Jan-82	0.010	mg/l	0.02	0.02	0.05	0.05	ND	0.01	0.03
TOX	05-Jan-82	0.010	mg/l	0.02	0.06	0.05	0.05	0.02	0.01	0.02
TOX	13-Apr-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	0.01
TOX	13-Apr-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
TOX	13-Apr-82	0.010	mg/l	ND	ND	ND	ND	ND	ND	ND
TOX	13-Apr-82	0.010	mg/l	ND	ND	0.01	ND	ND	0.01	0.01
TOX	29-Jun-82	0.010	mg/l	0.02	0.07	0.06	ND	0.06	ND	0.03
TOX	29-Jun-82	0.010	mg/l	0.08	0.04	ND	ND	0.10	ND	0.03
TOX	29-Jun-82	0.010	mg/l	0.07	0.03	0.05	ND	0.05	0.02	0.03
TOX	29-Jun-82	0.010	mg/l	0.07	0.08	ND	ND	0.04	ND	0.02
TOX	28-Sep-82	0.010	mg/l	0.07	NA	0.10	NA	ND	0.01	NA
TOX	28-Sep-82	0.010	mg/l	ND	NA	0.07	NA	ND	0.08	NA
TOX	28-Sep-82	0.010	mg/l	0.08	NA	ND	NA	ND	0.10	NA
TOX	28-Sep-82	0.010	mg/l	0.04	NA	0.06	NA	ND	0.10	NA
TOX	08-Feb-83	0.010	mg/l	0.04	0.02	0.05	0.03	0.04	0.04	0.03
TOX	08-Feb-83	0.010	mg/l	0.03	0.03	0.05	0.05	0.04	0.05	0.04
TOX	08-Feb-83	0.010	mg/l	0.04	0.04	0.03	0.04	0.04	0.04	0.05
TOX	08-Feb-83	0.010	mg/l	0.04	0.04	0.06	0.04	0.04	0.04	0.04
TOX	09-Aug-83	0.010	mg/l	NA	ND	ND	0.04	0.04	0.04	NA
TOX	09-Aug-83	0.010	mg/l	NA	ND	ND	0.04	0.04	0.04	NA
TOX	09-Aug-83	0.010	mg/l	NA	ND	ND	0.04	0.04	0.03	NA
TOX	09-Aug-83	0.010	mg/l	NA	ND	ND	0.04	0.04	0.04	NA
TOX	14-Feb-84	0.010	mg/l	0.04	0.06	0.06	0.06	0.07	ND	ND
TOX	14-Feb-84	0.010	mg/l	0.04	0.03	0.06	0.07	0.06	ND	0.01
TOX	14-Feb-84	0.010	mg/l	0.04	0.04	0.05	0.04	0.08	ND	0.01
TOX	14-Feb-84	0.010	mg/l	0.04	0.04	0.06	0.06	0.03	ND	0.01
TOX	18-Sep-84	0.010	mg/l	0.02	ND	0.01	0.02	0.02	0.01	0.03
TOX	18-Sep-84	0.010	mg/l	0.03	ND	0.01	0.02	0.02	ND	0.03
TOX	18-Sep-84	0.010	mg/l	0.01	ND	ND	0.02	0.02	0.01	0.05
TOX	18-Sep-84	0.010	mg/l	0.01	ND	NA	0.03	0.02	ND	0.05
TOX	20-Mar-85	0.010	mg/l	ND	ND	ND	ND	NA	ND	0.01
TOX	20-Mar-85	0.010	mg/l	ND	ND	ND	ND	NA	ND	0.01
TOX	20-Mar-85	0.010	mg/l	ND	ND	ND	ND	NA	ND	0.01
TOX	20-Mar-85	0.010	mg/l	ND	ND	ND	ND	NA	ND	0.01
TOX	13-Sep-85	0.010	mg/l	ND	ND	ND	NA	ND	ND	NA
TOX	13-Sep-85	0.010	mg/l	ND	ND	ND	NA	ND	ND	NA
TOX	13-Sep-85	0.010	mg/l	ND	ND	ND	NA	ND	ND	NA
TOX	13-Sep-85	0.010	mg/l	ND	ND	ND	NA	ND	ND	NA
TOX	18-Mar-86	0.010	mg/l	ND	ND	ND	ND	ND	0.01	NA
TOX	18-Mar-86	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	18-Mar-86	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	18-Mar-86	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	16-Sep-86	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	16-Sep-86	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	16-Sep-86	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	16-Sep-86	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	17-Mar-87	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	17-Mar-87	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	17-Mar-87	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA
TOX	17-Mar-87	0.010	mg/l	ND	ND	ND	ND	ND	ND	NA

TABLE 1-5

HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES FROM SEVEN WELLS

SENECA ARMY DEPOT
OB GROUNDS

Parameter	Sampling Date	Detection Limit	Units	Well Numbers						
				W-1	W-2	W-3	W-4	W-5	W-6	W-7
Spec Cond (lab)	05-Jan-82	1.0	umhos	850.00	930.00	860.00	1130.00	730.00	720.00	640.00
Spec Cond (lab)	05-Jan-82	1.0	umhos	850.00	930.00	860.00	1120.00	730.00	720.00	640.00
Spec Cond (lab)	05-Jan-82	1.0	umhos	850.00	930.00	850.00	1130.00	730.00	720.00	640.00
Spec Cond (lab)	05-Jan-82	1.0	umhos	850.00	920.00	850.00	1130.00	730.00	720.00	640.00
Spec Cond (lab)	13-Apr-82	1.0	umhos	810.00	975.00	1000.00	1300.00	719.00	699.00	639.00
Spec Cond (lab)	13-Apr-82	1.0	umhos	810.00	972.00	1000.00	1302.00	718.00	699.00	639.00
Spec Cond (lab)	13-Apr-82	1.0	umhos	810.00	974.00	1000.00	1301.00	719.00	699.00	640.00
Spec Cond (lab)	13-Apr-82	1.0	umhos	810.00	973.00	1000.00	1300.00	720.00	699.00	638.00
Spec Cond (lab)	29-Jun-82	1.0	umhos	750.00	890.00	1040.00	590.00	620.00	580.00	490.00
Spec Cond (lab)	29-Jun-82	1.0	umhos	760.00	890.00	1030.00	590.00	620.00	580.00	490.00
Spec Cond (lab)	29-Jun-82	1.0	umhos	760.00	890.00	1030.00	600.00	620.00	585.00	490.00
Spec Cond (lab)	29-Jun-82	1.0	umhos	750.00	890.00	1030.00	600.00	620.00	580.00	490.00
Spec Cond (lab)	28-Sep-82	1.0	umhos	700.00	980.00	925.00	NA	795.00	665.00	NA
Spec Cond (lab)	28-Sep-82	1.0	umhos	700.00	980.00	920.00	NA	790.00	665.00	NA
Spec Cond (lab)	28-Sep-82	1.0	umhos	700.00	980.00	920.00	NA	795.00	665.00	NA
Spec Cond (lab)	28-Sep-82	1.0	umhos	700.00	980.00	920.00	NA	795.00	665.00	NA
Spec Cond (lab)	08-Feb-83	1.0	umhos	760.00	755.00	680.00	1160.00	580.00	685.00	605.00
Spec Cond (lab)	08-Feb-83	1.0	umhos	755.00	755.00	680.00	1160.00	580.00	690.00	605.00
Spec Cond (lab)	08-Feb-83	1.0	umhos	755.00	760.00	680.00	1160.00	585.00	680.00	600.00
Spec Cond (lab)	08-Feb-83	1.0	umhos	760.00	760.00	685.00	1160.00	580.00	685.00	605.00
Spec Cond (lab)	09-Aug-83	1.0	umhos	NA	930.00	1050.00	1190.00	900.00	1020.00	NA
Spec Cond (lab)	09-Aug-83	1.0	umhos	NA	940.00	1050.00	1200.00	890.00	1020.00	NA
Spec Cond (lab)	09-Aug-83	1.0	umhos	NA	940.00	1040.00	1190.00	890.00	1020.00	NA
Spec Cond (lab)	09-Aug-83	1.0	umhos	NA	940.00	1040.00	1200.00	900.00	1020.00	NA
Spec Cond (lab)	14-Feb-84	1.0	umhos	400.00	570.00	500.00	430.00	360.00	620.00	88.00
Spec Cond (lab)	14-Feb-84	1.0	umhos	410.00	580.00	510.00	420.00	360.00	620.00	87.00
Spec Cond (lab)	14-Feb-84	1.0	umhos	400.00	580.00	510.00	430.00	360.00	620.00	88.00
Spec Cond (lab)	14-Feb-84	1.0	umhos	400.00	570.00	510.00	430.00	360.00	630.00	88.00
Spec Cond (lab)	18-Sep-84	1.0	umhos	670.00	860.00	760.00	1000.00	710.00	620.00	500.00
Spec Cond (lab)	18-Sep-84	1.0	umhos	680.00	860.00	760.00	990.00	720.00	620.00	500.00
Spec Cond (lab)	18-Sep-84	1.0	umhos	680.00	860.00	760.00	1000.00	770.00	620.00	490.00
Spec Cond (lab)	18-Sep-84	1.0	umhos	680.00	860.00	760.00	1000.00	720.00	620.00	510.00
Spec Cond (lab)	20-Mar-85	1.0	umhos	750.00	750.00	760.00	990.00	NA	700.00	390.00
Spec Cond (lab)	20-Mar-85	1.0	umhos	750.00	740.00	760.00	1000.00	NA	700.00	400.00
Spec Cond (lab)	20-Mar-85	1.0	umhos	750.00	740.00	760.00	1000.00	NA	700.00	390.00
Spec Cond (lab)	20-Mar-85	1.0	umhos	760.00	740.00	760.00	990.00	NA	700.00	390.00
Spec Cond (lab)	13-Sep-85	1.0	umhos	880.00	840.00	830.00	NA	720.00	610.00	NA
Spec Cond (lab)	13-Sep-85	1.0	umhos	880.00	840.00	840.00	NA	720.00	600.00	NA
Spec Cond (lab)	13-Sep-85	1.0	umhos	870.00	840.00	840.00	NA	730.00	600.00	NA
Spec Cond (lab)	13-Sep-85	1.0	umhos	880.00	830.00	830.00	NA	730.00	600.00	NA
Spec Cond (lab)	18-Mar-86	1.0	umhos	670.00	520.00	620.00	960.00	590.00	490.00	3600.00
Spec Cond (lab)	18-Mar-86	1.0	umhos	660.00	520.00	620.00	960.00	590.00	500.00	3600.00
Spec Cond (lab)	18-Mar-86	1.0	umhos	670.00	520.00	620.00	950.00	590.00	500.00	3600.00
Spec Cond (lab)	18-Mar-86	1.0	umhos	660.00	520.00	610.00	950.00	590.00	490.00	3600.00
Spec Cond (lab)	16-Sep-86	1.0	umhos	870.00	820.00	950.00	1160.00	710.00	690.00	600.00
Spec Cond (lab)	16-Sep-86	1.0	umhos	880.00	810.00	950.00	1150.00	720.00	690.00	600.00
Spec Cond (lab)	16-Sep-86	1.0	umhos	880.00	820.00	950.00	1150.00	710.00	690.00	600.00
Spec Cond (lab)	16-Sep-86	1.0	umhos	880.00	820.00	960.00	1160.00	720.00	690.00	610.00
Spec Cond (lab)	17-Mar-87	1.0	umhos	820.00	730.00	710.00	990.00	640.00	670.00	530.00
Spec Cond (lab)	17-Mar-87	1.0	umhos	810.00	730.00	710.00	1000.00	630.00	680.00	530.00
Spec Cond (lab)	17-Mar-87	1.0	umhos	820.00	730.00	720.00	1000.00	630.00	680.00	530.00
Spec Cond (lab)	17-Mar-87	1.0	umhos	820.00	740.00	710.00	1000.00	640.00	690.00	530.00
Cond (field)	20-Mar-85	1.0	umhos	540.00	490.00	550.00	680.00	NA	440.00	270.00
Cond (field)	18-Mar-86	1.0	umhos	460.00	340.00	440.00	650.00	415.00	315.00	240.00
Cond (field)	18-Mar-86	1.0	umhos	460.00	335.00	440.00	645.00	415.00	320.00	240.00
Cond (field)	18-Mar-86	1.0	umhos	460.00	335.00	450.00	650.00	415.00	315.00	240.00
Cond (field)	18-Mar-86	1.0	umhos	460.00	335.00	445.00	645.00	415.00	310.00	235.00
Cond (field)	17-Mar-87	1.0	umhos	500.00	450.00	445.00	700.00	380.00	400.00	310.00
Cond (field)	17-Mar-87	1.0	umhos	495.00	445.00	440.00	705.00	375.00	400.00	315.00
Cond (field)	17-Mar-87	1.0	umhos	500.00	450.00	445.00	700.00	370.00	405.00	315.00
Cond (field)	17-Mar-87	1.0	umhos	500.00	440.00	440.00	695.00	375.00	405.00	315.00

TABLE 1-5

HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES FROM SEVEN WELLS

SENECA ARMY DEPOT
OB GROUNDS

Parameter	Sampling Date	Detection Limit	Units	Well Numbers						
				W-1	W-2	W-3	W-4	W-5	W-6	W-7
pH (field)	05-Jan-82	NA	st. units	7.20	7.30	7.40	7.20	7.30	7.50	7.10
pH (field)	05-Jan-82	NA	st. units	7.20	7.30	7.40	7.20	7.30	7.50	7.10
pH (field)	05-Jan-82	NA	st. units	7.20	7.30	7.40	7.20	7.30	7.50	7.10
pH (field)	05-Jan-82	NA	st. units	7.20	7.30	7.40	7.20	7.30	7.50	7.10
pH (field)	13-Apr-82	NA	st. units	7.60	7.40	7.40	7.20	7.60	7.60	7.40
pH (field)	13-Apr-82	NA	st. units	7.60	7.40	7.40	7.20	7.60	7.60	7.40
pH (field)	13-Apr-82	NA	st. units	7.60	7.40	7.40	7.20	7.60	7.60	7.40
pH (field)	13-Apr-82	NA	st. units	7.60	7.40	7.40	7.20	7.60	7.60	7.40
pH (field)	29-Jun-82	NA	st. units	8.10	7.80	7.70	7.80	7.80	7.80	7.80
pH (field)	29-Jun-82	NA	st. units	8.10	7.80	7.70	7.80	7.80	7.80	7.80
pH (field)	29-Jun-82	NA	st. units	8.10	7.80	7.70	7.80	7.80	7.80	7.80
pH (field)	29-Jun-82	NA	st. units	8.10	7.80	7.70	7.80	7.80	7.80	7.80
pH (field)	27-Sep-82	NA	st. units	7.50	7.60	7.50	7.90	7.60	7.70	NA
pH (field)	27-Sep-82	NA	st. units	7.50	7.60	7.50	7.90	7.60	7.70	NA
pH (field)	27-Sep-82	NA	st. units	7.50	7.60	7.50	7.90	7.60	7.70	NA
pH (field)	27-Sep-82	NA	st. units	7.50	7.60	7.50	7.90	7.60	7.70	NA
pH (field)	08-Feb-83	NA	st. units	7.50	7.70	7.50	7.30	7.80	7.80	7.60
pH (field)	08-Feb-83	NA	st. units	7.50	7.70	7.50	7.30	7.80	7.80	7.60
pH (field)	08-Feb-83	NA	st. units	7.50	7.70	7.50	7.30	7.80	7.80	7.60
pH (field)	08-Feb-83	NA	st. units	7.50	7.70	7.50	7.30	7.80	7.80	7.60
pH (field)	09-Aug-83	NA	st. units	NA	7.10	7.00	6.90	7.10	6.90	NA
pH (field)	09-Aug-83	NA	st. units	NA	7.10	7.00	6.90	7.10	6.90	NA
pH (field)	09-Aug-83	NA	st. units	NA	7.10	7.00	6.90	7.10	6.90	NA
pH (field)	09-Aug-83	NA	st. units	NA	7.10	7.00	6.90	7.10	6.90	NA
pH (field)	14-Feb-84	NA	st. units	7.30	7.40	7.40	6.80	7.30	7.20	7.50
pH (field)	14-Feb-84	NA	st. units	7.30	7.50	7.40	6.90	7.30	7.20	7.50
pH (field)	14-Feb-84	NA	st. units	7.30	7.40	7.40	6.80	7.40	7.30	7.60
pH (field)	14-Feb-84	NA	st. units	7.30	7.40	7.50	6.90	7.30	7.30	7.60
pH (field)	27-Jun-84	NA	st. units	7.10	7.10	7.00	6.80	7.00	7.10	7.10
pH (field)	18-Sep-84	NA	st. units	7.60	7.10	7.50	7.50	8.40	7.60	7.60
pH (field)	18-Sep-84	NA	st. units	7.70	7.10	7.40	7.60	8.30	7.50	7.50
pH (field)	18-Sep-84	NA	st. units	7.70	7.10	7.40	7.60	8.40	7.50	7.50
pH (field)	18-Sep-84	NA	st. units	7.60	7.20	7.40	7.50	8.30	7.60	7.50
pH (field)	20-Mar-85	NA	st. units	6.70	7.00	6.80	6.80	NA	6.90	7.00
pH (field)	13-Sep-85	NA	st. units	7.10	7.00	7.10	NA	7.10	7.10	NA
pH (field)	18-Mar-86	NA	st. units	7.20	7.20	7.00	6.80	7.10	7.40	7.30
pH (field)	18-Mar-86	NA	st. units	7.30	7.30	7.10	6.90	7.10	7.40	7.30
pH (field)	18-Mar-86	NA	st. units	7.20	7.30	7.00	6.80	7.10	7.40	7.30
pH (field)	18-Mar-86	NA	st. units	7.10	7.20	7.00	6.80	7.10	7.40	7.30
pH (field)	16-Sep-86	NA	st. units	6.90	7.00	7.00	7.00	7.10	7.40	7.20
pH (field)	17-Mar-87	NA	st. units	6.90	7.10	7.20	7.30	6.90	7.40	6.90
pH (field)	17-Mar-87	NA	st. units	6.80	7.00	7.10	7.20	7.00	7.40	7.00
pH (field)	17-Mar-87	NA	st. units	6.90	6.90	7.10	7.10	6.80	7.50	6.80
pH (field)	17-Mar-87	NA	st. units	6.90	6.90	7.10	7.20	6.90	7.40	6.90
pH (lab)	14-Mar-84	NA	st. units	7.70	7.90	7.80	7.70	7.90	7.80	7.50

Notes:
1) Source: USAEHA Interim Final Report, Groundwater Contamination Survey No. 38-0868-88,
Evaluation of Solid Waste Management Units, Seneca Army Depot, Romulus, New York, 27-31 July 1987
2) All metals and other parameters (where appropriate) are on a dissolved (filtered) basis unless otherwise noted.
3) piC/l = picoCuries/liter

TABLE 1 – 6

SUMMARY OF HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES FROM WELLS MW–1 TO MW–7 (1981 THROUGH 1987)

SENECA ARMY DEPOT OB GROUNDS

CHEMICAL	EPA MCL (μg/l)	NYSGWS (μg/l)	DETECTION LIMIT (μg/l)	RANGE DETECTED (μg/l)	TOTAL NUMBER OF SAMPLES	NUMBER OF SAMPLES EXCEEDING DETECTION LIMIT	NUMBER OF SAMPLES EXCEEDING GREATER THAN STANDARDS	WELLS WITH CONCENTRATION ABOVE STANDARD
Inorganics								
As	50	25	10	ND	26	0	0	–
Ba	2,000	1,000	100	ND	26	0	0	–
Cd	5	10	5	ND	26	0	0	–
Cr	100	50	10	ND	26	0	0	–
Hg	2	2	0.2	ND	26	0	0	–
Pb	15 (**)	25	10	ND	26	0	0	–
Se	50	20	5	ND	26	0	0	–
Ag	50 (***)	50	10	ND	26	0	0	–
Fe	NA	300	2 – 100	ND – 1,020	65	40	3	1, 7
Mn	NA	300	1 – 30	ND – 320	65	2	17	2, 5, 6, 7
F	4,000 (***)	1,500	100	100 – 300	27	27	0	5
NO3	10,000 (*)	10,000 (*)	50	ND – 10,000	27	23	1	5
Explosives								
HMX	NA	35 (+)	100	ND	46	0	0	–
RDX	NA	35 (+)	30	ND	46	0	0	–
Tetryl	NA	1 (+)	10	ND	46	0	0	–
2,4,6–TNT	NA	1 (+)	1	ND	46	0	0	–
2,6–DNT	NA	1.1 (!)	1	ND	46	0	0	–
2,4–DNT	NA	1 (+)	1	ND	46	0	0	–
pH	NA	6.5 – 8.5		6.7 – 8.1	300	300	0	–
TOC	NA	NA	100	1,000–54,000	340	340	–	–
TOX	NA	NA	10	ND – 130	335	133	–	–

Notes:
1. NA = Not Available
2. ND = Not Detected
3. MCL = Maximum Contaminant Level
4. NYSGWS = New York State Groundwater Standard
5. (*) Standard is for NO3 only
6. (+) Guidelines proposed from the Criteria Developement Report for the Closure of Nine Burning Pads; (M & E, Oct. 1989)
7. (!) EPA Water Quality Criteria for 10E–5 Risk
8. Data Summarized from the 1987 USAEHA Groundwater Contamination Survey
9. (**) Action Level.
10. (***) Secondary Maximum Contaminant Level.

During the installation of the ten additional monitoring wells, M&E performed sieve analyses on samples collected from the monitoring wells. The sieve analyses, were performed in accordance with American Society of Testing and Materials (ASTM) methods, and characterized the till as poorly sorted sands with some silt and clay. Core samples were collected from the upper zones in the shale. The Rock Quality Designations (RQD) ranged from 0-37%. As mentioned previously in Section 1.2.1.3 hydraulic conductivity measurements ranged from 0.02 to 1.47 feet per day. These conductivities are in general agreement with tabulated ranges in glacial tills and shale. Based upon groundwater level measurements, the groundwater flow direction was determined to be northeast towards Reeder Creek.

Following the development of the ten new wells and six of the seven previous wells (MW-7 was dry and not re-developed), groundwater samples were collected for analysis of EP Toxicity metals and explosives. None of the groundwater samples collected from the new wells contained metals or explosives greater than established criteria. Although several of the previous six wells had elevated metals, this was attributed to poor well development as evidenced by water turbidity. No well samples were filtered prior to acidification. The results of the groundwater analyses are presented in Table 1-7.

1.3 OFF-SITE WELL INVENTORY

Eleven private homes with private drinking water wells were identified within a one-mile radius of the OB grounds (Figure 1-8). Private drinking water wells are located west and north of the site. The nearest location with a well is located approximately 2,400 feet west of the OB Grounds on Route 96A. Other off-site wells are located along 96A and McGrane Road.

1.4 REPORT ORGANIZATION

The remaining sections of this report are organized to describe the investigation programs, the results of the data collected during the RI and to identify the magnitude and extent of impacts. Section 2.0 (Study Area Investigation) presents a description of the important site features, characteristics, sources of impacts and discusses the investigation programs (i.e., geophysical, surface water and sediment, soils, groundwater, and ecological) performed during the RI. Section 3.0 (Detailed Site Description) discusses the results of the investigation programs. Specifically, surface features, ecology, surface water hydrology and sediments, geology and hydrogeology are discussed. The nature and extent of contamination on and off-site is discussed in Section 4.0. Section 5.0 (Contaminant Fate and Transport) provides a discussion of the mechanisms involved in the weathering and transport of constituents found at the site. Section 6.0 (Baseline Risk Assessment) evaluates the risk to human health and the environment. Section 7 (Summary and Conclusions) presents a summary discussion of the results and a brief conclusion. Appendices are included within a separate volume and contain the data on which the text and conclusions are based.

TABLE 1 – 7

HISTORICAL ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Well	M&E	Inorganics (μg/L)							Explosives (μg/L)							Hydrocarbons (μg/L)	Indicators (see note)		
Number	Sample ID	As	Ba	Cd	Cr	Pb	Hg	Se	HMX	RDX	Tetryl	2,4,6–TNT	2,6–DNT	2,4–DNT	PETN	Petr. Hydr.	pH	Cond.	Temp.
MW–1	3161–101	<10.0	551	<5.0	52.3	104.0	0.58	7.5	<1.30	0.86	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	6.85	854	11.8
MW–2	3161–102	<10.0	<200	<5.0	21.5	38.9	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.40	1380	10.8
MW–3	3161–103	<10.0	294	<5.0	31.2	100.0	0.47	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.19	1282	11.4
MW–4	3161–104	<10.0	835	18.8	152.0	206.0	<2.0	<5.0	<1.30	1.84	<0.96	<0.78	<0.55	<0.60	<45*	<1000	7.05	792	11.6
MW–5	3161–105	19.3	440	<5.0	55.0	83.2	<2.0	14.3	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	8.5	<1000	7.58	700	11.3
MW–6	3161–106	<10.0	859	<5.0	143.0	106.0	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.33	707	14.9
MW–8	3161–108	<10.0	<200	<5.0	<10.0	<5.0	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.11	1260	12.9
MW–9	3161–109	<10.0	<200	<5.0	<10.0	<5.0	<2.0	5.6	<1.30	<0.63	<0.66	5.61	<0.55	<0.60	<4.5	<1000	7.06	977	10.5
MW–10(a)	3161–110	<10.0	<200	<5.0	<10.0	<5.0	<2.0	<5.0	<1.30	<0.63	<0.66	1.80	<0.55	<0.60	<4.5	<1000	6.51	855	13.1
MW–11	3161–111	<10.0	<200	<5.0	<10.0	9.0	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.06	1321	10.0
MW–12	3161–112	<10.0	<200	<5.0	<10.0	<5.0	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.32	1153	10.3
MW–13	3161–113	<10.0	<200	<5.0	<10.0	<5.0	<2.0	<5.0	<1.30	0.71	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.12	840	11.2
MW–14	3161–114	<10.0	<200	<5.0	<10.0	<5.0	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.02	1134	11.7
MW–15	3161–115	<10.0	<200	<5.0	<10.0	6.0	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.01	1470	11.0
MW–16	3161–116	<10.0	<200	<5.0	<10.0	<5.0	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.10	956	12.1
MW–17	3161–117	<10.0	<200	<5.0	<10.0	9.9	<2.0	<5.0	<1.30	<0.63	<0.66	<0.78	<0.55	<0.60	<4.5	<1000	7.20	674	10.9

Notes:

1) Source: Metcalf & Eddy (1989), Criteria Development Report for the Closure of Nine Burning Pads, Seneca Army Depot, Romulus, New York.

2) pH is measured in standard units.

3) Specific conductivity is measured in μmhos/cm

4) Temperature is measured in degree Celcius

5) * A 1 : 9 sample dilution was necessary due to interferences present.

2.0 STUDY AREA INVESTIGATIONS

2.1 INTRODUCTION

Previous geotechnical studies, conducted at the OB grounds have served as the basis for the planning of the current investigation. The initial phase of the planning process involved a development of a conceptual understanding of site conditions, which was derived from the previously described database. The focus of this investigation has been to refine and expand the understanding of the site. This CERCLA investigation combined the existing database with additional hydrologic, geologic and ecological information required to provide a comprehensive CERCLA investigation report. This additional information was acquired through the implementation of numerous focused tasks described in the OB grounds workplan. The field work for the RI was conducted in two phases, (Phase I and II), with a Preliminary Site Characterization Report (PSCR) being prepared after the completion of the Phase I work. The PSCR provided the basis for the Phase II field work and was used to eliminate any data gaps in order to complete the RI. The following sections describe, in detail, the Phase I and II work completed by ES to further characterize the environmental setting of the site.

The OB workplan was approved by EPA, Region II, on November 7, 1991. Following completion of Phase I, additional Phase II field tasks were incorporated into the workplan and were approved by EPA Region II, on November 25, 1992. The workplan described the following Phase I and Phase II field tasks:

1. Site Survey (Phase I and II)
2. Geophysical investigations (Phase I and II)
3. Soil sampling (Phase I and II)
4. Monitoring well installation and sampling (Phase I and II)
5. Surface water/sediment sampling (Phase I and II)
6. Ecological investigation (Phase I and II)

2.2 SITE SURVEY PROGRAM

The site survey program consisted of field reconnaissance, ground control and aerial photogrammetry. A reconnaissance of the site was performed to locate general site features and confirm the presence of significant features (i.e., burn pads) identified in the workplan. Also, sampling locations were identified and marked during this initial survey.

The site and surrounding area was photographed from the air on December 12, 1991 for the purpose of constructing a photogrammetric site plan with 2 foot contour intervals. This photogrammetric map was used as the basis for the site base map. The photographs were also used by the ecological survey to identify significant vegatative ground types. Ground control was performed during the months of November and December of 1991, and January and February of 1992. All sampling locations and monitoring wells were located and surveyed. The top of the polyvinyl chloride (PVC) riser pipe, protective steel casing and the ground surface elevation at each well location were also surveyed. Each location was referenced to the New York State Plane Coordinate System. Figure 2-1 presents the base map prepared as part of this task.

2.3 GEOPHYSICAL INVESTIGATIONS

The geophysical program described in the OB grounds workplan consisted of the following tasks:

1) Unexploded ordnance (UXO) site clearance surveys of the proposed Phase I and II soil boring, monitoring well, and access sites;

2) Subsurface Interface Radar (SIR) surveys of the individual burn pads for Phase I, and;

3) Cross-sectional sampling of subsurface geophysical anomaly locations identified during the Phase I SIR surveys. This included test pit excavations to identify the sources of individual geophysical anomalies.

The geophysical survey program was conducted to provide safe access to the OB grounds during both Phase I and Phase II work and to evaluate the shallow subsurface in and around each of the nine burning pads. Access to each burning pad, monitoring well, soil boring location, and surface water sampling location was cleared using geophysical techniques to insure the safe entry and exit of project personnel. The detailed Phase I GPR surveys conducted at each burning pad identified three locations where trenches or pits might have existed within the shallow subsurface. Test pit excavations were performed at these three locations to confirm the shallow stratigraphic conditions. Results of these surveys are summarized below.

TABLE 2 – 1

CROSS–SECTIONAL SOIL SAMPLING OF GPR GEOPHYSICAL ANOMALIES

PHASE I

SENECA ARMY DEPOT
OB GROUNDS

GPR ANOMALY	BURN PAD	TEST PIT NUMBER	SAMPLE DEPTH (ft)	SAMPLE PARAMETERS
1	G	GAE–G–1	2.0	Volatile organic compounds, explosives, metals Pesticides/PCBs, Semivolatile organic compounds, Cyanide
2	G	GAE–G–2	2.0	Volatile organic compounds, explosives, metals Pesticides/PCBs, Semivolatile organic compounds, Cyanide
3	J	GAE–J–1	1.0	Volatile organic compounds, explosives, metals Pesticides/PCBs, Semivolatile organic compounds, Cyanide

Notes:

1) The geophysical anomaly excavations consisted of cross–sectional excavations at the location of the identified GPR anomaly.
2) GAE = Geophysical Anomaly Excavation
3) The test pit number also serves as the soil sample designation.

TABLE 2-2

SURFACE WATER SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

SURFACE WATER SAMPLE LOCATION	PHASE	MATRIX	SAMPLE NUMBER	SAMPLE DEPTH
SW - 110	I	WATER	W0711-37..42	12"
SW - 120	I	WATER	W0711-44..49	3"
SW - 130	I	WATER	W0711-53..58	6"
SW - 140	I	WATER	W0711-62..67	3"
SW - 150	I	WATER	W0811-71..76	18"
SW - 150	I	WATER	W0811-80..85	18"
SW - 150	I	WATER	W1411-83A	24"
SW - 160	I	WATER	W1211-96	3"
SW - 170	I	WATER	W1211-97	2"
SW - 180	I	WATER	W1012-117	2"
SW - 191	I	WATER	W0611-13..18	3"
SW - 192	I	WATER	W1311-103	4"
SW - 193	I	WATER	W1311-100	4"
SW - 194	I	WATER	W1311-101	5"
SW - 195	I	WATER	W1311-102	4"
SW - 196	I	WATER	W1211-98	12"
SW - 197	I	WATER	W1311-104	2"
SW - 200	II	WATER	SW - 200	3"
SW - 210	II	WATER	SW - 210	3"
SW - 220	II	WATER	SW - 220	2"
SW - 230	II	WATER	SW - 230	3"
SW - 240	II	WATER	SW - 240	4"
SW - 250	II	WATER	SW - 250	2"
SW - 260	II	WATER	SW - 260	3"
SW - 261	II	WATER	SW - 261	3"
SW - 270	II	WATER	SW - 270	3"
SW - 280	II	NO WATER	NA	NA
SW - 290	II	WATER	SW - 290	2"
SW - 300	II	WATER	SW - 300	4"
SW - 310	II	WATER	SW - 310	4"
SW - 320	II	WATER	SW - 320	4"

Notes:

1) Sample numbers contain a "W" for water, the day and month (i.e., 1211), followed by a number which is characteristic to each sample.
2) Sample numbers for Phase II samples are simply the sample location with a surface water identifier (SW).
3) All samples were analyzed for the following: pH, temperature, conductivity (field), volatile organics, semivolatile organics, pesticides/PCBs, explosives, metals, and cyanide (laboratory).
4) Sample SW - 261 is a duplicate of SW - 260.

TABLE 2–3

SEDIMENT SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

SAMPLE LOCATION	PHASE	MATRIX	SAMPLE NUMBER	SAMPLE DEPTH
SD – 120	I	SEDIMENT	S0711–50..52	2"
SD – 120	I	SEDIMENT	S1012–118	3"
SD – 130	I	SEDIMENT	S1411–61A	2"
SD – 130	I	SEDIMENT	S0711–59..61	2"
SD – 130	I	SEDIMENT	S1411–60A	2"
SD – 140	I	SEDIMENT	S0811–68..70	3"
SD – 150	I	SEDIMENT	S0811–77..79	2"
SD – 150	I	SEDIMENT	S0811–86..88	2"
SD – 150	I	SEDIMENT	S1411–78A	4"
SD – 150	I	SEDIMENT	S1411–87A	4"
SD – 160	I	SEDIMENT	S1211–96	3"
SD – 170	I	SEDIMENT	S1211–97	4"
SD – 180	I	SEDIMENT	S0811–89..91	2"
SD – 180	I	SEDIMENT	S1012–117	5"
SD – 190	I	SEDIMENT	S0611–22..24	4"
SD – 191	I	SEDIMENT	S0611–19..21	4"
SD – 192	I	SEDIMENT	S1311–103	2"
SD – 193	I	SEDIMENT	S1311–100	3"
SD – 194	I	SEDIMENT	S1311–101	2"
SD – 195	I	SEDIMENT	S1311–102	2"
SD – 196	I	SEDIMENT	S1211–98	3"
SD – 197	I	SEDIMENT	S1311–104	2"
SD – 200	II	SEDIMENT	SD – 200	2"
SD – 210	II	SEDIMENT	SD – 210	2"
SD – 220	II	SEDIMENT	SD – 220	2"
SD – 230	II	SEDIMENT	SD – 230	2"
SD – 240	II	SEDIMENT	SD – 240	2"
SD – 250	II	SEDIMENT	SD – 250	2"
SD – 260	II	SEDIMENT	SD – 260	2"
SD – 261	II	SEDIMENT	SD – 261	2"
SD – 270	II	SEDIMENT	SD – 270	2"
SD – 280	II	SEDIMENT	SD – 280	2"
SD – 290	II	SEDIMENT	SD – 290	2"
SD – 300	II	SEDIMENT	SD – 300	2"
SD – 310	II	SEDIMENT	SD – 310	2"
SD – 320	II	SEDIMENT	SD – 320	2"

Notes:

1) Sample numbers contain a "W" for water, the day and month (i.e., 1211), followed by a number which is characteristic to each sample.
2) For Phase II samples, the sample number contains the sample location with a sediment identifier (SD).
3) All samples were chemically analyzed for the following: volatile organics, semivolatile organics, pesticides/PCBs, heavy metals, and explosives.
4) Sample SD – 261 is a duplicate of SD – 260.

2.4 SURFACE WATER AND SEDIMENT PROGRAM

The objectives of the surface water investigation at the OB grounds were to determine the nature and extent of impacts to the on-site and off-site surface waters and to evaluate the relationship between groundwater and surface water at the site. The results from the surface water and sediment sampling program were also used to determine the potential exposure levels for the risk assessment. Groundwater at the site has been shown to flow eastward toward Reeder Creek. The relationship between groundwater and surface water is of concern since if a groundwater plume is present, it may be discharging to Reeder Creek. The results of the analytical characterization of the surface water and sediment are in Section 4.

In accordance with the OB grounds workplan, 16 locations were sampled and surveyed for the collection of surface water and sediment samples in and around the OB grounds for Phase I and 13 locations were sampled and surveyed for Phase II. The sampling program for surface water and sediment is summarized in Tables 2-2 and 2-3, respectively. The sample locations are shown on Figure 2-4. The Phase I work was completed by ES during November and December of 1991 and the Phase II work was completed during November 1992.

2.4.1 Chemical Sampling of Surface Water and Sediments

For Phase I, surface water and/or sediment samples were collected at 16 stations that were representative of wetlands and areas of standing water on the OB grounds. One of the wetlands sampled was beyond the probable influence of activities that may originate from the OB grounds, and served as a reference location. In addition, three stations in two drainage swales were sampled to provide an indication of the degree of surface transport of materials from the OB grounds to Reeder Creek. If standing water was not present at the time of sampling, only sediment samples were collected.

Chemical characteristics of Reeder Creek were determined by sampling four stations that were established downstream of known points of surface water discharge from the OB grounds. In addition, a downstream Reeder Creek station (SW-110) was established to characterize the

Based upon the interpretation of the geophysical data, a subsurface sampling program was completed to further evaluate the geophysical anomaly sources and to collect subsurface soil samples at each anomaly location. The field exploration and VOC screening results from the subsurface sampling of these suspected pits are presented in the Section 2.3.3.

2.3.3 Cross-Sectional Sampling

Cross-sectional sampling of the three subsurface geophysical anomalies was performed during Phase I to verify the interpretation made using the GPR data. A total of three Geophysical Anomaly Excavations (GAE) were performed to evaluate the subsurface conditions at each geophysical anomaly. Cross-sectional sampling was performed at the three geophysical anomaly locations shown on Figure 2-3. The logs of the individual GAEs are included within Appendix D.

The analysis of the GPR data identified three areas where suspected pits or trenches might exist. Two of the areas were on Pad G and the third was located on Pad J. Three excavations were performed to confirm the source of the geophysical anomalies, to provide data on the shallow stratigraphy at the site, and to provide a subsurface soil sample to be used for subsequent chemical analysis. The cross-sectional sampling was performed on October 11, 1991.

The cross-sectional sampling excavations were performed with a Case 480 backhoe operated by an HFA UXO technician. The excavations were extended to a distance of 2 feet on either side of the subsurface anomaly. The width, length, and depth of each excavation was based upon the extent of the individual geophysical anomalies. Soil samples were collected from the excavations at the required depth by scooping soil from the sides of the open pit with a backhoe bucket. The soil sample was collected from the soil that was not in contact with the metal backhoe bucket using a stainless steel trowel and bowl. Volatiles were collected first prior to homogenization followed by collection of the remaining samples. The soil sampling program for these excavations is presented in Table 2-1. One sample from each excavation was collected and analyzed for level IV explosives, the Target Analyte List (TAL) and the Target Compound List (TCL) compounds. The excavation was continuously monitored for VOCs and particulates by ES with hand held monitoring units at the excavation and approximately 40 feet downwind of each excavation. Volatile organic monitoring continued throughout the trenching process. No indications of VOCs were observed during any of the three excavations. No precipitation occurred during the excavations and therefore no surface water runoff occurred from the soils removed from each pit. Following examination and sample collection the soils were placed back in the pit.

2.3.1 UXO Site Clearance Surveys

Two unexploded ordnance specialty companies were contracted to perform the UXO site clearance. Explosive Ordnance Disposal (EOD) Division of Human Factors Applications Inc. (HFA) performed the clearance for Phase I and UXB, International (UXB) performed the clearance for the Phase II work. The objective of these surveys was to ensure the safe entry and exit of personnel and equipment into each of the proposed sampling locations during both the Phase I and Phase II fieldwork.

HFA performed a UXO site clearance survey during Phase I to provide access to each burning pad and clearance for work areas for each soil boring, monitoring well, berm excavation and surface water sampling location. HFA utilized two survey methods, Electromagnetic (EM) Induction detectors and Passive Ferrous Metal detectors, to clear the above mentioned areas. The areas investigated by HFA are presented on Figure 2-2. The details of the investigation are included within the HFA report presented in Appendix B. A brief summary of the work is included below.

The burning pads at the OB grounds contain both surface and subsurface metallic objects. Some areas, such as Burn Pads J and G, were nearly covered with metallic waste. This precluded Passive Ferrous Metal detection surveys within these areas. A work area of 10 feet by 10 feet for each pad boring and 50 feet by 50 feet for each of the proposed monitoring well locations was cleared by HFA using EM induction. In addition, an access lane 25 feet wide was cleared to allow access to each boring or monitoring well location and to provide access to wetlands and other surface water sediment sampling locations.

HFA personnel spent 33 days on-site performing site clearance activities. During this time a total of 4,037 subsurface objects were located and excavated. A large quantity of the metallic waste uncovered consisted of hinges, nails, banding material, and other hardware associated with ammunition packaging. No summary account of these materials was generated. Only the UXO or significant and/or potentially hazardous items discovered by HFA have been cataloged.

During the 33 days spent on-site by HFA, a total of 37,500 square feet of work area, and approximately 173,500 square feet of access routes were cleared down to a depth of approximately 18 inches.

UXB, International (UXB) performed a follow up site clearance survey for the Phase II field work. UXB provided access to each burn pad and clearance for work areas for each soil boring, monitoring well, berm excavation and surface water/sediment sampling location. No summary account of the materials encountered during the clearance was generated by UXB.

2.3.2 Ground Penetrating Radar (GPR) Surveys

In order to evaluate the subsurface conditions below each burning pad for Phase I, a GPR survey was conducted by personnel from Blasland, Bouck and Lee (B&B) during October and November, 1991. The areas investigated by B&B are shown on Figure 2-3. A summary of the work performed by B&B, is presented below.

A GPR survey was performed at the OB grounds to identify any burn trenches, burn pits, or UXO/residue burial areas that might exist under each burn pad site. These features were considered to be of importance due to safety issues and the potential for contaminants to occur within these burn pits or trenches. The GPR data were collected using a Geophysical Survey Systems, Inc. (GSSI) SIR-10 radar system equipped with a 300 mHz antenna. The data were collected along variably spaced profiles across each burn pad. The profile locations are shown on Figure 2-3. A total of 104 profiles were surveyed at the 9 burning pad locations. The data were collected by hand towing the GPR antenna and recording the radar response on paper printouts. Station locations were maintained using pre-set survey points in conjunction with a surveyors tape. The radar records were annotated at 10 foot intervals along each profile to ensure an accurate determination of potential target locations.

An analysis of the GPR data has identified numerous areas of fill materials and areas exhibiting a radar response indicative of disturbed soils. In addition to these disturbed soil areas, the GPR data was used to identify three areas where the subsurface radar signatures indicated that pits or trenches may be present within the shallow subsurface. Two areas were identified on Pad G and the third potential pit was identified on Pad J. These locations are shown on Figure 2-3. An analysis of the GPR data indicated that no large metallic objects were present within any of the three suspected pits.

water quality of the stream as it left the depot. The substrate of the stream at this station (SW-110) was coarse gravel and bedrock, which prevented a sediment sample from being collected. A reference station (SW-196) was also established upstream of the probable influence of the OB Grounds to serve as a background location.

Six surface water and sediment samples were collected from Reeder Creek during Phase I. The data from the up-gradient sample location SW-196 was used to determine the background surface water and sediment chemical concentrations. At each of the surface water and sediment sample locations on Reeder Creek a staff gage was also installed and surveyed. The cross-sectional geometry of the creek, and stream flow measurements were made at these locations. These data have been used to evaluate the stream flow variations within Reeder Creek and to evaluate the inter-relationship between surface and groundwater at the OB grounds. Temperature, pH and conductivity, were also measured at each surface water sample location.

Ten additional surface water and sediment samples were collected within the low lying areas and smaller surface water drainages within the OB grounds during Phase I. At one location (SW-180) no water was present although a sediment sample was collected. At a second location, (SW-110), a surface water sample was collected but no sediment was readily available to be sampled. Samples were also collected from background reference wetlands in order to establish the background wetland chemical constituents. The remaining samples have been analyzed to characterize the environmental setting as it pertains to the extent and degree of constituents present within the surface water and sediments.

During Phase II, 13 additional surface water and sediment samples were collected at the site. Surface water and sediment samples were collected from the wetlands south and west of Pad J (4 sample locations), from the wetlands surrounding Pad C (4 sample locations), and within Reeder Creek and the nearby perennial drainage swales, northeast of the OD Grounds (5 sample locations).

Surface water samples were generally collected by directly filling appropriate sample containers. If the sample was collected by sampling personnel wading into the body of water, the sampler approached the sampling location from downstream and all parts of the sampler's body remained downstream during sample collection. When the water depth was relatively shallow, sample containers were typically filled by decanting water into sample containers with a decontaminated glass beaker or using a clean sample bottle without preservatives. For parameters that did not require preservatives, the sample container was submerged directly into the water body to collect the sample. For parameters that required preservatives, the preserved sample containers were filled by decanting water collected in a decontaminated glass beaker or an unused, unpreserved sample container. In all cases, the sample bottles contained the preservative, if required, prior to decanting the sample into the sample container. Volatile organic samples with no headspace were collected first. Samples were then placed in chilled coolers. Temperature, conductivity and pH were measured directly in the surface water body with calibrated meters. Temperature and pH were measured with an Orion pH meter, Model 230A, and conductivity was measured with a YSI Model 33 conductivity meter.

Sediment samples were collected by scooping sediment into a decontaminated stainless steel bowl with a decontaminated trowel. No volatiles were detected during screening and collection of the sediment samples. Thus, the Volatile Organic Analyte (VOA) sample was collected first, from the soil in the stainless steel bowl in order to avoid any prolonged volatilization from the sample. If necessary, the bowl was refilled with additional sediment, thoroughly mixed and the other sample containers filled with sediment. Samples were then placed in chilled coolers.

All of the collected samples were analyzed for level IV explosives, total TAL metals, hardness and TCL Organics (VOAs, AB/Ns, and Pesticides/PCBs). No volatiles were detected in the groundwater for Phase I, therefore the volatile analysis for Phase II was the EPA Method 524.2, due to its lower detection limits. The results of the chemical analyses are discussed in detail within Section 4 of this report.

2.4.2 Physical Characterization of Reeder Creek

Reeder Creek is the only perennial stream near the OB Grounds. Physical characteristics of this stream were determined in Phase I by field measurements as well as interpretation of existing information including stream discharge, water velocity, water depth, cross-sectional configuration, substrate properties and estimates of seasonal and historic stream flows. Field measurements, used to quantify these parameters, were taken at six stations along Reeder Creek as shown on Figure 2-4. These staff gage locations generally corresponded to surface water and sediment sampling locations.

Stream cross-sections were determined by driving a stake into the western bank of Reeder Creek (the "head pin") and another stake on the eastern bank (the "tail pin"). The tail pin was positioned so that the transect formed by the two stakes was perpendicular to the streamflow. Both stakes were positioned above the high water mark of the stream as determined by riparian vegetation characteristics. The zero demarkation of a measuring tape was clamped onto the top of the head pin, extended across the stream, pulled tight and the other end of the tape clamped to the top of the tail pin. A calibrated rod was used to determine the distance from the tape to the ground or stream bottom along each transect. Vertical measurements were taken at each break in topography at a minimum. The elevation of the top of the head pin and tail pin was documented by surveying techniques which enabled the establishment of the relationship of each stream cross-section to the surrounding topography and the other stream cross-sections.

Stream velocity was measured by clamping the sensor of a Marsh McBirney flowmeter onto the calibrated rod, positioning it so that it was measuring the velocity at approximately 60 percent of the water column depth (e.g., if the stream was one foot deep, velocity would be measured 0.6 feet from the bottom) and recording the value to the nearest hundredth of a foot per second. Velocity measurements were typically taken at 0.2- to 0.4-foot intervals across the stream, using the transect measuring tape for reference. Distance between measurements was smaller (0.2 feet) at higher velocity points in the stream. These measurements enabled the stream discharge to be calculated.

Prior to measuring stream velocities, a staff gage was installed at or near each station, which enabled quantification of the water surface elevation at a specific time. These gages were used to document that the stream flow was not changing significantly during discharge measurements, and also enabled an estimate to be made as to whether streamflow was greater or less than the measured stream discharge during other field activities. Finding an acceptable location for installing the staff gage also served to characterize the typical sediment depth at each station. At least 6 inches of sediment was required to firmly anchor the staff gage in the stream bottom. The elevation of the top of the staff gage was established by a New York State registered land surveyor and the water surface elevation determined by using the gradations on the staff.

Seasonal and historical flow characteristics of Reeder Creek were estimated by determining the drainage basin of the stream using USGS 1:24000 scale topographic maps and estimating the area of the basin by using a planimeter, establishing representative soil runoff properties by using Soil Conservation Service Mapping (SCS 1972), analyzing daily rainfall data from the Aurora Monitoring Station (approximately seven miles from the SEDA) and relating these parameters to the measured stream discharge.

2.5 SOILS INVESTIGATION

In accordance with the approved workplan, a comprehensive soils investigation program was completed at the OB grounds. The Phase I program consisted of 24 grid borings, 22 pad borings, and 33 berm excavations. The Phase II program consisted of 20 grid borings, 22 pad borings, 30 berm excavations, 4 burn kettle soil samples, 43 low hill excavations and 11 downwind soil samples. The locations of the various borings, excavations, and other sampling points are shown on Figures 2-5 through 2-7. The individual boring logs are included within Appendix C.

The objectives of the soils investigation program were to determine the nature and extent of soils at the site and to provide information to develop a data base for the subsequent site risk assessment and feasibility studies. Empire Soils Investigation, Inc. of Groton, New York was contracted to provide drilling services for Phases I and II. The Phase I berm excavations were performed by HFA under the direction of ES personnel. Phase II berm excavations and low hill excavations were performed by UXB under the direction of ES personnel. All of the Phase I grid and pad borings were installed in November and December 1991 and the Phase II grid and pad borings were performed between January and March 1992. The Phase I and II berm excavations were also completed during these times. All drilling on the burn pads was performed either remotely or by clearing the hole for UXO prior to continuation of drilling.

The following sections describe the procedures used to complete the borings and excavations, and discusses the sample collection and sample screening procedures used at the site.

2.5.1 Grid and Pad Borings

A geostatistical evaluation of the data collected from the U.S. Army Environmental Hygiene Agency (USAEHA) Phase 4 soils investigation was used to determine two soil sample grid spacings. One grid spacing was used for the entire 30 acre OB grounds and one was for the burn pads. Section 3.5.3, Data Quality Objectives (DQO) of the original Workplan (MAIN, 1991) provides a detailed discussion of these grid spacings. A grid sample spacing of 200 feet was determined to be appropriate for the entire 30 acre site, and a 25-foot to 50-foot spacing was determined to be appropriate for the burn pads. The locations of these borings are shown in Figure 2-5.

All of the Phase I and II soil borings were performed using continuous split spoon sampling methods. At each boring location a 0 to 6 inches surficial soil grab sample was collected using a stainless steel trowel and bowl prior to starting each boring. The soil borings on the burn pads were completed using either remote drilling procedures or UXO clearance. Most of the grid borings, i.e. off the pads, were completed using normal boring methods, however, some were completed remotely. Each boring was advanced using a 6 1/4-inch I.D. hollow stem auger and split spoon samplers to collect undisturbed soil samples ahead of the auger. Samples were collected using a standard 2-inch or 3-inch diameter, 2-foot long carbon steel split spoon barrels. Soil samples were characterized and screened for the presence of volatile organic compounds using a Thermoenvironmental, Inc. Organic Vapor Meter (OVM) equipped with a Photoionization Detector (PID) at the borehole. The soil from each interval was divided between three sample containers. A grab soil sample from the location in the split spoon sampled with the highest OVM response was placed in a pre-cleaned 250 milliliter (mL) amber glass container, placed on ice and used for the level II analysis at the laboratory. To gain representativeness, the remaining soil from the spoon was homogenized in a clean stainless steel bowl and placed in one 250 amber glass for analysis of semivolatiles, pesticides/PCBs, and explosives and one 500 mL clear glass container for analysis of metals and cyanide. These sample containers were retained for possible CLP laboratory analysis. Each soil boring was completed down to auger refusal. In general, refusal was encountered above a depth of 15 feet at this site. Tables 2-4 and 2-5 summarize the sampling for the grid and pad borings, respectively.

All of the samples presented in Tables 2-4 and 2-5 underwent level II soil analysis. Based upon the level II results, a select portion of these samples underwent level IV New York State Department of Environmental Conservation (NYSDEC) CLP analysis for metals, explosives and volatile organics. Two complete level IV analyses were performed for each borehole, one at the surface and one at a location between this sample and refusal. The exact location was determined based upon the results of the level II screening data. Each soil sample was screened for lead, total VOCs and trinitrotoluene (TNT). The details of the analytical program are presented in Section 2.5.5.

2.5.2 Berm Excavations and Burn Kettle Samples

In addition to the grid and pad borings, a total of 63 berm excavations were completed at the site for Phases I and II. The locations of the berm excavations are shown on Figure 2-6. A Case 480 backhoe was used to open each berm for sampling. Grab samples were taken at mid-depth along the cross-section of each berm. In addition, four surface soil samples were

TABLE 2-4

GRID BORING AND MONITORING WELL ADVANCEMENT
SOIL SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

GRID/WELL BORING	PHASE	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE METHOD
GB-1	I	GB-1-1	0-6"	GS
	I	GB-1-2	0-2’	SS
	I	GB-1-3	2-4’	SS
	I	GB-1-4	4-6’	SS
GB-2	I	GB-2-1	0-6"	GS
	I	GB-2-2	0-2’	SS
	I	GB-2-3	2-4’	SS
	I	GB-2-4	4-5.8’	SS
GB-3	I	GB-3-1	0-6"	SS
	I	GB-3-2	0-2’	SS
	I	GB-3-3	2-4’	SS
	I	GB-3-4	4-6’	SS
	I	GB-3-5	6-7.3’	SS
GB-4	I	GB-4-1	0-6"	GS
	I	GB-4-2	0-2’	SS
	I	GB-4-3	2-4’	SS
	I	GB-4-4	4-6’	SS
	I	GB-4-5	6-7.9’	SS
GB-5	I	GB-5-1	0-6"	GS
	I	GB-5-2	0-2’	SS
	I	GB-5-3	2-4’	SS
GB-6	I	GB-6-1	0-6"	GS
	I	GB-6-2	0-2’	SS
	I	GB-6-3	2-4’	SS
	I	GB-6-4	4-6’	SS
	I	GB-6-5	6-6.9	SS
GB-7	I	GB-7-1	0-6"	GS
	I	GB-7-2	0-2’	SS
	I	GB-7-3	2-4’	SS
	I	GB-7-4	4-4.8’	SS
GB-8	I	GB-8-1	0-6"	GS
	I	GB-8-2	0-2’	SS
	I	GB-8-3	2-4’	SS
	I	GB-8-4	4-6’	SS
	I	GB-8-5	6-6.8’	SS
GB-9	I	GB-9-1	0-6"	GS
	I	GB-9-2	0-2’	SS
	I	GB-9-3	2-4’	SS
	I	GB-9-4	4-5.4’	SS
GB-10	I	GB-10-1	0-6"	GS
	I	GB-10-2	0-2’	SS
	I	GB-10-3	2-3.6’	SS
GB-11	I	GB-11-1	0-6"	GS
	I	GB-11-2	0-2’	SS
	I	GB-11-3	2-4’	SS
	I	GB-11-4	4-6’	SS
GB-12	I	GB-12-1	0-6"	GS
	I	GB-12-2	0-2’	SS
	I	GB-12-2A	0-2’	SS
	I	GB-12-3	2-4’	SS
	I	GB-12-3A	2-4’	SS
	I	GB-12-4	4-6’	SS
	I	GB-12-4A	4-6’	SS
	I	GB-12-5	6-6.7’	SS
	I	GB-12-5A	6-6.7’	SS

TABLE 2–4

GRID BORING AND MONITORING WELL ADVANCEMENT
SOIL SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

GRID/WELL BORING	PHASE	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE METHOD
GB–13	I	GB–13–1	0–6"	GS
	I	GB–13–2	0–2’	SS
	I	GB–13–3	2–4’	SS
	I	GB–13–4	4–5.8’	SS
GB–14	I	GB–14–1	0–6"	GS
	I	GB–14–2	0–2’	SS
	I	GB–14–2A	0–2’	SS
	I	GB–14–3	2–4’	SS
	I	GB–14–3A	2–4’	SS
	I	GB–14–4	4–6’	SS
	I	GB–14–4A	4–6’	SS
	I	GB–14–5	6–8’	SS
	I	GB–14–5A	6–8’	SS
	I	GB–14–6	8–10’	SS
	I	GB–14–6A	8–10’	SS
	I	GB–14–7	10–11.6’	SS
	I	GB–14–7A	10–11.6’	SS
GB–15	I	GB–15–1	0–6"	GS
	I	GB–15–2	0–2’	SS
	I	GB–15–3	2–4’	SS
	I	GB–15–4	4–5.9’	SS
GB–16	I	GB–16–1	0–6"	GS
	I	GB–16–2	0–2’	SS
	I	GB–16–3	2–4’	SS
	I	GB–16–4	4–6’	SS
	I	GB–16–5	6–6.8’	SS
GB–17 (MW–21)	I	GB–17–1	0–6"	GS
	I	S1101–5	0–2’	SS
	I	S1101–6	2–3.7’	SS
GB–18 (MW–19)	I	GB–18–1	0–6"	GS
	I	S1030–1	0–2’	SS
	I	S1030–2	2–4’	SS
	I	S1030–3	4–5’	SS
	I	S1030–4	5–5.5’	SS
GB–19 (MW–31)	I	GB–19–1	0–6"	GS
	I	S1511–115	0–2’	SS
	I	S1511–116	2–4’	SS
	I	S1811–117	4–4.5’	SS
GB–20 (MW–29)	I	GB–20–1	0–6"	GS
	I	S1311–105	0–2’	SS
	I	S1311–106	2–3.7’	SS
	I	S1311–107	5.5–7.5’	SS
	I	S1311–108	7.75–9.5’	SS
	I	S1311–109	9.5–10.6’	SS
GB–23	II	GB–23–1–92	0–2’	SS
	II	GB–23–2–92	2–4’	SS
	II	GB–23–6–92	0–2’	SS
GB–24	II	GB–24–1–92	0–2’	SS
	II	GB–24–2–92	2–4’	SS

TABLE 2-4

GRID BORING AND MONITORING WELL ADVANCEMENT
SOIL SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

GRID/WELL BORING	PHASE	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE METHOD
GB-25	II	GB-25-1-92	0-2'	SS
	II	GB-25-2-92	2-4'	SS
GB-26	II	GB-26-1-92	0-2'	SS
	II	GB-26-2-92	2-4'	SS
	II	GB-26-3-92	4-5.9'	SS
	II	GB-26-4-92	0-2'	SS
GB-27	II	GB-27-1-92	0-2'	SS
	II	GB-27-2-92	2-4'	SS
	II	GB-27-3-92	4-6'	SS
GB-28	II	GB-28-1-92	0-2'	SS
	II	GB-28-2-92	2-4'	SS
GB-29	II	GB-29-1-92	0-2'	SS
	II	GB-29-2-92	2-4'	SS
	II	GB-29-4-92	0-2'	SS
GB-30	II	GB-30-1-92	0-2'	SS
	II	GB-30-2-92	2-4'	SS
	II	GB-30-3-92	4-6'	SS
GB-31	II	GB-31-1-92	0-2'	SS
	II	GB-31-2-92	2-4'	SS
GB-32	II	GB-32-1-92	0-2'	SS
	II	GB-32-2-92	2-4'	SS
	II	GB-32-3-92	4-5'	SS
GB-33	II	GB-33-1-92	0-2'	SS
	II	GB-33-2-92	2-4'	SS
GB-34	II	GB-34-1-92	0-2'	SS
	II	GB-34-2-92	2-4'	SS
	II	GB-34-3-92	4-6'	SS
	II	GB-34-4-92	6-8'	SS
GB-35	II	GB-35-1-92	0-2'	SS
	II	GB-35-2-92	2-4'	SS
	II	GB-35-6-92	0-2'	SS
GB-36	I	S1411-112	4-6'	SS
	I	S1411-113	6-8'	SS
	I	S1411-114	8-10'	SS
	II	GB-36-1-92	0-2'	SS
	II	GB-36-2-92	2-4'	SS
MW-30	I	S1411-110	0-2'	SS
	I	S1411-111	2-4'	SS
	I	S1411-112	4-6'	SS
	I	S1411-113	6-8'	SS
	I	S1411-114	8-8.7'	SS
MW-32	I	S1911-117	0-6"	GS
	I	S1911-118	0-2'	SS
	I	S1911-119	2-4'	SS
	I	S1911-120	4-6'	SS
MW-34	I	S2011-121	0-2'	SS
	I	S2011-122	2-4'	SS
	I	S2011-123	4-4.5'	SS
MW-36	II	MW-36-1-92	0-2'	SS
	II	MW-36-2-92	2-4'	SS
	II	MW-36-3-92	4-5.5'	SS

TABLE 2-4

GRID BORING AND MONITORING WELL ADVANCEMENT
SOIL SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

GRID/WELL BORING	PHASE	SAMPLE NUMBER	SAMPLE INTERVAL	SAMPLE METHOD
MW-37	II	MW-37-1-92	0-2'	SS
	II	MW-37-2-92	2-4'	SS
	II	MW-37-3-92	4-5.5'	SS
MW-38	II	MW-38-1-92	0-2'	SS
	II	MW-38-2-92	2-4'	SS
	II	MW-38-3-92	4-6'	SS
MW-39	II	MW-39-1-92	0-2'	SS
	II	MW-39-2-92	2-4'	SS
	II	MW-39-3-92	4-6'	SS
MW-40	II	MW-40-1-92	0-2'	SS
	II	MW-40-2-92	2-4'	SS
	II	MW-40-3-92	4-5.5'	SS
MW-41	II	MW-41-1-92	0-2'	SS
	II	MW-41-2-92	2-4'	SS
	II	MW-41-3-92	4-5.7'	SS

NOTES:
1) SS = Split spoon
2) GS = Ground scrape
3) MW = Monitoring Well
4) GB = Grid Boring
5) All samples were analyzed for 2,4,6-TNT, lead, and total volatile organics as TCE and benzene using Level II screening methods.

TABLE 2–5

BURN PAD BORING
SOIL SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

BURN PAD	BORING NUMBER	PHASE	SAMPLE NUMBER	SAMPLE METHOD	SAMPLE INTERVAL
A	A1	I	PB–A1–1–91	GS	0–6"
	A1	I	PB–A1–2–91	SS	0–2'
	A1	I	PB–A1–2A–91	SS	0–2'
	A1	I	PB–A1–3–91	SS	2–4'
	A1	I	PB–A1–3A–91	SS	2–4'
	A1	I	PB–A1–4–91	SS	4–5.8'
	A1	I	PB–A1–4A–91	SS	4–5.8'
B	B1	I	PB–B1–1–91	GS	0–6"
	B1	I	PB–B1–2–91	SS	0–2'
	B1	I	PB–B1–3–91	SS	2–4'
	B1	I	PB–B1–4–91	SS	4–6'
	B1	I	PB–B1–5–91	SS	6–8'
C	C1	I	PB–C1–1–91	GS	0–6"
	C1	I	PB–C1–2–91	SS	0–2'
	C1	I	PB–C1–2A–91	SS	0–2'
	C1	I	PB–C1–3–91	SS	2–4'
	C1	I	PB–C1–3A–91	SS	2–4'
	C1	I	PB–C1–4–91	SS	4–6'
	C1	I	PB–C1–4A–91	SS	4–6'
	C1	I	PB–C1–5–91	SS	6–8'
	C1	I	PB–C1–5A–91	SS	6–8'
	C2	II	PB–C2–1–92	SS	0–2'
	C2	II	PB–C2–2–92	SS	0–2'
	C3	II	PB–C3–1–92	SS	0–2'
	C4	II	PB–C4–1–92	SS	0–2'
	C5	II	PB–C5–1–92	SS	0–2'
D	D1	I	PB–D1–1–91	GS	0–6"
	D1	I	PB–D1–2–91	SS	0–2'
	D1	I	PB–D1–2A–91	SS	0–2'
	D1	I	PB–D1–3–91	SS	2–4'
	D1	I	PB–D1–3A–91	SS	2–4'
	D1	I	PB–D1–4–91	SS	4–6'
	D1	I	PB–D1–5–91	SS	6–8'
	D1	I	PB–D1–6–91	SS	8–9.2'
E	E1	I	PB–E1–1–91	SS	0–6"
	E1	I	PB–E1–2–91	GS	0–2'
	E1	I	PB–E1–3–91	SS	2–4'
	E1	I	PB–E1–4–91	SS	4–6'
	E1	I	PB–E1–5–91	SS	6–8'
	E1	I	PB–E1–6–91	SS	8–10'
	E1	I	PB–E1–7–91	SS	10–11.4'
	E2	II	PB–E2–1–92	SS	0–2'
	E3	II	PB–E3–1–92	SS	0–2'
	E4	II	PB–E4–1–92	SS	0–2'
	E5	II	PB–E5–1–92	SS	0–2'
F	F1	I	PB–F1–1–91	GS	0–6"
	F1	I	PB–F1–2–91	SS	0–2'
	F1	I	PB–F1–3–91	SS	2–4'
	F1	I	PB–F1–4–91	SS	4–6'
	F1	I	PB–F1–5–91	SS	6–8'
	F1	I	PB–F1–6–91	SS	8–8.4'
	F2	II	PB–F2–1–92	SS	0–2'
	F2	II	PB–F2–2–92	SS	2–4'
	F2	II	PB–F2–3–92	SS	4–6'
	F2	II	PB–F2–4–92	SS	6–8'
	F2	II	PB–F2–5–92	SS	8–10'
	F2	II	PB–F2–6–92	SS	0–2'
	F2	II	PB–F2–7–92	SS	10–12'
	F3	II	PB–F3–1–92	SS	0–2'
	F3	II	PB–F3–2–92	SS	0–2'
	F4	II	PB–F4–1–92	SS	0–2'
	F5	II	PB–F5–1–92	SS	0–2'
	F6	II	PB–F6–1–92	SS	0–2'

TABLE 2−5

BURN PAD BORING
SOIL SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

BURN PAD	BORING NUMBER	PHASE	SAMPLE NUMBER	SAMPLE METHOD	SAMPLE INTERVAL
G	G1	I	PB−G1−1−91	GS	0−6"
	G1	I	PB−G1−2−91	SS	0−2'
	G1	I	PB−G1−3−91	SS	2−4'
	G1	I	PB−G1−4−91	SS	4−6'
	G1	I	PB−G1−5−91	SS	6−8'
	G1	I	PB−G1−6−91	SS	8−9.3'
	G2	I	PB−G2−1−91	GS	0−6"
	G2	I	PB−G2−2−91	SS	0−2'
	G2	I	PB−G2−3−91	SS	2−4'
	G2	I	PB−G2−4−91	SS	4−6'
	G2	I	PB−G2−5−91	SS	6−8'
	G3	I	PB−G3−1−91	GS	0−6"
	G3	I	PB−G3−2−91	SS	0−2'
	G3	I	PB−G3−3−91	SS	2−4'
	G3	I	PB−G3−4−91	SS	4−6'
	G3	I	PB−G3−5−91	SS	6−6.9'
	G4	I	PB−G4−1−91	GS	0−6"
	G4	I	PB−G4−2−91	SS	0−2'
	G4	I	PB−G4−4−91	SS	4−6'
	G5	I	PB−G5−1−91	GS	0−6"
	G5	I	PB−G5−2−91	SS	0−2'
	G5	I	PB−G5−3−91	SS	2−4'
	G5	I	PB−G5−4−91	SS	4−6'
	G5	I	PB−G5−5−91	SS	6−8'
	G6	I	PB−G6−1−91	GS	0−6"
	G6	I	PB−G6−2−91	SS	0−2'
	G6	I	PB−G6−3−91	SS	2−4'
	G6	I	PB−G6−4−91	SS	4−6'
	G6	I	PB−G6−5−91	SS	6−6.4'
	G7	I	PB−G7−1−91	GS	0−6"
	G7	I	PB−G7−2−91	SS	0−2'
	G7	I	PB−G7−3−91	SS	2−4'
	G7	I	PB−G7−4−91	SS	4−6'
	G7	I	PB−G7−5−91	SS	6' +
	G8	II	PB−G8−1−92	SS	0−2'
	G8	II	PB−G8−2−92	SS	2−4'
	G8	II	PB−G8−3−92	SS	4−6'
	G8	II	PB−G8−6−92	SS	0−2'
	G9	II	PB−G9−1−92	SS	0−2'
	G9	II	PB−G9−2−92	SS	2−4'
	G9	II	PB−G9−3−92	SS	4−6'
	G9	II	PB−G9−4−92	SS	6−8'
	G9	II	PB−G9−5−92	SS	8−9.2'
H	H1	I	PB−H1−1−91	GS	0−6"
	H1	I	PB−H1−2−91	SS	0−2'
	H1	I	PB−H1−3−91	SS	2−4'
	H1	I	PB−H1−4−91	SS	4−5.4'
	H2	II	PB−H2−1−92	SS	0−2'
	H2	II	PB−H2−2−92	SS	2−4'
	H2	II	PB−H2−3−92	SS	4−6'
	H2	II	PB−H2−4−92	SS	6−8'
	H2	II	PB−H2−5−92	SS	8−8.8'
	H3	II	PB−H3−1−92	SS	0−2'
	H4	II	PB−H4−1−92	SS	0−2'
	H5	II	PB−H5−1−92	SS	0−2'
	H6	II	PB−H6−1−92	SS	0−2'

TABLE 2–5

BURN PAD BORING
SOIL SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

BURN PAD	BORING NUMBER	PHASE	SAMPLE NUMBER	SAMPLE METHOD	SAMPLE INTERVAL
J	J1	I	PB–J1–1–91	GS	0–6"
	J1	I	PB–J1–2–91	SS	0–2'
	J1	I	PB–J1–3–91	SS	2–3.9'
	J2	I	PB–J2–1–91	GS	0–6"
	J2	I	PB–J2–2–91	SS	0–2'
	J2	I	PB–J2–3–91	SS	2–4'
	J2	I	PB–J2–4–91	SS	4–7.2'
	J3	I	PB–J3–1–91	GS	0–6"
	J3	I	PB–J3–2–91	SS	0–2'
	J3	I	PB–J3–3–91	SS	2–4'
	J3	I	PB–J3–4–91	SS	4–5.7'
	J4	I	PB–J4–1–91	GS	0–6"
	J4	I	PB–J4–2–91	SS	0–2'
	J4	I	PB–J4–3–91	SS	2–4'
	J4	I	PB–J4–4–91	SS	4–5.8'
	J5	I	PB–J5–1–91	GS	0–6"
	J5	I	PB–J5–2–91	SS	0–2'
	J5	I	PB–J5–4–91	SS	2–4.1'
	J6	I	PB–J6–1–91	GS	0–6"
	J6	I	PB–J6–2–91	SS	0–2'
	J6	I	PB–J6–3–91	SS	2–4'
	J6	I	PB–J6–4–91	SS	4–5.7'
	J7	I	PB–J7–1–91	GS	0–6"
	J7	I	PB–J7–2–91	SS	0–2'
	J7	I	PB–J7–3–91	SS	2–4'
	J7	I	PB–J7–4–91	SS	4–6'
	J7	I	PB–J7–5–91	SS	6–7.6'
	J8	I	PB–J8–1–91	GS	0–6"
	J8	I	PB–J8–2–91	SS	0–2'
	J8	I	PB–J8–3–91	SS	2–4'
	J8	I	PB–J8–4–91	SS	4–6'
	J9	II	PB–J9–1–92	SS	0–2'
	J9	II	PB–J9–2–92	SS	2–4'
	J9	II	PB–J9–3–92	SS	4–5.4'
	J10	II	PB–J10–1–92	SS	0–2'
	J10	II	PB–J10–2–92	SS	2–4'
	J10	II	PB–J10–3–92	SS	4–5'

NOTES:
1) SS = Split spoon
2) GS = Ground scrape
3) PB = Pad Borings
4) Sample I.D. Key: PB–J1–1–91 indicates pad boring J(1), sample number 1, collected in 1991.
5) All samples were analyzed for 2,4,6–TNT, lead, and total volatile organics as TCE and benzene using level II screening methods.

collected around the burn kettle (Figure 2-6). Table 2-6 summarizes the sampling program for the berm excavations and burn kettle samples.

2.5.3 Low Hill Excavations

Sampling of the low hill was performed during Phase II. A total of 43 samples were collected at 50-foot centers along the low elongated hill in the southern portion of the site (Figure 2-6). The low hill samples were collected as a grab samples using a stainless steel trowel and bowl after a Case 480 backhoe had exposed the hill to mid-depth along the cross-section of the hill. The soil that was moved by the backhoe bucket was immediately returned to the excavation after the sample was collected.

All samples were collected at a depth of approximately 2 feet in the hill. Sample handling procedures were the same as for the other soil samples. All samples were shipped off-site for level II screening and select samples were chosen for level IV analyses. Table 2-7 is a sampling summary for the low hill.

2.5.4 Downwind Sampling

In order to investigate the presence of chemical parameters that may have been transported away from the site via wind action, nine surface soil samples (eight samples plus one duplicate) were collected downwind and within 2,000 feet of the site along a roughly east-west azimuth defined by the windrose (Section 3, Figure 3-1). Four samples were collected to the west of the site and four were collected east of the site. In addition, three background soil samples were collected off-site, near New York Route 96A. The locations of these samples are shown on Figure 2-7.

All samples were collected from 0 to 2 inches below the ground surface using a stainless steel trowel and bowl after removing any surface vegetation present. Sampling handling procedures were the same as for the other soil samples. The downwind sampling is summarized in Table 2-8. All samples were shipped off-site for level IV analyses.

2.5.5 Analytical Program

Level II analyses were performed at the laboratory on all soil samples collected. These analyses were for the indicator compounds lead, TNT, VOCs as benzene, and VOCs as trichloroethene (TCE). Lead and TNT were chosen as indicator parameters because they

TABLE 2–6

BERM EXCAVATION AND BURN KETTLE SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

EXCAVATION LOCATION	PHASE	SAMPLE NUMBER	EXCAVATION NUMBER	SAMPLE DEPTH
PAD A	I	BE–A–1–91	A–1	3.5'
	I	BE–A–2–91	A–2	3.5'
	II	BE–A–3–92	A–3	2.0'
	II	BE–A–4–92	A–4	2.0'
PAD B	I	BE–B–1–91	B–1	2.0'
	I	BE–B–2–91	B–2	2.5'
	II	BE–B–3–92	B–3	2.0'
	II	BE–B–4–92	B–4	2.0'
PAD C	I	BE–C–1–91	C–1	1.5'
	I	BE–C–2–91	C–2	4.0'
	I	BE–C–3–91	C–3	4.0'
	I	BE–C–4–91	C–4	1.5'
	II	BE–C–5–92	C–5	2.0'
	II	BE–C–6–92	C–6	2.0'
PAD D	I	BE–D–1–91	D–1	3.0'
	I	BE–D–2–91	D–2	2.5'
	II	BE–D–3–92	D–3	2.0'
	II	BE–D–4–92	D–4	2.0'
PAD E	I	BE–E–1–91	E–1	3.0'
	I	BE–E–2–91	E–2	3.0'
	II	BE–E–3–92	E–3	2.0'
	II	BE–E–4–92	E–4	2.0'
PAD F	I	BE–F–1–91	F–1	2.0'
	I	BE–F–1A–91	F–1	2.0'
	I	BE–F–2–91	F–2	2.0'
	I	BE–F–2A–91	F–2	2.0'
	I	BE–F–3–91	F–3	3.0'
	I	BE–F–3A–91	F–3	3.0'
	II	BE–F–4–92	F–4	2.0'
	II	BE–F–5–92	F–5	2.0'
	II	BE–F–6–92	F–6	2.0'
	II	BE–F–7–92	F–7	2.0'
PAD G	I	BE–G–1–91	G–1	2.5'
	I	BE–G–2–91	G–2	4.0'
	I	BE–G–3–91	G–3	4.5'
	I	BE–G–4–91	G–4	2.0'
	I	BE–G–5–91	G–5	4.0'
	I	BE–G–6–91	G–6	3.0'
	I	BE–G–7–91	G–7	3.0'
	II	BE–G–8–92	G–8	2.0'
	II	BE–G–9–92	G–9	2.0'
	II	BE–G–10–92	G–10	2.0'
	II	BE–G–11–92	G–11	2.0'
	II	BE–G–12–92	G–12	2.0'
	II	BE–G–13–92	G–13	2.0'
	II	BE–G–14–92	G–14	2.0'

TABLE 2–6

BERM EXCAVATION AND BURN KETTLE SAMPLING SUMMARY
PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

EXCAVATION LOCATION	PHASE	SAMPLE NUMBER	EXCAVATION NUMBER	SAMPLE DEPTH
PAD H	I	BE–H–1–91	H–1	3.0'
	I	BE–H–2–91	H–2	4.0
	I	BE–H–3–91	H–3	4.0'
	I	BE–H–4–91	H–4	4.0'
	II	BE–H–5–92	H–5	2.0'
	II	BE–H–6–92	H–6	2.0'
PAD J	I	BE–J–1–91	J–1	2.5'
	I	BE–J–2–91	J–2	2.5'
	I	BE–J–3–91	J–3	4.0'
	I	BE–J–4–91	J–4	3.0'
	I	BE–J–5–91	J–5	3.0'
	I	BE–J–6–91	J–6	3.0'
	I	BE–J–7–91	J–7	4.0'
	II	BE–J–8–92	J–8	2.0'
	II	BE–J–9–92	J–9	2.0'
	II	BE–J–10–92	J–10	2.0'
	II	BE–J–11–92	J–11	2.0'
	II	BE–J–12–92	J–12	2.0'
	II	BE–J–13–92	J–13	2.0'
	II	BE–J–14–92	J–14	2.0'
BURN KETTLE	II	BKTL–01	NA	6"
	II	BKTL–02	NA	6"
	II	BKTL–03	NA	6"
	II	BKTL–04	NA	10"

Notes:
1) BE = Berm Excavation
2) Sample I.D. Key: BE–A–1–91 indicates Berm Pad A Excavation 1, sampled in 1991.
3) All samples were analyzed for 2,4,6–TNT, lead, and total volatile organics as TCE and benzene using level II screening results.
4) A 91 in the sample number indicates Phase I samples.
A 92 in the sample number indicates Phase II samples.
5) BKTL = Burn Kettle
6) NA = Not Applicable

TABLE 2 – 7

LOW HILL SOIL SAMPLING SUMMARY
PHASE II

SENECA ARMY DEPOT
OB GROUNDS

LOW HILL LOCATION NUMBER	PHASE	SAMPLE I.D. NUMBER	SAMPLE DEPTH
LH – 1	II	LH–1–92	2’
LH – 2	II	LH–2–92	2’
LH – 3	II	LH–3–92	2’
LH – 4	II	LH–4–92	2’
LH – 5	II	LH–5–92	2’
LH – 6	II	LH–6–92	2’
LH – 7	II	LH–7–92	2’
LH – 8	II	LH–8–92	2’
LH – 9	II	LH–9–92	2’
LH – 10	II	LH–10–92	2’
LH – 11	II	LH–11–92	2’
LH – 12	II	LH–12–92	2’
LH – 13	II	LH–13–92	2’
LH – 14	II	LH–14–92	2’
LH – 15	II	LH–15–92	2’
LH – 16	II	LH–16–92	2’
LH – 17	II	LH–17–92	2’
LH – 18	II	LH–18–92	2’
LH – 19	II	LH–19–92	2’
LH – 20	II	LH–20–92	2’
LH – 21	II	LH–21–92	2.5’
LH – 22	II	LH–22–92	2.5’
LH – 23	II	LH–23–92	2.5’
LH – 24	II	LH–24–92	2’
LH – 25	II	LH–25–92	2’
LH – 26	II	LH–26–92	2’
LH – 27	II	LH–27–92	2’
LH – 28	II	LH–28–92	2’
LH – 29	II	LH–29–92	2’
LH – 30	II	LH–30–92	2’
LH – 31	II	LH–31–92	2’
LH – 32	II	LH–32–92	2’
LH – 33	II	LH–33–92	2’
LH – 34	II	LH–34–92	2’
LH – 35	II	LH–35–92	2’
LH – 36	II	LH–36–92	2’
LH – 37	II	LH–37–92	2’
LH – 38	II	LH–38–92	2’
LH – 39	II	LH–39–92	2’
LH – 40	II	LH–40–92	2’
LH – 41	II	LH–41–92	2’
LH – 42	II	LH–42–92	2’
LH – 43	II	LH–43–92	2’
LH – 80	II	LH–80–92	2’

Notes:

1) LH = Low Hill

2) All samples were analyzed for: volatile organics, semivolatile organics,pesticides/PCBs, explosives, metals, and cyanide.

TABLE 2 – 8

DOWNWIND SOIL SAMPLING SUMMARY
PHASE II

SENECA ARMY DEPOT
OB GROUNDS

DOWNWIND SAMPLE NUMBER	SAMPLE I.D. NUMBER	SAMPLE METHOD	SAMPLE INTERVAL
DW – 1	DW–1–92	GS	0–2"
DW – 2	DW–2–92	GS	0–2"
DW – 3	DW–3–92	GS	0–2"
DW – 4	DW–4–92	GS	0–2"
DW – 5	DW–5–92	GS	0–2"
DW – 6	DW–6–92	GS	0–2"
DW – 7	DW–7–92	GS	0–2"
DW – 8	DW–8–92	GS	0–2"
DW – 9	DW–9–92	GS	0–2"
DW – 10	DW–10–92	GS	0–2"
DW – 11	DW–11–92	GS	0–2"
DW – 12	DW–12–92	GS	0–2"

<u>Notes:</u>

1) GS = Ground scrape
2) All samples were analyzed for volatile organics, semivolatile organics, pesticides/PCBs, explosives, metals, and cyanide.

were found to be prevalent in site soils in previous investigations. Volatile organics had not previously been analyzed at this site. Benzene and TCE are good indicator compounds because they are major constituents in the two most common types of volatile organic contaminants: fuels (benzene) and solvents (TCE). The levels of these compounds were used to indicate which samples underwent further analysis. For each borehole, when possible, five samples, including the surficial sample, were collected. The four subsurfaces samples were analyzed by level II methods. In general, the surficial soil sample and one other from the remaining samples underwent level IV analyses.

Approximately 450 soil samples were screened by the laboratory using level II techniques. For lead, the samples were acid digested at the laboratory, Aquatec, Inc. with a microwave digestion system. The digesates were analyzed using a Perkin Elmer Plasma II Inductively Coupled Plasma Spectrophotometer (ICP). For TNT, the soils were extracted in acetone, potassium hydroxide, and sodium sulfite, and analyzed using a Spec 20 spectrophotometer. For volatile organics, the samples were analyzed using a Gas Chromatograph (GC) equipped (GC) with a Flame Ionization Detector (FID) and a Photoionization Detector (PID) in series using purge and trap techniques.

All level II screening instruments were calibrated daily with one calibration standard and one blank.

In addition to selecting samples for level IV analyses, the level II screening data was used to evaluate the extent of vertical and horizontal contamination at the site. For the berm excavations, a level II analysis has been performed on each sample collected. Tables 2-9 through 2-12 summarize the level II results and highlight the samples from each soil boring that underwent level IV analyses for the grid, pad, berm, and low hill samples respectively. The results of these analyses are discussed in Section 4.

2.6 GROUNDWATER INVESTIGATION PROGRAM

2.6.1 Objectives

The goals of the groundwater investigation at the OB grounds were to determine the interrelationship between groundwater and surface water, verify the data collected from previous reports, and evaluate the vertical and lateral extent of contaminant migration. To

TABLE 2 – 9

SUMMARY OF LEVEL II SCREENING RESULTS AT THE GRID BORINGS – PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

GRID/WELL BORING	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene µg/kg	VOA–TCE µg/kg
GB–1	I	GB–1–1	NA	NA	NA	NA
	I	GB–1–2	280.0	< 1.0	< 100	< 100
	I	GB–1–3	970.0	< 1.0	< 100	< 100
	I	GB–1–4	21.0	< 1.0	< 100	< 100
GB–2	I	GB–2–1	NA	NA	NA	NA
	I	GB–2–2	1940.0	< 1.0	< 100	< 100
	I	GB–2–3	25.0	< 1.0	< 100	< 100
	I	GB–2–4	19.5	< 1.0	< 100	< 100
GB–3	I	GB–3–1	NA	NA	NA	NA
	I	GB–3–2	230.0	< 1.0	< 100	< 100
	I	GB–3–3	11.4	< 1.0	< 100	< 100
	I	GB–3–4	18.3	< 1.0	< 100	< 100
	I	GB–3–5	24.0	< 1.0	< 100	< 100
GB–4	I	GB–4–1	NA	NA	NA	NA
	I	GB–4–2	18.7	< 1.0	< 100	< 100
	I	GB–4–3	<10.0	< 1.0	< 100	< 100
	I	GB–4–4	16.0	< 1.0	< 100	< 100
	I	GB–4–5	19.1	< 1.0	< 100	< 100
GB–5	I	GB–5–1	NA	NA	NA	NA
	I	GB–5–2	<10.0	1.15	< 100	< 100
	I	GB–5–3	<10.0	< 1.0	< 100	< 100
GB–6	I	GB–6–1	NA	NA	NA	NA
	I	GB–6–2	<10.0	< 1.0	< 100	< 100
	I	GB–6–3	<10.0	< 1.0	< 100	< 100
	I	GB–6–4	16.0	< 1.0	< 100	< 100
	I	GB–6–5	19.9	< 1.0	< 100	< 100
GB–7	I	GB–7–1	NA	NA	NA	NA
	I	GB–7–2	22.0	< 1.0	< 100	< 100
	I	GB–7–3	15.6	< 1.0	< 100	< 100
	I	GB–7–4	19.6	< 1.0	< 100	< 100
GB–8	I	GB–8–1	NA	NA	NA	NA
	I	GB–8–2	131.0	< 1.0	< 100	< 100
	I	GB–8–3	<10.0	< 1.0	< 100	< 100
	I	GB–8–4	9800.0	< 1.0	< 100	< 100
	I	GB–8–5	55.0	< 1.0	< 100	< 100
GB–9	I	GB–9–1	NA	NA	NA	NA
	I	GB–9–2	<10.0	< 1.0	< 100	< 100
	I	GB–9–3	23.0	< 1.0	< 100	< 100
	I	GB–9–4	11.7	< 1.0	< 100	< 100
GB–10	I	GB–10–1	NA	NA	NA	NA
	I	GB–10–2	21.0	< 1.0	< 100	< 100
	I	GB–10–3	15.0	< 1.0	< 100	< 100
GB–11	I	GB–11–1	NA	NA	NA	NA
	I	GB–11–2	10.1	< 1.0	< 100	< 100
	I	GB–11–3	15.1	< 1.0	< 100	< 100
	I	GB–11–4	<10.0	< 1.0	< 100	< 100
GB–12	I	GB–12–1	NA	NA	NA	NA
	I	GB–12–2	138.0	< 1.0	< 100	< 100
	I	GB–12–2A	149.0	< 1.0	< 100	< 100
	I	GB–12–3	15.7	< 1.0	< 100	< 100
	I	GB–12–3A	18.9	< 1.0	< 100	< 100
	I	GB–12–4	30.0	< 1.0	< 100	< 100
	I	GB–12–4A	19.5	< 1.0	< 100	< 100
	I	GB–12–5	NA	< 1.0	< 100	< 100
	I	GB–12–5A	NA	NA	NA	NA

TABLE 2 – 9

SUMMARY OF LEVEL II SCREENING RESULTS AT THE GRID BORINGS – PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

GRID/WELL BORING	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene μg/kg	VOA–TCE μg/kg
GB–13	I	GB–13–1	NA	NA	NA	NA
	I	GB–13–2	910.0	< 1.0	< 100	< 100
	I	GB–13–3	20.0	< 1.0	< 100	< 100
	I	GB–13–4	420.0	< 1.0	< 100	< 100
GB–14	I	GB–14–1	NA	NA	NA	NA
	I	GB–14–2	87.0	< 1.0	< 100	< 100
	I	GB–14–2A	84.0	< 1.0	< 100	< 100
	I	GB–14–3	<10.0	< 1.0	< 100	< 100
	I	GB–14–3A	<10.0	< 1.0	< 100	< 100
	I	GB–14–4	10.9	< 1.0	< 100	< 100
	I	GB–14–4A	<10.0	< 1.0	< 100	< 100
	I	GB–14–5	<10.0	< 1.0	< 100	< 100
	I	GB–14–5A	20.0	< 1.0	< 100	< 100
	I	GB–14–6	10.8	< 1.0	< 100	< 100
	I	GB–14–6A	11.8	< 1.0	< 100	< 100
	I	GB–14–7	17.0	< 1.0	< 100	< 100
	I	GB–14–7A	12.3	< 1.0	< 100	< 100
GB–15	I	GB–15–1	NA	NA	NA	NA
	I	GB–15–2	830.0	< 1.0	< 100	< 100
	I	GB–15–3	14.9	< 1.0	< 100	< 100
	I	GB–15–4	153.0	< 1.0	< 100	< 100
GB–16	I	GB–16–1	NA	NA	NA	NA
	I	GB–16–2	<10.0	< 1.0	< 100	< 100
	I	GB–16–3	<10.0	< 1.0	< 100	< 100
	I	GB–16–4	<10.0	< 1.0	< 100	< 100
	I	GB–16–5	<10.0	< 1.0	< 100	< 100
GB–17 (MW–21)	I	GB–17–1	NA	NA	NA	NA
	I	S1101–4	NA	NA	NA	NA
	I	S1101–5	NA	NA	NA	NA
	I	S1101–6	NA	NA	NA	NA
GB–18 (MW–19)	I	GB–18–1	NA	NA	NA	NA
	I	S1030–1	NA	NA	NA	NA
	I	S1030–2	NA	NA	NA	NA
	I	S1030–3	NA	NA	NA	NA
	I	S1030–4	NA	NA	NA	NA
	I	S1030–5	NA	NA	NA	NA
GB–19 (MW–31)	I	GB–19–1	NA	NA	NA	NA
	I	S1511–114	NA	NA	NA	NA
	I	S1511–115	NA	NA	NA	NA
	I	S1511–116	NA	NA	NA	NA
	I	S1811–117	NA	NA	NA	NA
GB–20 (MW–29)	I	GB–20–1	NA	NA	NA	NA
	I	S1311–104	NA	NA	NA	NA
	I	S1311–105	NA	NA	NA	NA
	I	S1311–106	NA	NA	NA	NA
	I	S1311–107	NA	NA	NA	NA
	I	S1311–108	NA	NA	NA	NA
	I	S1311–109	NA	NA	NA	NA
GB–23	II	GB–23–1–92	NA	NA	NA	NA
	II	GB–23–2–92	138.0	<1.0	< 100	< 100
	II	GB–23–6–92	NA	NA	NA	NA

TABLE 2 – 9

SUMMARY OF LEVEL II SCREENING RESULTS AT THE GRID BORINGS – PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

GRID/WELL BORING	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene µg/kg	VOA–TCE µg/kg
GB–24	II	GB–24–1–92	NA	NA	NA	NA
	II	GB–24–2–92	10.6	<1.0	< 100	< 100
GB–25	II	GB–25–1–92	NA	NA	NA	NA
	II	GB–25–2–92	26.0	<1.0	< 100	< 100
GB–26	II	GB–26–1–92	NA	NA	NA	NA
	II	GB–26–2–92	NA	NA	NA	NA
	II	GB–26–3–92	NA	NA	NA	NA
	II	GB–26–4–92	NA	NA	NA	NA
GB–27	II	GB–27–1–92	NA	NA	NA	NA
	II	GB–27–2–92	NA	NA	NA	NA
	II	GB–27–3–92	NA	NA	NA	NA
GB–28	II	GB–28–1–92	NA	NA	NA	NA
	II	GB–28–2–92	17.1	<1.0	< 100	< 100
GB–29	II	GB–29–1–92	NA	NA	NA	NA
	II	GB–29–2–92	17.5	<1.0	< 100	< 100
	II	GB–29–4–92	NA	NA	NA	NA
GB–30	II	GB–30–1–92	NA	NA	NA	NA
	II	GB–30–2–92	15.6	<1.0	< 100	< 100
	II	GB–30–3–92	19.3	<1.0	< 100	< 100
GB–31	II	GB–31–1–92	NA	NA	NA	NA
	II	GB–31–2–92	25.0	<1.0	< 100	< 100
GB–32	II	GB–32–1–92	NA	NA	NA	NA
	II	GB–32–2–92	18.4	<1.0	< 100	< 100
	II	GB–32–3–92	21.0	<1.0	< 100	< 100
GB–33	II	GB–33–1–92	NA	NA	NA	NA
	II	GB–33–2–92	14.1	<1.0	< 100	< 100
GB–34	II	GB–34–1–92	NA	NA	NA	NA
	II	GB–34–2–92	NA	NA	NA	NA
	II	GB–34–3–92	NA	NA	NA	NA
	II	GB–34–4–92	NA	NA	NA	NA
GB–35	II	GB–35–1–92	NA	NA	NA	NA
	II	GB–35–2–92	NA	NA	NA	NA
	II	GB–35–6–92	NA	NA	NA	NA
GB–36	I	S1411–112	NA	NA	NA	NA
	I	S1411–113	NA	NA	NA	NA
	I	S1411–114	NA	NA	NA	NA
	II	GB–36–1–92	NA	NA	NA	NA
	II	GB–36–2–92	NA	NA	NA	NA
MW–30	I	S1411–110	NA	NA	NA	NA
	I	S1411–111	NA	NA	NA	NA
	I	S1411–112	NA	NA	NA	NA
	I	S1411–113	NA	NA	NA	NA
	I	S1411–114	NA	NA	NA	NA
MW–32	I	S1911–117	NA	NA	NA	NA
	I	S1911–118	NA	NA	NA	NA
	I	S1911–119	NA	NA	NA	NA
	I	S1911–120	NA	NA	NA	NA
MW–34	I	S2011–121	NA	NA	NA	NA
	I	S2011–122	NA	NA	NA	NA
	I	S2011–123	NA	NA	NA	NA
MW–36	II	MW–36–1–92	NA	NA	NA	NA
	II	MW–36–2–92	<10.0	<1.0	< 100	< 100
	II	MW–36–3–92	10.1	<1.0	< 100	< 100

TABLE 2 – 9

SUMMARY OF LEVEL II SCREENING RESULTS
AT THE GRID BORINGS – PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

GRID/WELL BORING	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene µg/kg	VOA–TCE µg/kg
MW–37	II	MW–37–1–92	NA	NA	NA	NA
	II	MW–37–2–92	<10.0	<1.0	< 100	< 100
	II	MW–37–3–92	<10.0	<1.0	< 100	< 100
MW–38	II	MW–38–1–92	NA	NA	NA	NA
	II	MW–38–2–92	27.0	<1.0	< 100	< 100
	II	MW–38–3–92	29.0	<1.0	< 100	< 100
MW–39	II	MW–39–1–92	NA	NA	NA	NA
	II	MW–39–2–92	21.0	<1.0	< 100	< 100
	II	MW–39–3–92	27.0	<1.0	< 100	< 100
MW–40	II	MW–40–1–92	NA	NA	NA	NA
	II	MW–40–2–92	34.0	<1.0	< 100	< 100
	II	MW–40–3–92	30.0	<1.0	< 100	< 100
MW–41	II	MW–41–1–92	NA	NA	NA	NA
	II	MW–41–2–92	20.0	<1.0	< 100	< 100
	II	MW–41–3–92	13.8	<1.0	< 100	< 100

Notes:
1) A shaded row indicates Level IV and V analyses were performed; Level II analyses were also performed.
2) NA = Not analyzed for screening parameters.

TABLE 2 – 10

SUMMARY OF LEVEL II SCREENING RESULTS AT THE PAD BORINGS – PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

BURN PAD	BORING NUMBER	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene µg/kg	VOA–TCE µg/kg
A	A1	I	PB–A–1–91	NA	NA	NA	NA
	A1	I	PB–A–2–91	2100.0	< 1.0	< 100	< 100
	A1	I	PB–A–2A–91	940.0	1.46	< 100	< 100
	A1	I	PB–A–3–91	97.0	< 1.0	< 100	< 100
	A1	I	PB–A–3A–91	101.0	< 1.0	< 100	< 100
	A1	I	PB–A–4–91	68.0	< 1.0	< 100	< 100
	A1	I	PB–A–4A–91	51.0	< 1.0	< 100	< 100
B	B1	I	PB–B1–1–91	NA	NA	NA	NA
	B1	I	PB–B1–2–91	77.0	< 1.0	< 100	< 100
	B1	I	PB–B1–3–91	2600.0	< 1.0	< 100	< 100
	B1	I	PB–B1–4–91	2100.0	< 1.0	< 100	< 100
	B1	I	PB–B1–5–91	960.0	1.01	< 100	< 100
C	C1	I	PB–C1–1–91	NA	NA	NA	NA
	C1	I	PB–C1–2–91	173.0	< 1.0	< 100	< 100
	C1	I	PB–C1–2A–91	250.0	< 1.0	< 100	< 100
	C1	I	PB–C1–3–91	670.0	< 1.0	44500	19700
	C1	I	PB–C1–3A–91	770.0	< 1.0	25200	13000
	C1	I	PB–C1–4–91	900.0	< 1.0	1800	890
	C1	I	PB–C1–4A–91	370.0	< 1.0	8800	99
	C1	I	PB–C1–5–91	98.0	< 1.0	< 100	< 100
	C1	I	PB–C1–5A–91	800.0	< 1.0	< 100	< 100
	C2	II	PB–C2–1–92	NA	NA	NA	NA
	C2	II	PB–C2–2–92	NA	NA	NA	NA
	C3	II	PB–C3–1–92	NA	NA	NA	NA
	C4	II	PB–C4–1–92	NA	NA	NA	NA
	C5	II	PB–C5–1–92	NA	NA	NA	NA
D	D1	I	PB–D1–1–91	NA	NA	NA	NA
	D1	I	PB–D1–2–91	1270.0	< 1.0	< 100	< 100
	D1	I	PB–D1–2A–91	2800.0	< 1.0	< 100	< 100
	D1	I	PB–D1–3–91	12400.0	< 1.0	< 100	< 100
	D1	I	PB–D1–3A–91	3600.0	< 1.0	< 100	< 100
	D1	I	PB–D1–4–91	63.0	< 1.0	< 100	< 100
	D1	I	PB–D1–4A–91	1100.0	< 1.0	< 100	< 100
	D1	I	PB–D1–5–91	1090.0	< 1.0	< 100	< 100
	D1	I	PB–D1–6–91	1850.0	< 1.0	< 100	< 100
E	E1	I	PB–E1–1–91	NA	NA	NA	NA
	E1	I	PB–E1–2–91	36.0	< 1.0	< 100	< 100
	E1	I	PB–E1–3–91	970.0	< 1.0	< 100	< 100
	E1	I	PB–E1–4–91	32.0	< 1.0	< 100	< 100
	E1	I	PB–E1–5–91	33.0	< 1.0	< 100	< 100
	E1	I	PB–E1–6–91	280.0	< 1.0	< 100	< 100
	E1	I	PB–E1–7–91	17.4	< 1.0	< 100	< 100
	E2	II	PB–E2–1–92	NA	NA	NA	NA
	E3	II	PB–E3–1–92	NA	NA	NA	NA
	E4	II	PB–E4–1–92	NA	NA	NA	NA
	E5	II	PB–E5–1–92	NA	NA	NA	NA
F	F1	I	PB–F1–1–91	NA	NA	NA	NA
	F1	I	PB–F1–2–91	30.0	< 1.0	< 100	< 100
	F1	I	PB–F1–3–91	55.0	< 1.0	< 100	< 100
	F1	I	PB–F1–4–91	141.0	< 1.0	< 100	< 100
	F1	I	PB–F1–5–91	<10.0	< 1.0	< 100	< 100
	F1	I	PB–F1–6–91	28.0	< 1.0	< 100	< 100
	F2	II	PB–F2–1–92	NA	NA	NA	NA
	F2	II	PB–F2–2–92	15.8	<1.0	< 100	< 100
	F2	II	PB–F2–3–92	78.0	<1.0	4600	5100
	F2	II	PB–F2–4–92	13.0	<1.0	9100	11300
	F2	II	PB–F2–5–92	<10.0	<1.0	1030	1270
	F2	II	PB–F2–6–92	NA	NA	NA	NA
	F2	II	PB–F2–7–92	19.4	<1.0	1900	2100

TABLE 2 – 10

SUMMARY OF LEVEL II SCREENING RESULTS AT THE PAD BORINGS – PHASE I & II

SENECA ARMY DEPOT OB GROUNDS

BURN PAD	BORING NUMBER	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene µg/kg	VOA–TCE µg/kg
F	F3	II	PB–F3–1–92	NA	NA	NA	NA
	F3	II	PB–F3–2–92	NA	NA	NA	NA
	F4	II	PB–F4–1–92	NA	NA	NA	NA
	F5	II	PB–F5–1–92	NA	NA	NA	NA
	F6	II	PB–F6–1–92	NA	NA	NA	NA
G	G1	I	PB–G1–1–91	NA	NA	NA	NA
	G1	I	PB–G1–2–91	14100.0	2.6	< 100	< 100
	G1	I	PB–G1–3–91	2100.0	24.0	< 100	< 100
	G1	I	PB–G1–4–91	590.0	<1.0	< 100	< 100
	G1	I	PB–G1–5–91	135.0	<1.0	< 100	< 100
	G1	I	PB–G1–6–91	23.0	1.11	< 100	< 100
	G2	I	PB–G2–1–91	NA	NA	NA	NA
	G2	I	PB–G2–2–91	1250.0	< 1.0	< 100	< 100
	G2	I	PB–G2–3–91	18.0	<1.0	< 100	< 100
	G2	I	PB–G2–4–91	64.0	< 1.0	< 100	< 100
	G2	I	PB–G2–5–91	14.8	< 1.0	< 100	< 100
	G3	I	PB–G3–1–91	NA	NA	NA	NA
	G3	I	PB–G3–2–91	350.0	< 1.0	< 100	< 100
	G3	I	PB–G3–3–91	<10.0	<1.0	< 100	< 100
	G3	I	PB–G3–4–91	21.0	< 1.0	< 100	< 100
	G3	I	PB–G3–5–91	<10.0	< 1.0	< 100	< 100
	G4	I	PB–G4–1–91	NA	NA	NA	NA
	G4	I	PB–G4–2–91	15.9	< 1.0	< 100	< 100
	G4	I	PB–G4–4–91	11.7	<1.0	< 100	< 100
	G5	I	PB–G5–1–91	NA	NA	NA	NA
	G5	I	PB–G5–2–91	31.0	< 1.0	127	< 100
	G5	I	PB–G5–3–91	11.0	< 1.0	134	< 100
	G5	I	PB–G5–4–91	17.2	< 1.0	< 100	< 100
	G5	I	PB–G5–5–91	21.0	< 1.0	< 100	< 100
	G6	I	PB–G6–1–91	NA	NA	NA	NA
	G6	I	PB–G6–2–91	44.0	< 1.0	< 100	< 100
	G6	I	PB–G6–3–91	51.0	< 1.0	< 100	< 100
	G6	I	PB–G6–4–91	900.0	< 1.0	< 100	< 100
	G6	I	PB–G6–5–91	21.0	< 1.0	< 100	< 100
	G7	I	PB–G7–1–91	NA	NA	NA	NA
	G7	I	PB–G7–2–91	280.0	< 1.0	< 100	< 100
	G7	I	PB–G7–3–91	15.7	< 1.0	< 100	< 100
	G7	I	PB–G7–4–91	191.0	< 1.0	< 100	< 100
	G7	I	PB–G7–5–91	22.0	< 1.0	< 100	< 100
	G8	II	PB–G8–1–92	NA	NA	NA	NA
	G8	II	PB–G8–2–92	24.0	<1.0	< 100	< 100
	G8	II	PB–G8–3–92	<10.0	<1.0	< 100	154
	G8	II	PB–G8–6–92	NA	NA	NA	NA
	G9	II	PB–G9–1–92	NA	NA	NA	NA
	G9	II	PB–G9–2–92	27.0	<1.0	< 100	< 100
	G9	II	PB–G9–3–92	17.3	<1.0	< 100	< 100
	G9	II	PB–G9–4–92	8.8	<1.0	< 100	< 100
	G9	II	PB–G9–5–92	11.4	<1.0	< 100	< 100
H	H1	I	PB–H1–1–91	NA	NA	NA	NA
	H1	I	PB–H1–2–91	92.0	< 1.0	< 100	< 100
	H1	I	PB–H1–3–91	16.1	<1.0	< 100	< 100
	H1	I	PB–H1–4–91	<10.0	<1.0	< 100	< 100
	H2	II	PB–H2–1–92	NA	NA	NA	NA
	H2	II	PB–H2–2–92	2400.0	<1.0	1970	2300
	H2	II	PB–H2–3–92	23.0	<1.0	460	780
	H2	II	PB–H2–4–92	16.4	<1.0	260	310
	H2	II	PB–H2–5–92	18.1	<1.0	210	350

TABLE 2 – 10

SUMMARY OF LEVEL II SCREENING RESULTS AT THE PAD BORINGS – PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

BURN PAD	BORING NUMBER	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene µg/kg	VOA–TCE µg/kg
H	H3	II	PB–H3–1–92	NA	NA	NA	NA
	H4	II	PB–H4–1–92	NA	NA	NA	NA
	H5	II	PB–H5–1–92	NA	NA	NA	NA
	H6	II	PB–H6–1–92	NA	NA	NA	NA
J	J1	I	PB–J1–1–91	NA	NA	NA	NA
	J1	I	PB–J1–2–91	95.0	< 1.0	< 100	< 100
	J1	I	PB–J1–3–91	36.0	<1.0	< 100	< 100
	J2	I	PB–J2–1–91	NA	NA	NA	NA
	J2	I	PB–J2–2–91	230.0	< 1.0	< 100	< 100
	J2	I	PB–J2–3–91	17.4	<1.0	< 100	< 100
	J2	I	PB–J2–4–91	13.7	<1.0	< 100	< 100
	J3	I	PB–J3–1–91	NA	NA	NA	NA
	J3	I	PB–J3–2–91	880.0	< 1.0	< 100	< 100
	J3	I	PB–J3–3–91	21.0	<1.0	< 100	< 100
	J3	I	PB–J3–4–91	17.9	<1.0	< 100	< 100
	J4	I	PB–J4–1–91	NA	NA	NA	NA
	J4	I	PB–J4–2–91	85.0	< 1.0	< 100	< 100
	J4	I	PB–J4–3–91	15.6	<1.0	< 100	< 100
	J4	I	PB–J4–4–91	11.9	<1.0	210	< 100
	J5	I	PB–J5–1–91	NA	NA	NA	NA
	J5	I	PB–J5–2–91	450.0	< 1.0	< 100	< 100
	J5	I	PB–J5–4–91	24.0	<1.0	< 100	< 100
	J6	I	PB–J6–1–91	NA	NA	NA	NA
	J6	I	PB–J6–2–91	51.0	< 1.0	< 100	< 100
	J6	I	PB–J6–3–91	<10.0	<1.0	< 100	< 100
	J6	I	PB–J6–4–91	10.2	<1.0	< 100	< 100
	J7	I	PB–J7–1–91	NA	NA	NA	NA
	J7	I	PB–J7–2–91	400.0	< 1.0	< 100	< 100
	J7	I	PB–J7–3–91	<10.0	<1.0	< 100	< 100
	J7	I	PB–J7–4–91	27.0	<1.0	< 100	< 100
	J7	I	PB–J7–5–91	48.0	<1.0	< 100	< 100
	J8	I	PB–J8–1–91	NA	NA	NA	NA
	J8	I	PB–J8–2–91	55.0	< 1.0	< 100	< 100
	J8	I	PB–J8–3–91	18.2	<1.0	< 100	< 100
	J8	I	PB–J8–4–91	10.6	<1.0	< 100	< 100
	J9	II	PB–J9–1–92	NA	NA	NA	NA
	J9	II	PB–J9–2–92	25.0	<1.0	240	510
	J9	II	PB–J9–3–92	15.9	<1.0	118	210
	J10	II	PB–J10–1–92	NA	NA	NA	NA
	J10	II	PB–J10–2–92	<10.0	<1.0	< 100	< 100
	J10	II	PB–J10–3–92	15.7	<1.0	< 100	< 100

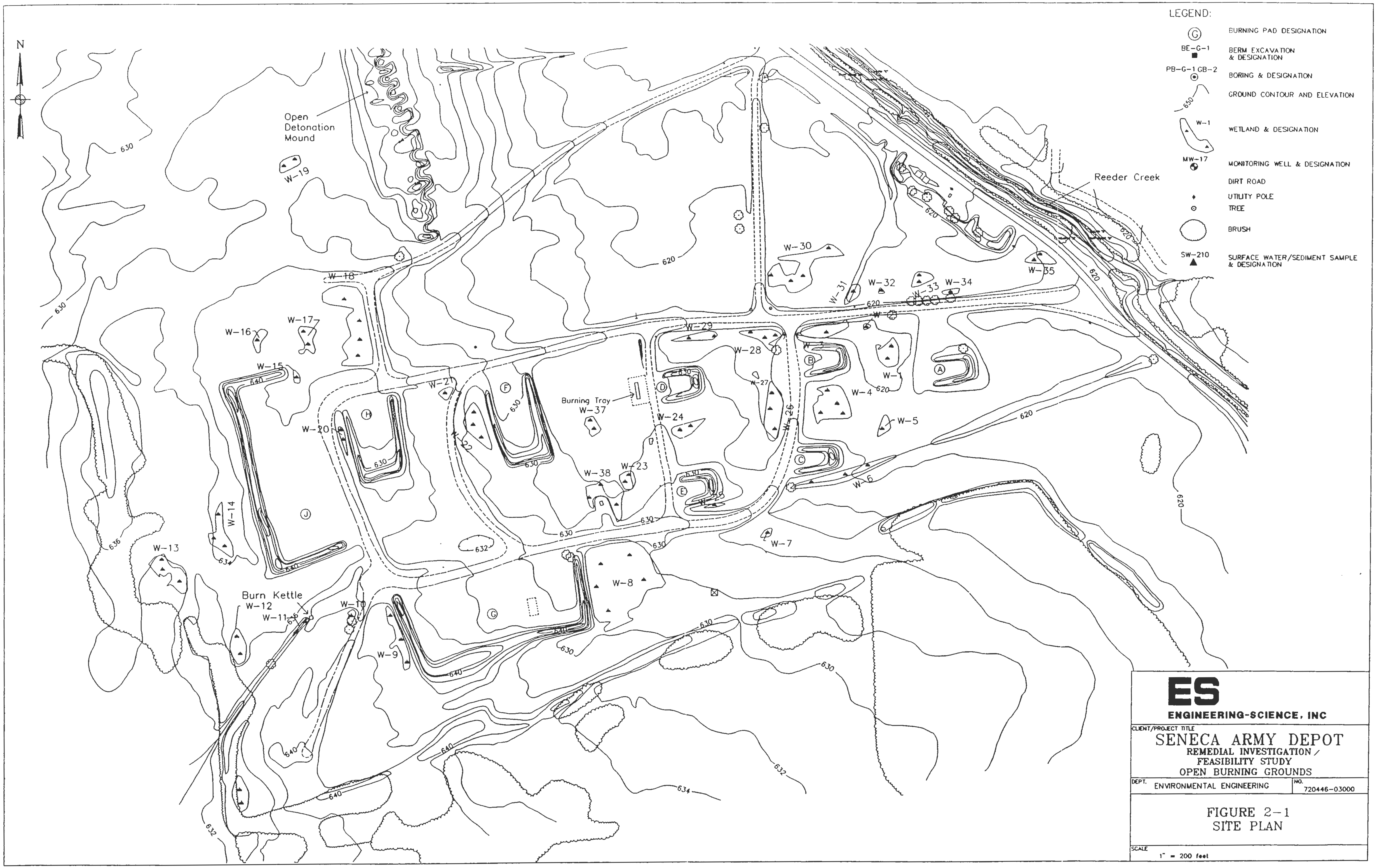
Notes:
1) A shaded row indicates Level IV and V analyses were performed; Level II analyses were also performed.
2) NA = Not analyzed for screening parameters.

TABLE 2 – 11

SUMMARY OF LEVEL II SCREENING RESULTS AT THE BERM EXCAVATIONS – PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

BERM LOCATION	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene µg/kg	VOA–TCE µg/kg
A	I	BE–A–1–91	6600.0	<1.0	< 100	< 100
	I	BE–A–2–91	800.0	<1.0	<100	<100
	II	BE–A–3–92	1170.0	<1.0	<100	<100
	II	BE–A–4–92	540.0	<1.0	<100	<100
B	I	BE–B–1–91	4000.0	<1.0	<100	<100
	I	BE–B–2–91	34000.0	1.27	<100	<100
	II	BE–B–3–92	3900.0	1.0	<100	<100
	II	BE–B–4–92	6000.0	<1.0	<100	<100
C	I	BE–C–1–91	3600.0	<1.0	<100	<100
	I	BE–C–2–91	44000.0	1.11	<100	<100
	I	BE–C–3–91	22000.0	<1.0	<100	<100
	I	BE–C–4–91	270.0	<1.0	<100	<100
	II	BE–C–5–92	1520.0	1.4	<100	<100
	II	BE–C–6–92	4900.0	<1.0	<100	<100
D	I	BE–D–1–91	12000.0	<1.0	<100	<100
	I	BE–D–2–91	1870.0	12.5	<100	<100
	II	BE–D–3–92	8100.0	<1.0	<100	<100
	II	BE–D–4–92	910.0	<1.0	<100	<100
E	I	BE–E–1–91	1030.0	<1.0	<100	<100
	I	BE–E–2–91	310.0	<1.0	<100	<100
	II	BE–E–3–92	820.0	<1.0	<100	<100
	II	BE–E–4–92	168.0	<1.0	<100	<100
F	I	BE–F–1–91	2200.0	1.02	<100	<100
	I	BE–F–1A–91	1170.0	<1.0	<100	<100
	I	BE–F–2–91	4500.0	29.0	<100	<100
	I	BE–F–2A–91	7700.0	69.0	<100	<100
	I	BE–F–3–91	159.0	<1.0	<100	<100
	I	BE–F–3A–91	140.0	<1.0	<100	<100
	II	BE–F–4–92	159.0	<1.0	<100	<100
	II	BE–F–5–92	1800.0	1.3	<100	<100
	II	BE–F–6–92	1890.0	<1.0	<100	<100
	II	BE–F–7–92	1440.0	<1.0	<100	<100
G	I	BE–G–1–91	103.0	1.47	<100	<100
	I	BE–G–2–91	19700.0	3.4	<100	<100
	I	BE–G–3–91	7100.0	1.46	<100	<100
	I	BE–G–4–91	2600.0	<1.0	<100	<100
	I	BE–G–5–91	850.0	1.64	<100	<100
	I	BE–G–6–91	7900.0	1.41	<100	<100
	I	BE–G–7–91	31.0	<1.0	<100	<100
	II	BE–G–8–92	57.0	<1.0	<100	<100
	II	BE–G–9–92	310.0	<1.0	<100	<100
	II	BE–G–10–92	540.0	<1.0	<100	<100
	II	BE–G–11–92	4800.0	1.3	<100	<100
	II	BE–G–12–92	32.0	<1.0	<100	<100
	II	BE–G–13–92	NA	NA	NA	NA
	II	BE–G–14–92	NA	NA	NA	NA



ES

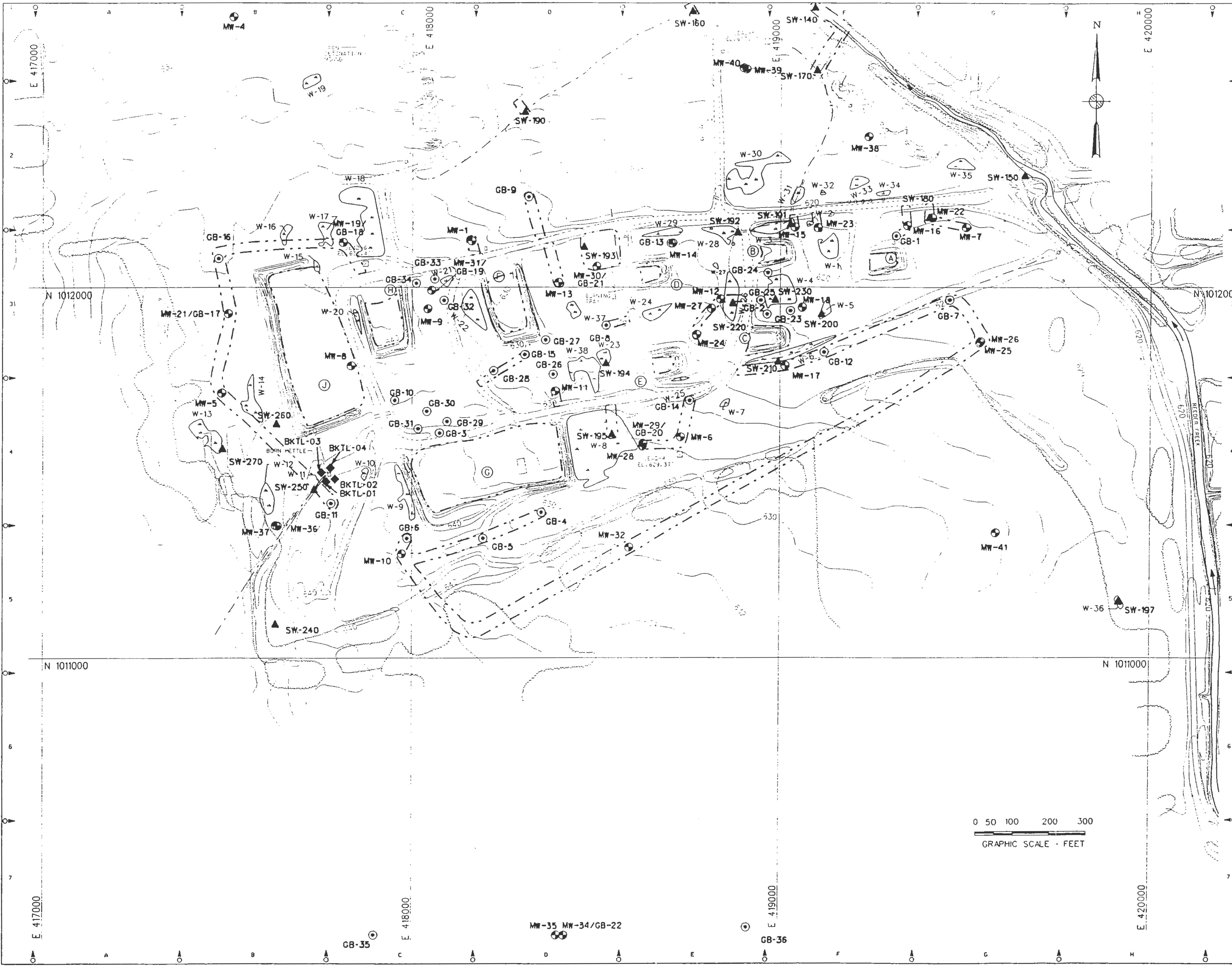
ENGINEERING-SCIENCE, INC

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT.	NO.
ENVIRONMENTAL ENGINEERING	720446-03000

FIGURE 2-1
SITE PLAN

SCALE 1" = 200 feet



LEGEND:

MW-27	MONITORING WELL & DESIGNATION (A GB LABEL AT A WELL INDICATES THAT A GRID BORING IS AT THE SAME LOCATION AS THE WELL)
	PAVED ROAD
	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
	UTILITY POLE
	TREE
	BRUSH
	WETLAND & DESIGNATION
	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
	CULVERT
☒ SEAD-4 EL.629.37'	MONUMENT AND DESIGNATION
▲ SW-197	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
⊙ GB-12	GRID BORING & DESIGNATION
	APPROXIMATE LOCATION OF ACCESS PATH CLEARED BY HFA USING GEOPHYSICAL METHODS.
◆ BKTL-01	BURN KETTLE SURFACE SAMPLE AND DESIGNATION

REV	DATE	DESCRIPTION
C	[illegible]	DRAFT PHASE II - RI/FS
B	[illegible]	PRE-DRAFT PHASE II- RI/FS
A	[illegible]	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN · CHECKED · DES.SUPV. · RESP.ENGR. · CH.DISC.ENG. · PROJ.MGR.

DRAWN BY E.SCHACHT	CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAEUN	RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. M.E.BAKER	MGR. OF ENGR. J.P.CHAPLICK
PROJECT MANAGER M.N.DUCHESNEAU	
MGR. OF PROJECTS J.P.CHAPLICK	
IN CHARGE W.D.PATTERSON	

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

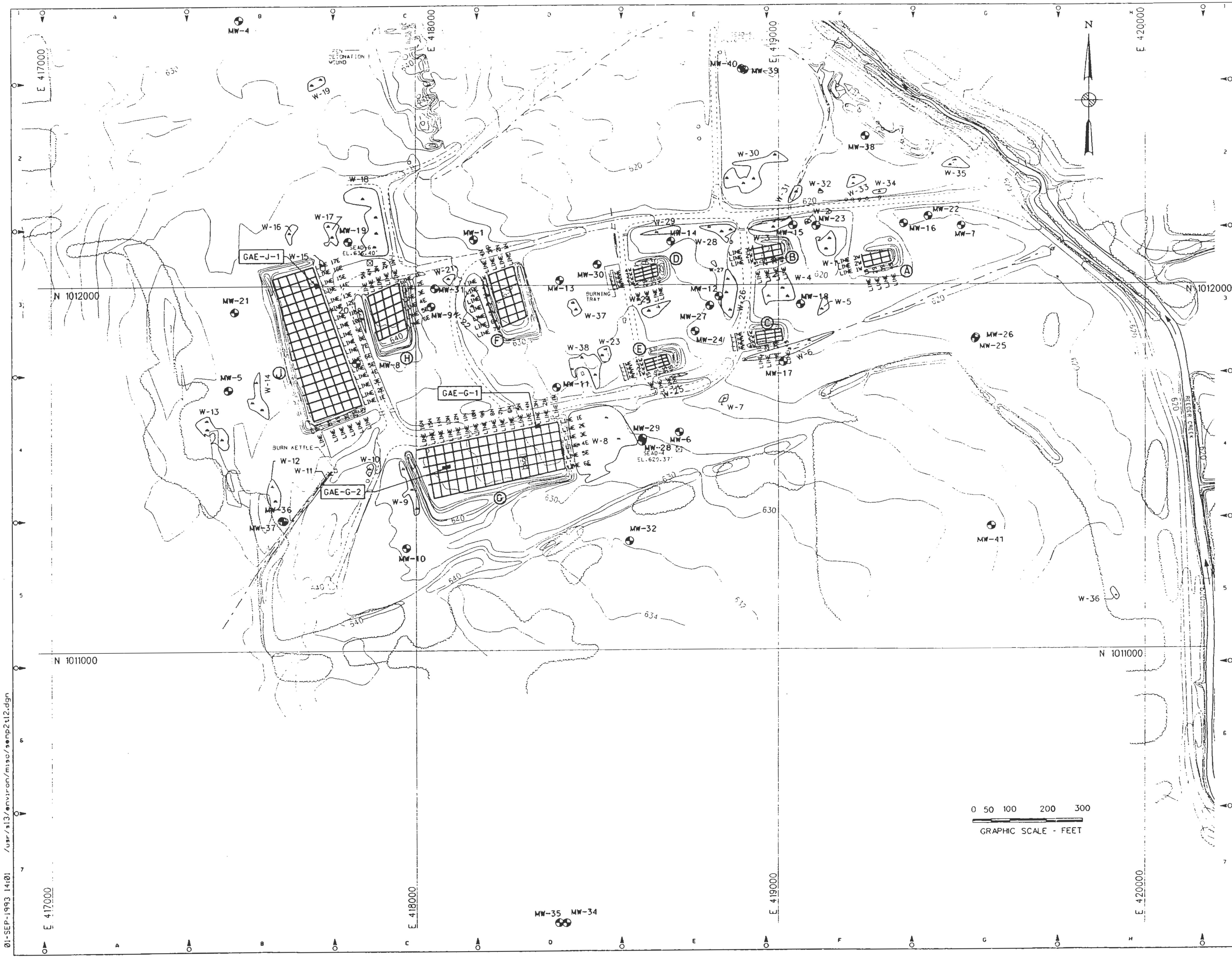
DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 2-2
EXTENT OF UXO
SITE CLEARANCE SURVEY

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-2-2
REV C

06-OCT-1993 13:09 /usr/s13/environ/misc/senp2t25.dgn



LEGEND:

MW-27	MONITORING WELL & DESIGNATION
	PAVED ROAD
	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
+	UTILITY POLE
○	TREE
	BRUSH
W-1	WETLAND & DESIGNATION
	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
	CULVERT
☒ SEAD-4 EL.629.37'	MONUMENT AND DESIGNATION
	LOCATION OF GROUND PENETRATING RADAR (GPR) GEOPHYSICAL SURVEYS
GAE-G-1	GEOPHYSICAL ANOMALY EXCAVATION & DESIGNATION

REV	DATE	DESCRIPTION
B	9/3/93	PRE-DRAFT PHASE II- RI/FS
A	5/23/92	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN BY E.SCHACHT	CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAELIN	RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. M.E.BAKER	MGR. OF ENGR. J.P.CHAPLICK

PROJECT MANAGER
M.N.DUCHESNEAU

MGR. OF PROJECTS
J.P.CHAPLICK

IN CHARGE
W.D.PATTERSON

DRAWN CHECKED DES.SUPV. RESP.ENGR. CH.DISC.ENG. PROJ. MGR.

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

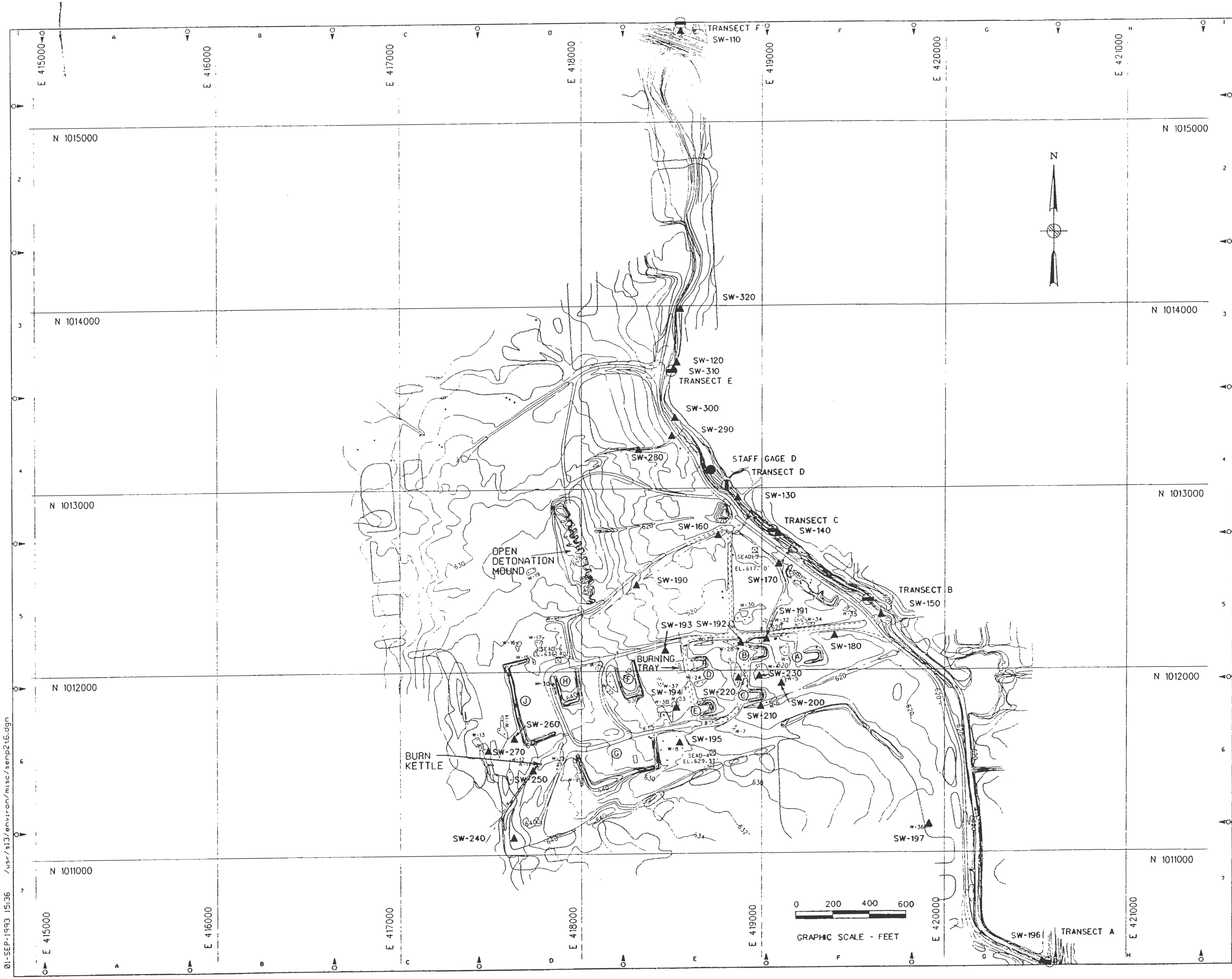
DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 2-3
LOCATION OF
GEOPHYSICAL SURVEYS
ON BURNING PADS

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-2-3
REV B

01-SEP-1993 14:01 /usr/s13/environ/misc/senp2t12.dgn



/usr/s13/environ/misc/senp216.dgn

01-SEP-1993 15:36

LEGEND:

	PAVED ROAD
	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
•	UTILITY POLE
○	TREE
	BRUSH
W-1	WETLAND & DESIGNATION
	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
	CULVERT
☒ SEAD-4 EL. 629.37'	MONUMENT AND DESIGNATION
▲ SW-110	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
⊖	TRANSECT & STAFF GAGE
◑	TRANSECT
●	STAFF GAGE

REV	DATE	DESCRIPTION	DRAWN	CHECKED	DES. SUPV.	RESP. ENGR.	CH. DISC. ENG.	PROJ. MGR.
B	[illegible]	PRE-DRAFT PHASE II- RI/FS						
A	[illegible]	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT						

DRAWN BY E.SCHACHT
CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAELIN
RESP. ENGR. M.N.DUCHESNEAU
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MGR. OF ENGR. J.P.CHAPLICK
PROJECT MANAGER M.N.DUCHESNEAU
MGR. OF PROJECTS J.P.CHAPLICK
IN CHARGE W.D.PATTERSON

ES

ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

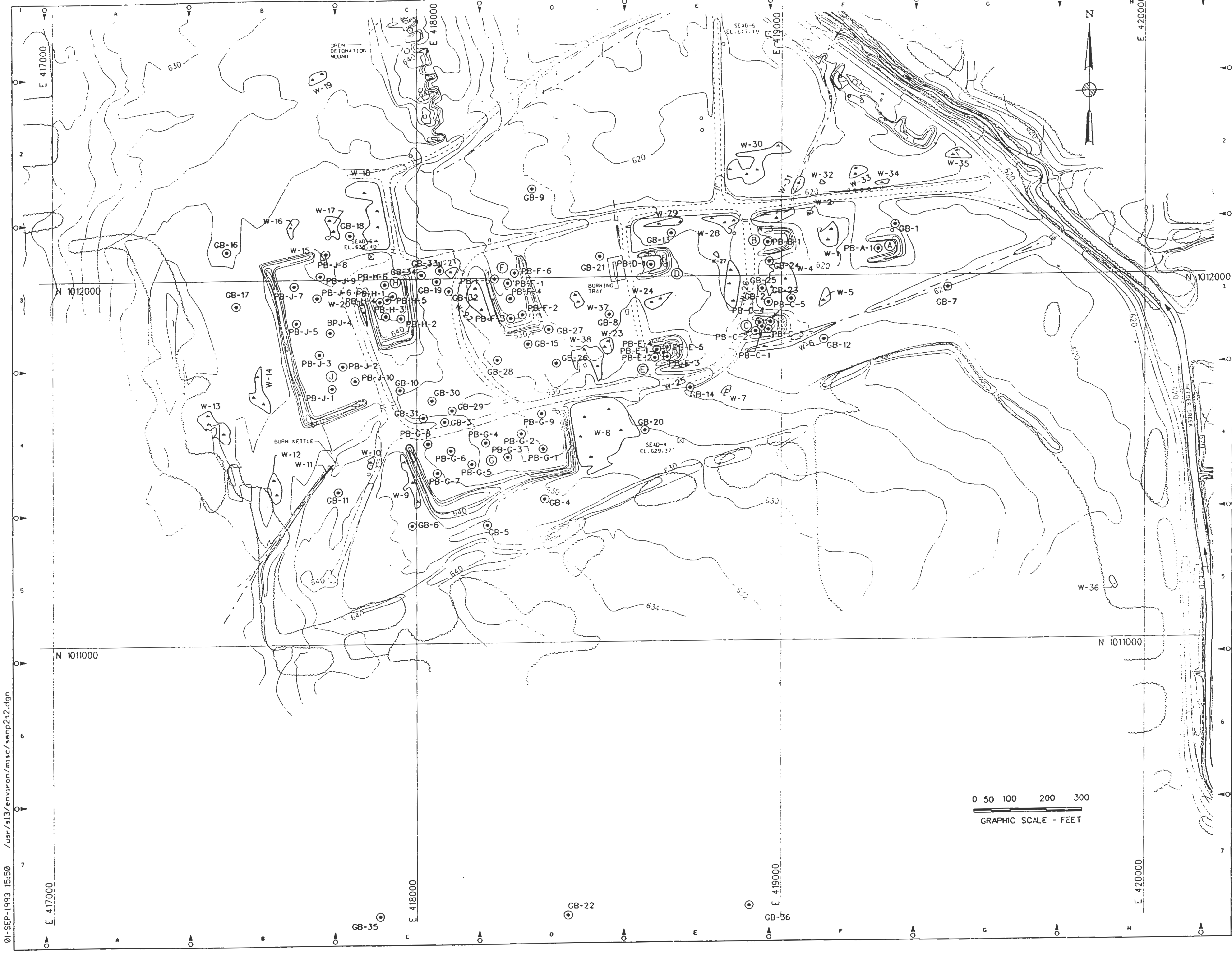
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO.

FIGURE 2-4
LOCATION OF SURFACE WATER
AND SEDIMENT SAMPLES

SCALE 1"=500'
ES'S DWG. NO. 720446-01022-2-4
REV B

01-SEP-1993 15:50 /usr/s13/environ/misc/senp2t2.dgn



LEGEND:

- PAVED ROAD
- DIRT ROAD
- 650 GROUND CONTOUR AND ELEVATION
- UTILITY POLE
- TREE
- BRUSH
- W-1 WETLAND & DESIGNATION
- RUNOFF SWALE
- Ⓓ BURNING PAD DESIGNATION
- CULVERT
- ☒ SEAD-4 EL.629.37' MONUMENT AND DESIGNATION
- ⊙ GB-2 BORINGS & DESIGNATION

REV	DATE	DESCRIPTION
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
	/ /	
B	7/3/93	PRE-DRAFT PHASE II- RI/FS
A	5/13/92	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN | CHECKED | DES.SUPV. | RESP.ENGR. | CH.DISC.ENG. | PROJ. MGR.

DRAWN BY E.SCHACHT
CHECKED BY W.E.BAKER
DESIGN SUPV. G.A.KAELIN
RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. W.E.BAKER
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PROJECT MANAGER M.N.DUCHESNEAU
MGR. OF PROJECTS J.P.CHAPLICK
IN CHARGE W.D.PATTERSON

ES
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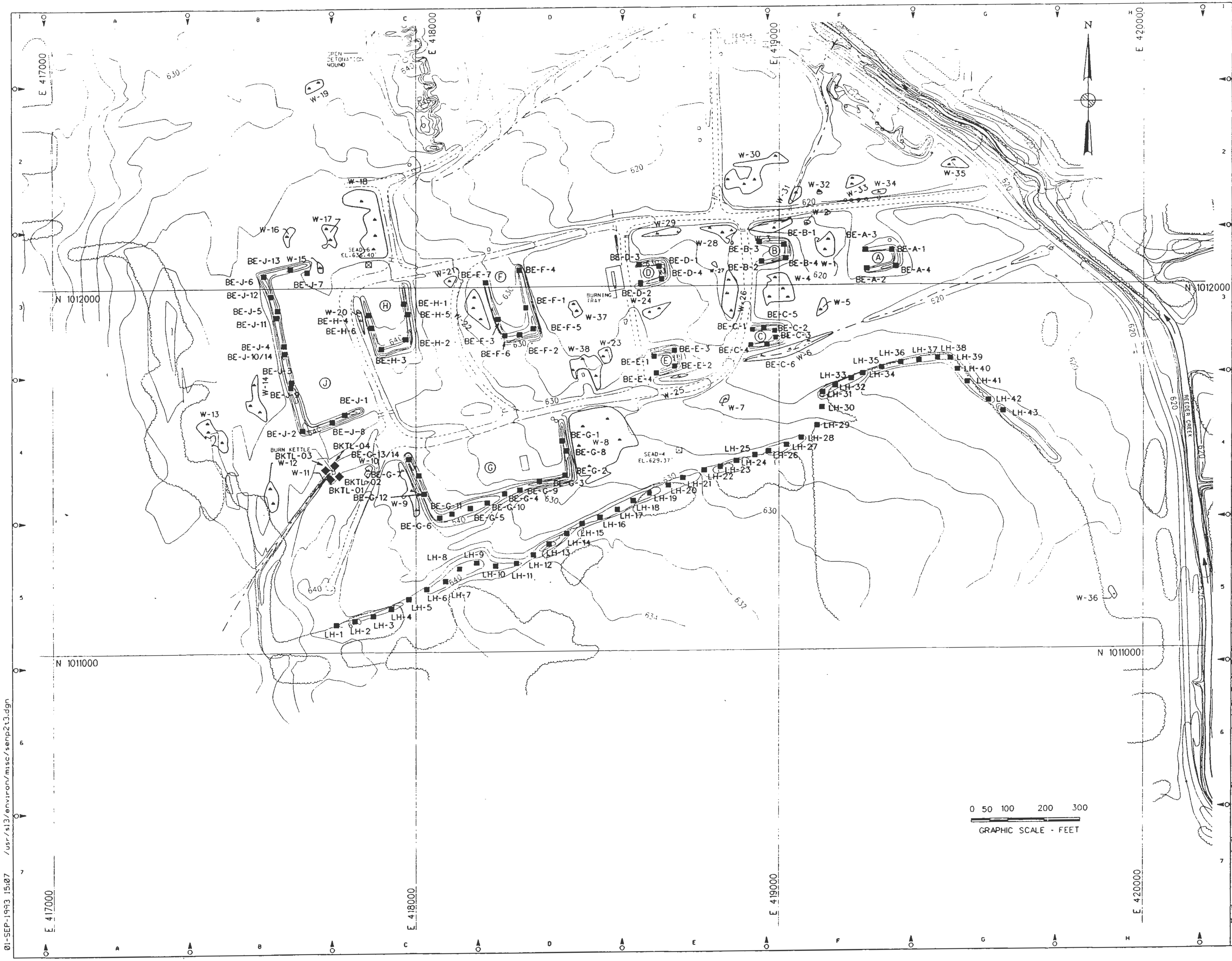
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 2-5
LOCATION OF
PAD AND GRID BORINGS

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-2-5
REV B



01-SEP-1993 15:07 /usr/s13/environ/misc/senp2t3.dgn

LEGEND:

■ LH-43 / BE-G-10	BERM & LOW HILL EXCAVATIONS & DESIGNATIONS
═	PAVED ROAD
┄	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
◆	UTILITY POLE
○	TREE
◯	BRUSH
W-1	WETLAND & DESIGNATION
— · —	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
\ \	CULVERT
☒ SEAD-4 EL.629.37'	MONUMENT AND DESIGNATION
◆ BKTL-01	BURN KETTLE SURFACE SAMPLE & DESIGNATION

REV	DATE	DESCRIPTION
B	3/3/93	PRE-DRAFT PHASE II- RI/FS
A	7/22/92	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN | CHECKED | DES.SUPV. | RESP.ENGR. | CH.DISC.ENG. | PROJ. MGR.

DRAWN BY E.SCHACHT	CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAEUN	RESP.ENGR. M.N.DUCHESNEAU
CHIEF DISC.ENGR. M.E.BAKER	MGR.OF ENGR. J.P.CHAPUCK

PROJECT MANAGER
M.N.DUCHESNEAU

MGR.OF PROJECTS
J.P.CHAPUCK

IN CHARGE
W.D.PATTERSON

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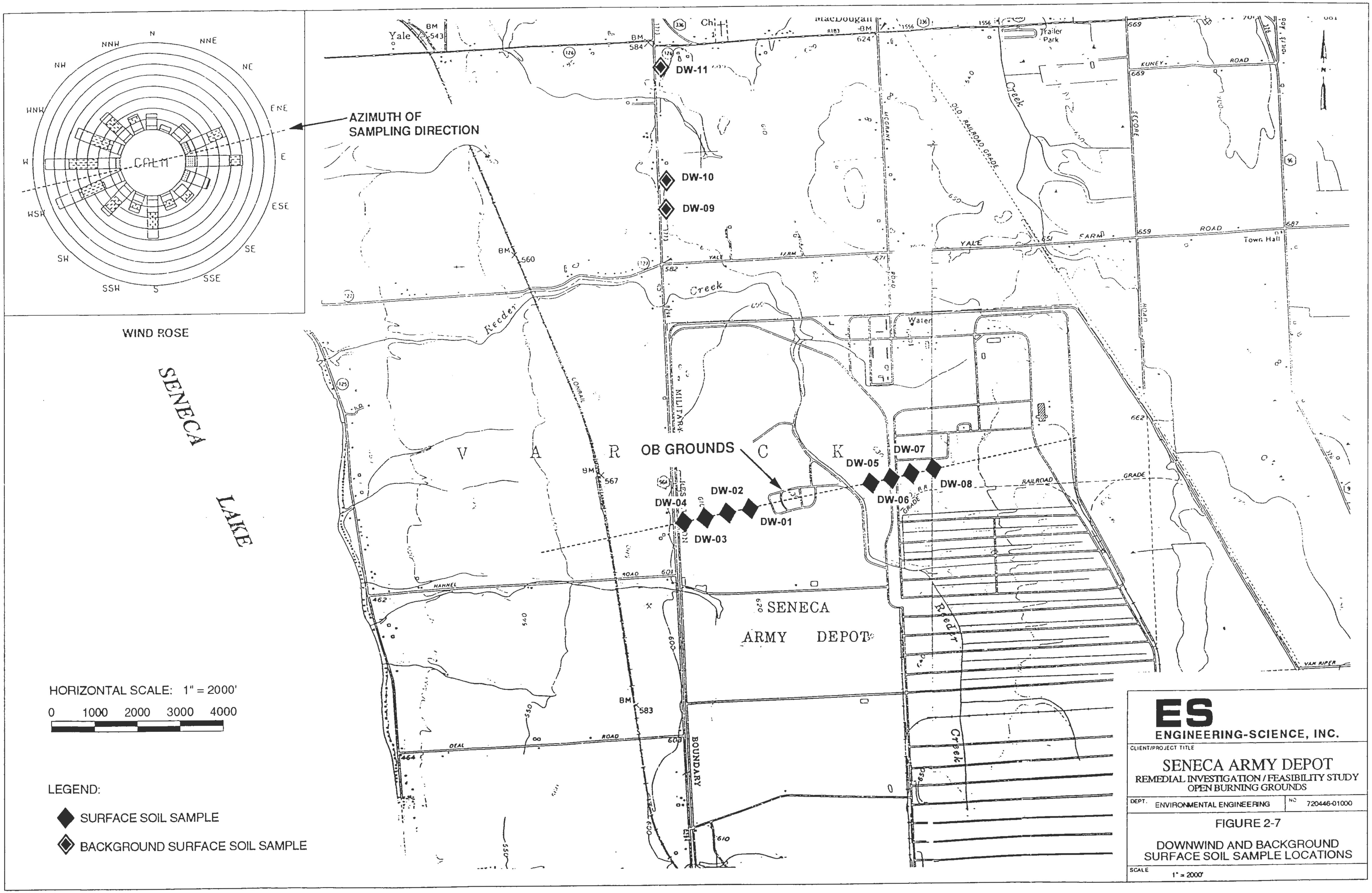
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING | NO. 720446-01000

FIGURE 2-6
LOCATION OF BERM
AND LOW HILL EXCAVATIONS,
AND BURN KETTLE SAMPLES

SCALE 1" = 250'

ESS DWG. NO. 720446-01022-2-6 | REV B



HORIZONTAL SCALE: 1" = 2000'

0 1000 2000 3000 4000

LEGEND:

◆ SURFACE SOIL SAMPLE

◈ BACKGROUND SURFACE SOIL SAMPLE

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REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING | NO. 720446-01000

FIGURE 2-7

DOWNWIND AND BACKGROUND SURFACE SOIL SAMPLE LOCATIONS

SCALE 1" = 2000'

TABLE 2 – 11

SUMMARY OF LEVEL II SCREENING RESULTS AT THE BERM EXCAVATIONS – PHASE I & II

SENECA ARMY DEPOT
OB GROUNDS

BERM LOCATION	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene µg/kg	VOA–TCE µg/kg
H	I	BE–H–1–91	35.0	<1.0	<100	<100
	I	BE–H–2–91	6000.0	1.18	<100	<100
	I	BE–H–3–91	17400.0	1.12	<100	<100
	I	BE–H–4–91	260.0	<1.0	<100	<100
	II	BE–H–5–92	1170.0	<1.0	<100	<100
	II	BE–H–6–92	115.0	<1.0	<100	<100
J	I	BE–J–1–91	18.6	<1.0	<100	<100
	I	BE–J–2–91	16.7	<1.0	<100	<100
	I	BE–J–3–91	19.1	<1.0	<100	<100
	I	BE–J–4–91	22.0	<1.0	<100	<100
	I	BE–J–5–91	690.0	<1.0	<100	<100
	I	BE–J–6–91	30.0	<1.0	<100	<100
	I	BE–J–7–91	NA	NA	NA	NA
	II	BE–J–8–92	260.0	<1.0	NA	NA
	II	BE–J–9–92	20.0	<1.0	NA	NA
	II	BE–J–11–92	10.6	<1.0	NA	NA
	II	BE–J–12–92	<10.0	<1.0	NA	NA
	II	BE–J–13–92	146.0	<1.0	NA	NA
	II	BE–J–14–92	NA	NA	NA	NA

Notes:
1) A shaded row indicates Level IV and V analyses were performed; Level II analyses were also performed.
2) NA = Not analyzed for screening parameters.

TABLE 2 – 12

SUMMARY OF LEVEL II SCREENING RESULTS AT THE LOW HILL EXCAVATIONS – PHASE II

SENECA ARMY DEPOT OB GROUNDS

LOW HILL EXCAVATION	PHASE	SAMPLE NUMBER	Pb, Total mg/kg	TNT mg/kg	VOA–Benzene μg/kg	VOA–TCE μg/kg
LH–1	II	LH–1–92	77.0	<1.0	< 100	< 100
LH–2	II	LH–2–92	38.0	<1.0	< 100	< 100
LH–3	II	LH–3–92	23.0	<1.0	< 100	< 100
LH–4	II	LH–4–92	32.0	<1.0	< 100	< 100
LH–5	II	LH–5–92	16.5	<1.0	< 100	< 100
LH–6	II	LH–6–92	14.9	1.4	< 100	< 100
LH–7	II	LH–7–92	32.0	<1.0	< 100	< 100
LH–8	II	LH–8–92	30.0	<1.0	< 100	< 100
LH–9	II	LH–9–92	41.0	1.1	< 100	< 100
LH–10	II	LH–10–92	19.6	<1.0	< 100	< 100
LH–11	II	LH–11–92	28.0	<1.0	< 100	< 100
LH–12	II	LH–12–92	30.0	<1.0	< 100	< 100
LH–13	II	LH–13–92	21.0	<1.0	< 100	< 100
LH–14	II	LH–14–92	36.0	<1.0	< 100	< 100
LH–15	II	LH–15–92	27.0	<1.0	< 100	< 100
LH–16	II	LH–16–92	38.0	<1.0	< 100	< 100
LH–17	II	LH–17–92	50.0	<1.0	< 100	< 100
LH–18	II	LH–18–92	42.0	<1.0	< 100	< 100
LH–19	II	LH–19–92	41.0	<1.0	< 100	< 100
LH–20	II	LH–20–92	48.0	<1.0	< 100	< 100
LH–21	II	LH–21–92	NA	NA	NA	NA
LH–22	II	LH–22–92	40.0	<1.0	< 100	< 100
LH–23	II	LH–23–92	49.0	<1.0	< 100	< 100
LH–24	II	LH–24–92	53.0	<1.0	< 100	< 100
LH–25	II	LH–25–92	50.0	<1.0	< 100	< 100
LH–26	II	LH–26–92	140.0	<1.0	< 100	< 100
LH–27	II	LH–27–92	153.0	<1.0	< 100	< 100
LH–28	II	LH–28–92	340.0	<1.0	< 100	< 100
LH–29	II	LH–29–92	184.0	<1.0	< 100	< 100
LH–30	II	LH–30–92	51.0	<1.0	< 100	< 100
LH–31	II	LH–31–92	1230.0	<1.0	< 100	< 100
LH–32	II	LH–32–92	1010.0	<1.0	< 100	< 100
LH–33	II	LH–33–92	430.0	<1.0	< 100	< 100
LH–34	II	LH–34–92	181.0	<1.0	< 100	< 100
LH–35	II	LH–35–92	NA	NA	NA	NA
LH–36	II	LH–36–92	290.0	1.0	< 100	< 100
LH–37	II	LH–37–92	102.0	<1.0	< 100	< 100
LH–38	II	LH–38–92	84.0	<1.0	< 100	< 100
LH–39	II	LH–39–92	73.0	<1.0	< 100	< 100
LH–40	II	LH–40–92	88.0	<1.0	< 100	< 100
LH–41	II	LH–41–92	73.0	<1.0	< 100	< 100
LH–42	II	LH–42–92	NA	NA	NA	NA
LH–43	II	LH–43–92	NA	NA	NA	NA
LH–80	II	LH–80–92	16.9	<1.0	< 100	< 100

Notes:
1) A shaded row indicates Level IV and V analyses were performed.

H:\ENG\SENECA\OBRI\TABLES\SL2SRLHE.WK3

accomplish these goals, ES installed 10 overburden (till) and 12 weathered shale monitoring wells in two phases of drilling; Phase I was performed in late 1991 and Phase II was performed in late 1992. The locations of the existing monitoring wells and the additional till and weathered shale monitoring wells installed by ES are shown on Figure 2-8.

2.6.2 Monitoring Well Installation

Previous groundwater investigations at the OB/OD grounds this site had installed 17 monitoring wells. Of these, 13 wells were located in the OB area, MW-1 thru MW-4, were located in the OD area and are not relevant for this investigation. Four of these monitoring wells were located directly downgradient of Burning Pads C, E, G, J. These wells were screened above the weathered shale within the glacial till. Previous investigations on the direction of groundwater flow at the site indicated that these four burning pads, (Pads C, E, G, and J), did not have monitoring wells located downgradient. Accordingly, the lateral migration of contaminants from these pads could not be adequately characterized. To address this deficiency, monitoring wells MW-18, MW-24, MW-29 and MW-19 were installed downgradient of these pads. Well MW-26 was installed in the southeastern portion of the site. MW-34 was installed in a background location to the south of the site.

Four additional overburden wells were installed on-site. Monitoring well MW-37 was installed in the southwestern part of the site near the burn kettle. Wells MW-38 and MW-40 were installed in the northeastern portion of the site in downgradient locations. Well MW-41 was installed southeast of the site beyond the low hill.

The ten overburden monitoring wells were installed, remotely, using hollow-stem augers. The base of these wells was installed just above the weathered shale zone. The details of the screen lengths and screen placements for each monitoring well are presented in Table 2-13.

Twelve weathered shale monitoring wells were installed at the site. The weathered shale wells (MW-21 through MW-23, MW-25, MW-27, MW-28, MW-30 through MW-32, MW-35, MW-36, and MW-40) were installed in various locations on the site either as single wells or as couplet pairs to overburden wells (e.g., MW-36 and MW-40 are coupled with overburden wells MW-37 and MW-39, respectively. These wells were installed below the glacial till with the screen set within the upper zone of the weathered shale. Due to the thin nature of this weathered zone the screen lengths are quite small. The details of the screen placements and screen lengths are summarized within Table 2-13.

TABLE 2 – 13

MONITORING WELL CONSTRUCTION DETAILS

SENECA ARMY DEPOT
OB GROUNDS

Well Number	Type of Monitoring Well	Depth of Well Relative to Ground Surface (ft)	Depth of Well Relative to Top of PVC (ft)	Diameter of Boring (in)	Diameter of Well (in)	Well Screen Length (ft)	Screened Interval (ft)	Well Screen Slat Size (in)	Thickness of Bentonite Seal (ft)	Height of PVC Well Stickup (ft)	Elevation of Top of PVC Well (MSL) (ft)	Well Casing Material	Well Screen Material
1 MW−5	NA	10.0	11.43	N/A	4	5.0	4.0 – 9.0	0.010	N/A	1.43	637.99	PVC	PVC
2 MW−6	NA	9.0	11.22	N/A	4	5.0	4.0 – 9.0	0.010	N/A	2.22	630.31	PVC	PVC
3 MW−7	NA	6.5	7.82	N/A	4	5.0	1.0 – 6.0	0.010	N/A	1.32	622.94	PVC	PVC
4 MW−8	Till	10.0	11.36	10.5	2	5.0	4.5 – 9.5	0.010	1.5	1.36	638.78	PVC	PVC
5 MW−9	Till	7.5	9.00	10.5	2	4.0	3.0 – 7.0	0.010	1.0	1.50	634.95	PVC	PVC
6 MW−10	Till	9.5	11.20	10.5	2	5.0	4.0 – 9.0	0.010	1.5	1.70	638.62	PVC	PVC
7 MW−11	Till	9.5	11.12	10.5	2	5.0	4.0 – 9.0	0.010	1.5	1.62	630.65	PVC	PVC
8 MW−12	Till	7.5	9.11	10.5	2	4.0	3.0 – 7.0	0.010	1.0	1.61	624.50	PVC	PVC
9 MW−13	Till	8.5	10.13	10.5	2	5.0	3.0 – 8.0	0.010	1.0	1.63	627.09	PVC	PVC
10 MW−14	Till	9.0	10.57	10.5	2	5.0	3.5 – 8.5	0.010	1.5	1.57	624.51	PVC	PVC
11 MW−15	Till	7.0	8.64	10.5	2	3.5	3.0 – 6.5	0.010	1.0	1.64	621.99	PVC	PVC
12 MW−16	NA	7.0	8.62	10.5	2	3.5	3.0 – 6.5	0.010	1.0	1.62	622.60	PVC	PVC
13 MW−17	Till	10.0	11.66	10.5	2	5.0	4.5 – 9.5	0.010	1.5	1.66	624.53	PVC	PVC
14 MW−18	WB	11.13	13.58	10.5	2	7.0	4.0 – 11.0	0.010	NA	2.45	623.95	PVC	PVC
15 MW−19	Till	7.10	9.34	10.5	2	2.0	3.0 – 5.0	0.010	NA	2.24	636.34	PVC	PVC
16 MW−21	WB	14.69	17.47	10.5	2	7.0	7.5 – 14.5	0.010	NA	2.78	637.88	PVC	PVC
17 MW−22	WB	16.09	18.74	10.5	2	10.0	6.0 – 16.0	0.010	NA	2.65	623.15	PVC	PVC
18 MW−23	WB	12.81	15.48	10.5	2	5.0	7.5 – 12.5	0.010	NA	2.67	622.87	PVC	PVC
19 MW−24	Till	7.33	9.66	10.5	2	2.0	5.0 – 7.0	0.010	NA	2.33	627.33	PVC	PVC
20 MW−25	WB	11.74	14.24	10.5	2	2.0	9.5 – 11.5	0.010	NA	2.50	623.80	PVC	PVC
21 MW−26	Till	4.58	7.49	10.5	2	2.0	3.0 – 5.0	0.010	NA	2.71	624.31	PVC	PVC
22 MW−27	WB	13.02	15.46	10.5	2	5.0	7.7 – 12.7	0.010	NA	2.44	625.94	PVC	PVC
23 MW−28	WB	13.64	16.24	10.5	2	2.0	11.5 – 13.5	0.010	NA	2.60	631.90	PVC	PVC
24 MW−29	Till	10.49	13.16	10.5	2	5.0	5.5 – 10.5	0.010	NA	2.67	632.07	PVC	PVC
25 MW−30	WB	10.10	12.62	10.5	2	2.0	8.0 – 10.0	0.010	NA	2.52	628.12	PVC	PVC
26 MW−31	WB	8.93	11.40	10.5	2	2.0	6.9 – 8.9	0.010	NA	2.47	634.57	PVC	PVC
27 MW−32	WB	13.58	15.79	10.5	2	8.0	5.6 – 13.6	0.010	NA	2.21	634.81	PVC	PVC
28 MW−34	Till	4.69	6.92	10.5	2	1.5	3.0 – 4.5	0.010	NA	2.23	640.43	PVC	PVC
29 MW−35	WB	NA	11.67	10.5	2	NA	NA	0.010	NA	NA	640.97	PVC	PVC
30 MW−36	WB	8.07	10.32	10.5	2	1.5	5.5 – 7.0	0.010	1.5	2.25	640.55	PVC	PVC
31 MW−37	Till	5.02	7.73	10.5	2	1.5	2.5 – 4.0	0.010	0.2	2.71	640.81	PVC	PVC
32 MW−38	Till	6.75	8.82	10.5	2	1.5	4.25 – 5.75	0.010	NA	2.07	620.67	PVC	PVC
33 MW−39	Till	12.0	14.24	10.5	2	1.5	9.0 – 10.5	0.010	2.0	2.24	620.14	PVC	PVC
34 MW−40	WB	5.5	8.16	10.5	2	1.5	2.5 – 4.0	0.010	0.5	2.66	620.46	PVC	PVC
35 MW−41	Till	6.15	8.55	10.5	2	1.5	3.5 – 5.0	0.010	0.5	2.40	628.80	PVC	PVC

Notes:

1. Wells MW−5 through MW−7 were installed by Parratt – Wolff, Inc. under the supervision of O'Brien & Gere Engineers, Inc.
2. Wells MW−8 through MW−17 were installed by Parratt – Wolff, Inc. under the supervision of Metcalf & Eddy, Inc.
3. Well MW−18 through MW−41 were installed by Empire Soils Investigations, Inc. under the supervision of Engineering – Science, Inc.
4. NA = Not Available
5. Till = monitoring well screened in till
6. WB = monitoring well screened in weathered bedrock (shale)

An off-site overburden well (MW-34) and an off-site weathered shale (MW-35) monitoring well were also installed. These wells will be used to evaluate the background water quality of the overburden glacial till and the underlying weathered shale bedrock.

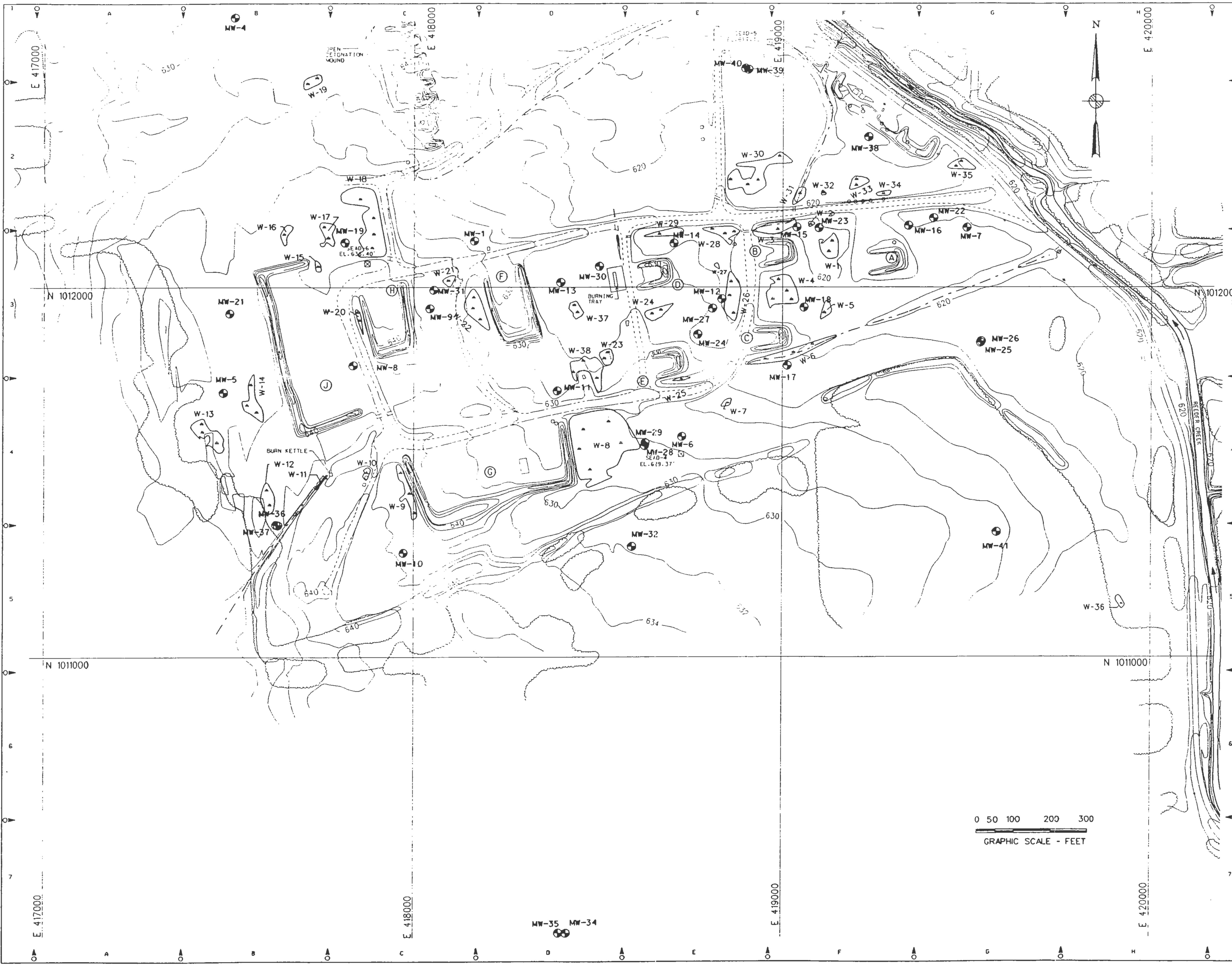
The remote drilling operation was performed using a modified hollow stem auger rig with 6¼-inch I.D. hollow stem augers. The rig used a hydraulic system to raise and lower the 140 lb hammer which drove the split spoons. At each drilling location the hollow stem augering was performed in a normal fashion until the depth was reached to collect soil samples. At this time the remote sampling system was engaged. The hydraulics which controlled the split spoon sampling were located at a mobile panel which contained a 50-foot long cable so that the operator could maintain a safe distance from the sampling location. Split spoon samples were collected continuously at each monitoring well installation. Soil samples were collected as described in Section 2.5, Soils Investigation.

The monitoring wells were constructed using 2-inch National Sanitation Foundation (NSF) or ASTM approved PVC. All of the monitoring wells had 0.010-inch slot size screens installed. For each monitoring well a sand pack was placed around and extended above the well screen. A thin layer of fine sand was placed above the sand pack around the well screen to provide a less permeable media onto which the bentonite seal was placed. If the remaining space in the length of the boring permitted, a cement/bentonite grout was placed above the bentonite and extended to the ground surface. However, in most cases space did not permit the use of grout, and bentonite was used to fill the hole to ground surface. A cement surface seal, with a slight slope away from the well, was placed around the well with a thin layer of bentonite between the steel casing and the cement. The protective steel casing at each monitoring well was installed up to four feet below the ground surface to prevent heaving by frost. Locking caps and a weather resistant padlock were also installed at each well. A permanent well identification stamp was made in the steel protective casing at each well location.

Table 2-13 summarizes the monitoring well construction details. The stratigraphic well logs are presented in Appendix C while the monitoring well construction logs are presented in Appendix E. The monitoring wells were installed by Empire Soils Investigation, Inc. of Groton, New York under the direction of ES.

2.6.3 Monitoring Well Development

Subsequent to the well installations, each monitoring well installed by ES was developed to insure that a proper hydraulic connection existed between the borehole and the surrounding



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LEGEND:

MW-27	MONITORING WELL & DESIGNATION
	PAVED ROAD
	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
♦	UTILITY POLE
○	TREE
	BRUSH
W-1	WETLAND & DESIGNATION
	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
	CULVERT
☒ SEAD-4 EL.629.37'	MONUMENT AND DESIGNATION

REV	DATE	DESCRIPTION
B		PRE-DRAFT PHASE II- RI/FS
A		ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN CHECKED DES.SUPV. RESP.ENGR. CH.DISC.ENG. PROJ. MGR.

DRAWN BY E.SCHACHT	CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAELIN	RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. M.E.BAKER	MGR. OF ENGR. J.P.CHAPLICK
PROJECT MANAGER M.N.DUCHESNEAU	
MGR. OF PROJECTS J.P.CHAPLICK	
IN CHARGE W.D.PATTERSON	

ES

ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING | NO. 720446-01002

FIGURE 2-8
LOCATION OF
MONITORING WELLS

SCALE 1" = 250'

E.S. DWG. NO. 720446-01022-2-8 | REV B

aquifer. The well development details for the new wells as well as for the existing wells are summarized on Table 2-14.

The collection of representative groundwater samples is partially dependent upon the turbidity of the sample. Guidance provided by NYSDEC indicates that a valid sample is considered to be one which has a turbidity of less than 50 Nephelometric Turbidity Units (NTUs). The procedure used to develop the new wells consisted of surging the water in the borehole with a bailer to loosen fine-grain materials present within the well screen and surrounding sand pack. The turbid water was then removed from each well using a gasoline powered pump or bailer and stored on-site in 55 gallon drums for later disposal. The well development was continued until the turbidity of the water from each of the monitoring wells had stabilized or dropped below the 50 NTU value. As seen in Table 2-14, the turbidity of the samples did not drop below 100 NTUs during the well development. This is a function of the clay rich, fine grained nature of the glacial till and weathered shale. A significant effort was made to improve the turbidity of the samples by removing large volumes of water. For example at monitoring well MW-22, 110 gallons of development water was removed from the well. This corresponds to approximately 42 well volumes removed with only a slight improvement in the turbidity of the samples. Turbidity was measured in the field with a Hach portable field turbidimeter with full scale ranges of 1.0, 10 and 100 NTUs.

The development procedure was modified for the wells installed during Phase II to reduce the turbidity of the water in the wells. For development of these wells, only light surging with a bailer for a 2 to 5 minutes was performed and the water in the well was removed using a peristaltic pump at a rate of between 1.5 and 3 liters per minute. The light surging was performed to remove any silt and clay "skin" that may have formed on the borehole wall during drilling. The relatively low flow rate water removal was performed to develop the well and surrounding formation by removing some silt and clay, while not creating an influx of large amounts of silt and clay, which are major components of the till. Final turbidity values for these wells are shown in Table 2-14. Turbidity was measured in the field with a Engineered Systems Model 800 portable field analyzer with full scale ranges of 20 and 200 NTUs.

TABLE 2 – 14

MONITORING WELL DEVELOPMENT INFORMATION

SENECA ARMY DEPOT
OB GROUNDS

MONITORING WELL	INSTALLATION DATE	DEVELOPMENT METHOD	INDICATORS				GALLONS REMOVED	BORING WELL VOLUMES REMOVED
			TEMPERATURE (°C)	pH (standard units)	CONDUCTIVITY (μmhos/cm)	TURBIDITY (NTUs)		
MW – 5	July 1981	NA	NA	NA	NA	NA	NA	NA
MW – 6	July 1981	NA	NA	NA	NA	NA	NA	NA
MW – 7	July 1981	NA	NA	NA	NA	NA	NA	NA
MW – 8	October 1988	Surge & Bail	NA	NA	NA	NA	9.5	1.2
MW – 9	October 1988	Surge & Bail	NA	NA	NA	NA	16.0	2.3
MW – 10	October 1988	Surge & Bail	NA	NA	NA	NA	14.5	1.8
MW – 11	October 1988	Surge & Pump	NA	NA	NA	NA	52	6.6
MW – 12	October 1988	Surge & Bail	NA	NA	NA	NA	18	2.6
MW – 13	October 1988	Surge & Bail	NA	NA	NA	NA	20	2.7
MW – 14	October 1988	Surge & Bail	NA	NA	NA	NA	14	1.9
MW – 15	October 1988	Surge & Bail	NA	NA	NA	NA	9.6	1.4
MW – 16	October 1988	Surge & Bail	NA	NA	NA	NA	Almost Dry	NA
MW – 17	October 1988	Surge & Pump	NA	NA	NA	NA	35	3.5
MW – 18	October 1991	Surge &	8.9 / 8.7	7.1 / 8.8	510 / 500	>100 / >100	105	10.6
MW – 19	October 1991	Surge &	5.0 / 7.0	7.1 / 8.8	510 / 500	>100 / >100	40	13.3
MW – 21	December 1991	Surge &	8.5 / 8.2	7.6 / 7.8	490 / 480	>100 / >100	30	2.6
MW – 22	November 1991	Surge &	8.0 / 8.5	6.8 / 6.8	425 / 410	>100 / >100	110	8.8
MW – 23	November 1991	Surge &	9.5 / 9.0	6.8 / 6.9	700 / 690	>100 / >100	110	11.1
MW – 24	November 1991	Surge &	8.0 / 8.0	7.0 / 7.2	800 / 790	>100 / >100	30	8.3
MW – 25	November 1991	Surge &	8.0 / 8.6	7.8 / 7.7	435 / 440	>100 / >100	110	22.1
MW – 26	November 1991	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW – 27	November 1991	Surge &	7.8 / 7.8	7.6 / 7.7	520 / 520	>100 / >100	110	10.7
MW – 28	November 1991	Surge &	9.6 / 9.2	7.3 / 7.3	550 / 520	>100 / >100	30	3.0
MW – 29	November 1991	Surge &	8.0 / 8.0	7.4 / 7.2	600 / 590	>100 / >100	110	15.5
MW – 30	November 1991	Surge &	9.6 / 9.2	7.3 / 7.4	650 / 620	>100 / >100	110	14.5
MW – 31	November 1991	Surge &	7.6 / 7.4	7.7 / 7.4	600 / 630	>100 / >100	45	8.7
MW – 32	November 1991	Surge &	8.1 / 7.8	7.7 / 7.5	460 / 450	>100 / >100	40	3.3
MW – 34	November 1991	Dry	Dry	Dry	Dry	Dry	Dry	Dry
MW – 35	November 1991	Surge &	9.0 / 9.2	7.6 / 7.8	485 / 465	86 / 90	20	2.5
MW – 36	February 1993	Surge & Bail	5.0 / 6.5 / 6.0 / 5.6 / 5.7 / 6.3 / 6.0 / 6.5	7.63 / 7.30 / 6.86 / 6.80 / 7.23 / 7.23 / 6.97 / 7.04	335 / 340 / 350 / 330 / 330 / 340 / 325 / 330	47.8 / 57.0 / 39.0 / 22.8 / 47.8 / 67.0 / 49.0 / 46.0	8.7	3.1
MW – 37	February 1993	Surge & Bail	2.7 / 4.9 / 4.2 / 3.6 / 3.8 / 4.6 / 3.9 / 4.6	7.92 / 7.11 / 7.29 / 7.32 / 7.20 / 7.66 / 7.25 / 7.39	NA / 360 / 375 / 355 / 340 / 355 / 330 / 360	38.8 / 72.0 / 42.5 / 79.0 / 65.0 / 29.0 / 45.0 / 54.0	2.18	1.8
MW – 38	February 1993	Surge & Bail	4.5 / 4.0 / 4.8 / 5.0 / 4.4 / 4.6 / 4.5 / 4.9	7.81 / 7.17 / 7.07 / 7.17 / 7.44 / 7.44 / 7.24 / 7.11	320 / 320 / 330 / 325 / 320 / 325 / 350 / 330	125 / 185 / 175 / 170 / 157 / 136 / 94 / 99	14.80	4.0
MW – 39	February 1993	Surge & Bail	8.0 / 8.0 / 7.6 / 6.6 / 6.3 / 7.4 / 6.1 / 7.1	7.41 / 7.09 / 6.77 / 7.42 / 7.45 / 7.52 / 7.29 / 7.33	600 / 610 / 600 / 600 / 600 / 600 / 600 / 600	>200 / >200 / >200 / >200 / 195 / 194 / 187 / 186	28.0	5.2
MW – 40	February 1993	Surge & Bail	4.0 / 4.5 / 4.0 / 3.5 / 3.3 / 4.0 / 3.6 / 4.4	7.28 / 6.84 / 6.82 / 7.35 / 7.30 / 7.59 / 6.92 / 7.09	400 / 410 / 400 / 385 / 345 / 380 / 370 / 385	>200 / ><75 / 133 / 196 160 / 125 / 130 / 143	14.85	4.6
MW – 41	February 1993	Surge & Bail	4.7 / 5.3 / 5.0 / 4.5 / 5.1 5.1 / 5.1 / 3.3 / 3.7	7.29 / 6.92 / 6.71 / 6.80 / 7.06 / 6.89 / 7.60 / 6.75 / 6.68	430 / 380 / 390 / 410 / 390 / 395 / 430 / 375 / 375	63.5 / 186 / 196 / 197 / 183 / <>250 / 183 / 98 / 158	7.85	2.5

Notes:
1) Wells MW–5 through MW–7 were installed and developed under the supervision of O'Brien & Gere, Engineers, Inc.
2) Wells MW–8 through MW–17 were installed and developed under the supervision of Metcalf & Eddy, Inc.
3) Wells MW–18 through MW–41 were installed and developed under the supervision of Engineering–Science, Inc.

2.6.4 Aquifer Testing

The in-situ hydraulic conductivity in the Phase I and Phase II monitoring wells was determined using rising head slug tests. The slug test parameters and related information are shown in Table 2-15; several of the wells did not contain enough water to conduct the slug test. The rising head test requires the instantaneous removal of a specific volume from the well resulting in the lowering of the water table in the well. Subsequent to the removal of the volume, rising water levels are recorded for data reduction and used to calculate the hydraulic conductivity.

The slug test procedure used is described below. Prior to the beginning the test water level in the well was measured using an electronic water level meter. Then an In-Situ, Inc. model PTX-161 pressure transducer rated to 10 pounds per square inch (psi) was lowered into the well to an appropriate depth so that when the slug was lowered into the well it would not come in contact with the transducer. At least one foot was allowed between the bottom of the well and the transducer. Next, either a 3-foot or 5-foot long stainless steel slug with a 1.66-inch diameter was lowered into the well using clean nylon rope so that the top of the slug was just below the static water level previously measured in the well. The hollow stainless steel slug contained machined ends onto which stainless screw caps with rubber o-ring gaskets fit. The slug was filled with potable water for the test. In some instances a thinner, solid 2-foot long slug had to be used for the slug test when the 5-foot slug became repeatedly snagged on the transducer cable, thereby disrupting the test. After the slug was lowered into the well, the water level in the well was allowed to equilibrate. Water levels were measured until they stabilized to within 0.01 feet for 5 minutes by monitoring the transducer. In most cases the stabilized water level at the end of the test was nearly equal to the original static water level.

After stabilization of water levels, simultaneously the slug was removed and data logger was started to begin the slug test. A 2-channel Hermit model 1000C data logger was used to record the slug test data. The data logger was configured for logarithmic data collection so that early changes in the water level were recorded. After 10 minutes of data collection the water level was monitored with the data logger to determine if it had stabilized. When the water level stabilized to within 0.02 feet over a 5-minute time period the test was stopped. The test data was downloaded to a portable computer in the field and reviewed to evaluate whether the data was acceptable.

The slug test information for each monitoring well was reduced using the procedure described by Bouwer and Rice (1976). Normalized recovery rates were plotted against time on a semi-

TABLE 2 – 15

INPUT DATA FOR SLUG TEST HYDRAULIC CONDUCTIVITY DETERMINATIONS

SENECA ARMY DEPOT
OB GROUNDS

Well Number	Depth to Bottom of Till/ Weathered Shale Aquifier		Well Point TOC (ft)	Screen Length (ft)	Static Water Level TOC (ft)	Static Height of Water Column (ft)	Initial Draw–down Relative to TOC (ft)	Displacement Relative to Static (ft)	Radius of Well Casing (ft)	Radius of Well Boring (ft)	Saturated Thickness of Aquifier (ft)	Screened Interval TOC (ft)	Slug Dimensions		Comments
	BGS (ft)	TOC (ft)											Length (ft)	Diameter (in)	
1 MW–5	10.0	11.43	11.43	5.0	3.46	7.97	4.424	0.964	0.166	0.437	7.97	5.4–10.4	5.38	1.66	A slug test was performed.
2 MW–6	9.0	11.22	11.22	5.0	3.75	8.07	3.904	0.154	0.166	0.437	8.07	6.2–11.2	2.0	1.0	A slug test was performed.
3 MW–7	6.5	7.82	7.82	5.0	4.35	3.47	4.535	0.185	0.166	0.437	4.27	2.3–7.3	2.0	1.0	A slug test was performed.
4 MW–8	13.5	14.86	11.36	5.0	3.50	7.81	3.953	0.453	0.084	0.437	11.31	5.8–10.8	2.0	1.0	A slug test was performed.
5 MW–9	10.0	11.5	9.00	4.0	NA	NA	NA	NA	0.084	0.437	NA	4.5–8.5	NA	NA	The well was frozen. No test was performed.
6 MW–10	13.5	15.2	11.20	5.0	3.60	7.60	4.337	0.737	0.084	0.437	11.60	5.7–10.7	2.0	1.0	A slug test was performed.
7 MW–11	12.5	14.12	11.12	5.0	4.00	7.12	7.401	3.401	0.084	0.437	10.12	5.6–10.6	5.38	1.66	A slug test was performed.
8 MW–12	10.0	11.61	9.11	4.0	NA	NA	NA	NA	0.084	0.437	NA	4.6–8.6	NA	NA	The well was dry. No test was performed.
9 MW–13	12.0	13.63	10.13	5.0	NA	NA	NA	NA	0.084	0.437	NA	4.6–9.6	NA	NA	The well was frozen. No test was performed.
10 MW–14	11.5	13.07	10.57	5.0	4.00	6.57	5.824	1.824	0.084	0.437	9.07	5.0–10.0	5.38	1.66	A slug test was performed.
11 MW–15	8.5	10.14	8.64	3.5	NA	NA	NA	NA	0.084	0.437	NA	4.6–8.1	NA	NA	The well was frozen. No test was performed.
12 MW–16	8.5	10.12	8.62	3.5	NA	NA	NA	NA	0.084	0.437	NA	4.6–8.1	NA	NA	The well was frozen. No test was performed.
13 MW–17	14.0	15.66	11.66	5.0	NA	NA	NA	NA	0.084	0.437	NA	6.1–11.1	NA	NA	The well was frozen. No test was performed.
14 MW–18	11.0	13.58	13.58	7.0	2.70	10.88	3.205	0.505	0.084	0.437	10.88	6.4–13.4	2.0	1.0	A slug test was performed.
15 MW–19	7.1	9.34	7.52	2.0	NA	NA	NA	NA	0.084	0.437	NA	15.2–17.2	NA	NA	The well was frozen. No test was performed.
16 MW–21	14.0	17.47	17.47	7.0	4.28	13.19	6.185	1.905	0.084	0.437	13.19	10.2–17.2	5.38	1.66	A slug test was performed.
17 MW–22	16.0	18.74	18.74	10.0	4.00	14.74	4.493	0.493	0.084	0.437	14.74	8.6–18.6	2.0	1.0	A slug test was performed.
18 MW–23	12.5	15.48	15.48	5.0	3.55	11.93	4.145	0.595	0.084	0.437	11.93	10.1–15.1	2.0	1.0	A slug test was performed.
19 MW–24	8.0	10.33	9.66	2.0	4.20	5.46	4.651	0.451	0.084	0.437	6.13	7.3–9.3	2.0	1.0	A slug test was performed.
20 MW–25	11.5	14.24	14.24	2.0	7.00	7.24	7.455	0.455	0.084	0.437	7.24	12.0–14.0	2.0	1.0	A slug test was performed.
21 MW–26	6.0	8.71	7.49	2.0	NA	NA	NA	NA	0.084	0.437	NA	5.7–7.7	NA	NA	The well was dry. No test was performed.
22 MW–27	12.7	15.46	15.46	5.0	3.55	11.91	5.639	2.089	0.084	0.437	11.91	10.1–15.1	5.38	1.66	A slug test was performed.
23 MW–28	9.4	16.24	16.24	2.0	4.86	11.38	7.050	2.190	0.084	0.437	11.38	14.1–16.1	5.38	1.66	A slug test was performed.
24 MW–29	10.5	13.16	13.16	5.0	4.60	8.56	5.184	0.584	0.084	0.437	8.56	8.1–13.1	2.0	1.0	A slug test was performed.
25 MW–30	9.0	12.62	12.62	2.0	4.80	7.82	8.912	4.112	0.084	0.437	7.82	10.5–12.5	5.38	1.66	A slug test was performed.
26 MW–31	9.0	11.40	11.40	2.0	3.60	7.80	5.525	1.925	0.084	0.437	7.80	9.3–11.3	5.38	1.66	A slug test was performed.
27 MW–32	13.5	15.79	15.79	8.0	3.12	12.67	4.990	1.870	0.084	0.437	12.67	7.8–15.8	5.38	1.66	A slug test was performed.
28 MW–34	6.0	8.23	6.92	1.5		NA	NA	NA	0.084	0.437	NA	5.2–6.2	NA	NA	The well was frozen. No test was performed.
29 MW–35	7.0	11.67	11.67			NA	NA	NA	0.084	0.437	NA		NA	NA	
30 MW–36	8.0	10.32	10.32	1.5	9.50	0.82	NA	NA	0.084	0.437	0.82	7.7–9.2	NA	NA	Not enough water to perform test.
31 MW–37	8.0	10.71	7.73	1.5	6.96	0.77	NA	NA	0.084	0.437	3.75	5.2–6.7	NA	NA	Not enough water to perform test.
32 MW–38	6.75	8.82	8.82	1.5	6.38	2.44	NA	NA	0.084	0.437	2.44	6.4–7.9	NA	NA	Not enough water to perform test.
33 MW–39	11.5	14.24	14.24	1.5	7.52	6.72	10.344	2.824	0.084	0.437	6.72	10.7–11.2	2.86	1.66	A slug test was performed.
34 MW–40	5.5	8.16	8.16	1.5	6.89	1.27	NA	NA	0.084	0.437	1.27	5.1–6.6	NA	NA	Not enough water to perform test.
35 MW–41	6.0	8.55	8.55	1.5	7.76	0.79	NA	NA	0.084	0.437	0.79	5.9–7.4	NA	NA	Not enough water to perform test.

Notes:

1. Slug Testing for wells MW–5 through MW–35 was performed during Phase I, January 1992.
2. Slug Testing for wells MW–36 through MW–41 was performed during Phase II, January 1993.
3. NA = Not Available

logarithmic plot and the hydraulic conductivity was determined by a computer program (AQTESOLV Version 1.1 Release 4).

The input data to AQTESOLV consisted of the following: 1) initial drawdown in test well; 2) internal radius of the test well casing; 3) effective radius of the test well; 4) saturated aquifer thickness under static conditions; 5) length of the test well screen; and 6) height of water column in test well under static conditions. The input data for the slug tests at the OB grounds are included in Table 2-15. Once the data were plotted, the hydraulic conductivity was determined using the automatic estimating and interactive on-screen curve matching capabilities of the program to match the straight line portion of the drawdown (displacement) curve; the straight line portion is the valid part of the readings (Bouwer and Rice, 1976).

The raw rising head slug test data as well as the results of the hydraulic conductivity determinations using AQTESOLV are included in Appendix F.

2.6.5 Groundwater Sampling

The monitoring wells were sampled to evaluate the presence and extent of organic chemical constituents present within the groundwater. Two rounds of groundwater sampling were performed. The first round, which included 29 wells was performed upon completion of the Phase I field work and data from this sampling, was presented in the PSCR. The second round of sampling, which included 35 wells, was performed upon the completion of the Phase II field work (Table 2-16).

For Phase I groundwater sampling, the wells were purged of at least three well volumes using a decontaminated Teflon bailer until indicator parameters (pH, temperature and specific conductance) were observed to vary by less than 10 percent and the turbidity was less than 50 NTUs. While stabilization of indicator parameters was achieved, water samples with turbidities less than 50 NTUs were rarely obtained. If during the purging process the well went to near dryness, purging was stopped and the well was allowed to recover 80 percent of the original water column before additional water was removed. If the well went to near dryness again, purging was stopped. Sampling occurred within three hours of purging for high yield wells. For low yield wells groundwater was removed from the well as permitted to fill the appropriate

TABLE 2 – 16

MONITORING WELL SAMPLING INFORMATION
PHASE II

SENECA ARMY DEPOT
OB GROUNDS

MONITORING WELL	INDICATORS				GALLONS REMOVED	STANDING WATER VOLUME (gal)	WELL VOLUMES REMOVED
	TEMPERATURE (°C)	pH (standard units)	CONDUCTIVITY (μmhos/cm)	TURBIDITY (NTUs)			
MW – 5	3.0	6.9	415	86.0	4.00	4.66	0.86
MW – 6	6.0 / 6.0	7.7 / 7.5	425 / 435	133.0	4.00	4.10	0.98
MW – 7	3.0 / 3.5	7.5 / 7.4	280 / 280	81.0	1.20	1.35	0.89
MW – 8	4.0 / 4.0 / 4.5	7.30 / 7.00 / 7.01	1000 / 1000 / 1000	33.50	2.00	1.03	1.94
MW – 9	FROZEN	FROZEN	FROZEN	FROZEN	FROZEN	FROZEN	FROZEN
MW – 10	4.50 / 4.50 / 4.75	6.42 / 6.56 / 6.69	470 / 550 / 510	> 200	3.00	1.07	2.80
MW – 11	5.3 / 5.0 / 5.5	7.95 / 8.06 / 7.97	725 / 700 / 700	4.10	1.44	1.44	1.00
MW – 12	3.5 / 3.5 / 3.9	8.98 / 8.82 / 8.72	1500 / 1500 / 1500	33.0	3.30	1.13	2.92
MW – 13	FROZEN	FROZEN	FROZEN	FROZEN	FROZEN	FROZEN	FROZEN
MW – 14	3.6 / 3.5 / 3.9	8.40 / 8.28 / 8.20	700 / 700 / 700	155.0	1.20	1.20	1.00
MW – 15	4.0 / 3.0 / 3.0	6.75 / 6.36 / 6.38	775 / 790 / 790	100.50	2.40	0.83	2.89
MW – 16	3.4 / 1.1 / 2.2 / 3.3	8.29 / 8.52 / 8.60 / 8.60	435 / 320 / 430 / 450	28.0	0.93	0.93	1.00
MW – 17	4.2 / 4.0 / 4.2	9.33 / 9.15 / 8.95	300 / 300 / 300	161.0	1.50	1.50	1.00
MW – 18	5.1 / 4.2 / 5.0	8.55 / 8.48 / 8.34	470 / 390 / 436	35.0	1.79	1.79	1.00
MW – 19	3.5 / 3.0 / 3.5	6.60 / 6.39 / 6.51	820 / 890 / 900	> 200	1.75	0.55	3.18
MW – 21	5.8 / 6.8 / 5.9	7.60 / 6.98 / 7.05	419 / 409 / 382	2.0	6.00	2.07	2.90
MW – 22	6.0 / 5.4 / 5.4	8.17 / 7.95 / 7.95	420 / 420 / 415	2.90	2.26	13.85	0.16
MW – 23	5.5 / 6.0 / 7.0	7.65 / 7.89 / 7.93	340 / 650 / 600	5.0	1.80	1.80	1.00
MW – 24	5.0 / 5.0 / 5.0	6.94 / 6.77 / 6.83	740 / 750 / 750	14.30	2.00	0.65	3.08
MW – 25	6.5 / 6.5 / 6.5	7.15 / 7.02 / 7.10	330 / 330 / 330	16.10	3.00	0.90	3.33
MW – 26	DRY	DRY	DRY	DRY	DRY	DRY	DRY
MW – 27	6.3 / 6.2 / 5.4 / 5.8	8.30 / 8.55 / 8.60 / 8.60	650 / 625 / 625 / 625	3.20	1.90	1.80	1.06
MW – 28	7.0 / 7.5	6.80 / 11.89	1100 / 1000	35.0	2.60	1.80	1.44
MW – 29	6.5 / 6.0 / 6.5	7.93 / 7.70 / 7.54	450 / 445 / 450	30.0	3.90	1.30	3.00
MW – 30	6.3 / 5.9 / 6.4	9.07 / 8.75 / 8.51	600 / 600 / 600	1.30	1.38	1.38	1.00
MW – 31	4.0 / 4.0 / 4.9	7.12 / 7.17 / 720	510 / 510 / 510	> 200	2.70	0.93	2.90
MW – 32	3.8 / 4.9 / 5.2	8.63 / 9.60 / 9.34	370 / 370 / 360	10.0	2.17	2.17	1.00
MW – 34	1.6 / 2.1	8.92 / 8.91	450 / 445	> 200	0.73	0.73	1.00
MW – 35	4.9 / 4.2 / 4.4	9.05 / 9.12 / 9.03	405 / 410 / 410	28.0	1.50	1.50	1.00
MW – 36	3.9 / 3.2 / 3.5 / 4.0 / 4.3 / 4.2	10.42 / 10.39 / 10.23 / 7.48 / 7.65 / 7.91	315 / 315 / 320 / 425 / 420 / 410	15.5	0.79	0.167	4.73
MW – 37	3.1	9.53	300	NA	0.145	0.145	1.00
MW – 38	2.1 / 2.4 / 2.8	8.45 / 8.96 / 9.07	340 / 395 / 420	11.1	0.65	0.65	1.00
MW – 39	7.0 / 7.0 / 7.5	7.35 / 7.28 / 7.32	600 / 600 / 590	48.50	3.00	1.07	2.80
MW – 40	3.5 / 3.5	7.45 / 7.48	415 / 410	7.80	0.203	0.18	1.14
MW – 41	4.5 / 4.0	7.27 / 7.37	355 / 345	NA	0.080	0.16	0.50

Notes:
1) NA = Not Available

sample containers. Samples were collected using a decontaminated Teflon bailer. The samples were collected in the following order: volatiles, semivolatiles, pesticides and PCBs, explosives, metals, and cyanide. In Phase I, if the turbidity for a well was greater than 50 NTUs, both total and dissolved (filtered) metals were collected.

In order to lower the turbidity of the groundwater samples in Phase II the sampling procedure was modified. Because it was suspected that the high turbidities were due to the turbulent and silt-producing surge of the Teflon bailer, a low flow purging method was developed. The low-flow purging method involved the use of a peristaltic pump which removed water from the well via dedicated Teflon tubing. The sampling order was also modified so that metals were collected sooner then in the Phase I program. Obtaining water samples for metals which are truly representative of the aquifer was a primary goal of the modified sampling procedure.

The modified groundwater sampling procedure used during Phase II is described below. The wells were purged prior to sampling using a peristaltic pump with a dedicated Teflon tube which extended to the bottom of the well. The purging process began with the open-end of the tube at the bottom of the well screen (or at least 6 inches from the bottom of the well). The purging flow rate was between 1.5 and 2 liter per minute (L/min) and the water was purged into a graduated 5-gallon bucket. During the purging process the water level in the well was monitored with an electronic water level meter. After approximately one well volume was removed, the time, flow rate, depth to the bottom of the opening of the Teflon tube and the total volume of water removed was recorded on the sampling data sheet. Measurements of indicator parameters (temperature, specific conductance and pH) were also made this time. For wells which were not purged to near dryness after one well volume was removed, the Teflon tube was slowly raised to point between the top of the well screen and the water surface. When two well volumes were removed the indicator parameters were measured and recorded. Purging of the well continued until three well volumes were removed. After purging the third well volume indicator parameters were recorded for the last time. If required, additional temperature, specific conductance, and pH measurements were made until the readings stabilized (two successive measurements varied by less than 10 percent). Moving the location of the tube from the screened interval to a point near the top of the water surface during purging ensured the removal of any stagnant water from the well prior to sampling. After removal of three well volumes the well was allowed to sit for 2½ hours prior to sampling at which time the water level was measured in the well. If the well has recovered to 95 percent of the original static level, then sampling of the well was performed. If the 95 percent recovery was not achieved after 3 hours, then the recovery requirement for the well was reduced to 85 percent prior to sampling.

For wells which were very slow to recharge, purging of groundwater at the 1.5 to 2 L/min flowrate continued until the well was drained to near dryness (i.e., when the water level is at 1 foot above the bottom of the well). Again the purging process began with the open end of the Teflon tube at the bottom of the well screen or at least 6 inches from the bottom of the well. The time, flow rate, depth to the bottom of the open tube, and total volume of water removed after purging the well to near dryness were recorded. Temperature, specific conductance and pH were also recorded for these wells. At this time the well was considered to have been purged enough to ensure that the subsequent water samples collected from the well were representative of water from the aquifer. Once pumped to near dryness the well was allowed to recover to 85 percent of the original static level prior to sampling. If, however, the well did not recharge to 85 percent after six hours, sampling of the well commenced regardless.

Prior to collecting the sample, the Teflon purging tube was removed from the well using a pair of latex gloves and placed into a clean plastic bag during sampling. To sample, the bailer was lowered into the well at a rate of 1/2-inch per second to minimize the disturbance of water and silt in the well. When the bailer was filled with water it was removed at a rate of 1/2-inch per second and the appropriate sample containers were filled. If during the sampling process the well was bailed to near dryness (i.e., two to three feet of water in the bottom of the well) sampling was stopped until the well recharged to 85 percent of the original static level. If it did not recharge to 85 percent after 6 hours, sampling was continued as water was available for each parameter. When sampling was complete, the dedicated Teflon tubing was returned to the well.

Monitoring wells at the OB grounds were sampled for the following parameters:

1. Target Compound List (TCL) for Volatile Organic Analytes (VOA)-Phase I only. For Phase II, groundwater from the wells was analyzed using EPA Method 524.2 as no volatiles were detected during the Phase I sampling and a lower detection limit was desired.
2. Target Compound List (TCL) for Acid, and Base/Neutral semivolatiles, Pesticides and Polychlorinated Biphenyls (AB/Ns, Pesticides and PCB's)
3. Target Analyte List (TAL) (Metals)

4. Method 8330 (Explosives)

The sampling order for Phase II was as follows: 1) volatile organic compounds, 2) semivolatile organic compounds, 3) total metals (prepreserved), 4) explosives, 5) pesticides and PCBs, and 6) cyanide. The results of the testing are discussed in detail within Section 4 of this report.

Three rounds of water level measurements were completed for monitoring wells MW-5 through MW-35 during Phase I. In addition, three rounds were conducted for wells MW-5 through MW-41 for Phase II. The water level data have been used to determine the direction of groundwater flow within the glacial till aquifer, and evaluate the relationship between the glacial till and weathered bedrock aquifers. These data are presented and discussed in detail within Section 3.

2.7 ECOLOGICAL INVESTIGATION PROGRAM

2.7.1 Objectives

The objective of the ecological assessment was to characterize the existing aquatic and terrestrial biotic environment on and near the OB grounds. The aquatic biotic assessment focused on Reeder Creek, which is the only perennial body of water situated on or near the OB grounds. The measurement endpoints of the aquatic assessment are primarily community oriented and include determining the species composition, relative abundance, species richness and guild (food web) structure of benthic macroinvertebrates and fish that are found in the stream. At an individual level, any suspected overt symptomology such as tumors or other abnormalities that could indicate adverse effects of contaminants were also quantified. These enabled the derivation of the Phase I assessment endpoints which are to identify potential aquatic receptors and characterize the existing aquatic community so that decisions regarding its value as a sport or recreational resource can be made and potential interactions with downstream aquatic communities or terrestrial communities can be identified.

The terrestrial biotic assessment focused on determining the species composition, relative abundance and species richness of the terrestrial floral and faunal communities inhabiting the OB grounds and adjacent areas. The measurement endpoints are, at the individual level where any overt symptomology, such as plant leaf chlorosis (yellowing) or reduced plant growth, would be qualitatively assessed. These measurement endpoints enabled the derivation of the Phase I assessment endpoints which were to characterize and evaluate the existing terrestrial biotic community and identify potential terrestrial biotic receptors and interactions with terrestrial communities adjacent to the OB grounds.

A macroinvertebrate sampling program was performed in a selected drainage swale on the OB grounds during Phase II. The objective of the study was to evaluate, through an aquatic biota assessment, a possible macroinvertebrate community in the drainage swale.

2.7.2 Aquatic Study Area

The only water body near the OB grounds that flows on a year round basis is Reeder Creek. Adjacent to the OB grounds, this stream is quite small, ranging in width from 4 to 10 feet with typical maximum depths ranging from 1 to 7 inches. Discharge measured during mid-November was only 0.1 cubic feet per second (cfs). Judging from the water surface elevation relative to the stream banks at the time of measurement, this discharge appears to be representative of normal conditions in this segment of Reeder Creek. The substrate is heavily influenced by near-surface shale deposits and is predominantly coarse, angular gravel and cobbles. There are some reaches where the stream flows directly over bedrock. Silt and some sand are typically imbedded in the interstitial spaces of the gravel and cobbles. Flow characteristics of the stream include approximately equal amounts of pool and riffle, although beaver activity has resulted in several impoundments on certain portions of the stream. Consequently, stream width and depth are atypical at these locations. The applicable State water quality standard given to Reeder Creek adjacent to the OB grounds is Class D, although downstream of the SEDA and two miles upstream of the Seneca Lake, the applicable standard is C(T). Reeder Creek discharges into Seneca Lake at a portion designated as AA(T).

The only known actively managed fisheries within two miles of the OB grounds are Seneca Lake and two "duck ponds" in the northeast corner of the SEDA. Seneca Lake supports a significant fishery for both cold water and warm water species. The NYSDEC enforces special fisheries regulations for the Finger Lakes, of which Seneca Lake is one. These regulations pertain to lake trout, land locked salmon, rainbow trout, largemouth and smallmouth bass, northern pike and walleye (NYSDEC, undated). The fishery associated with the "duck ponds" is managed primarily for military family members (SEDA, 1992). These ponds have been stocked in the past with channel catfish, which supplements the existing largemouth bass and bullhead fishery. The ponds are impoundments of Kendig Creek which is in a separate drainage basin from the OB grounds. There are no other known significant aquatic resources within two miles of the OB grounds.

Conversations with the NYSDEC Region 8 Fish Manager and local residents indicated that rainbow trout ("steelheads") and rainbow smelt migrate from Seneca Lake into the lower reaches of Reeder Creek to spawn. A reconnaissance of lower Reeder Creek was conducted on foot from State Route 125, near Seneca Lake, upstream to the railroad bridge to determine the probable upstream limit of migration of these two species of fish. A barrier to upstream movement was found approximately midway between the road and the railroad bridge, a distance of roughly 0.7 miles upstream from Seneca Lake and 2.3 miles downstream from the OB grounds.

The barrier consisted of a cascade over bedrock that was approximately six feet high. This cascade is near the ruins of an old mill. Consequently, steelhead and smelt are not expected to occur in Reeder Creek upstream of this location.

Aquatic biotic sampling locations within Reeder Creek were established to coincide with sediment and water quality sampling stations. This enabled direct correlations to be made between the aquatic community at different locations on Reeder Creek and the chemical constituents of the sediment and water. Stations SW-120, SW-130, SW-140 and SW-150 were all established downstream of known surface water discharge points from the OB grounds into Reeder Creek. Station SW-150 is within a stream reach that contains a series of small, relatively shallow (1 to 3 ft. deep) beaver ponds. Fish sampling was conducted in one of the beaver ponds. Benthic invertebrates were collected downstream of the beaver dam since the method of collection (Surber sampler) requires flowing water to be effective. The habitat at the remaining stations is representative of the non-impounded portions of the stream.

Station SW-110 was established downstream to characterize Reeder Creek as it leaves the SEDA and provide a measure of the potential downstream transport of contaminants. Two large culverts immediately upstream of this station are installed in such a manner that they form an impassible barrier to most species of fish under all but the highest flow conditions. Therefore, fish that may occur downstream of this station cannot normally move upstream of this location, but fish that occur at upstream locations can move downstream. Station SW-110 is upstream of the influence of a small sewage treatment plant and a small tributary of Reeder Creek (State Water Index Number ONT66-12-P369-6-1).

Station SW-196 was established as a reference on Reeder Creek approximately 0.5 mile above the expected influence of runoff from the OB grounds. There are no barriers that would be considered impassable to fish between stations SW-150 and SW-196, so it is possible for fish collected at the reference station to have spent some time in a portion of Reeder Creek that could be potentially influenced by runoff from the OB grounds. However, free movement upstream of Station SW-150 by most fish would be severely impeded by the beaver dams. A reconnaissance of Reeder Creek upstream of Station SW-196 failed to reveal what would be considered an impassable barrier. The number of samples collected at each station is presented in Table 2-17.

2.7.3 Terrestrial Study Area

The terrestrial biotic assessment involved two general study areas (Figure 2-9 and 2-10). Within the broadest study area, which included the OB grounds site and an area 2 miles from the site perimeter, significant resources such as NYSDEC significant habitats, habitats supporting endangered, threatened and rare species, species of concern, and state regulated wetlands, were identified. Also assessed for the 2-mile study area was the terrestrial resources used by humans that would potentially be affected by OB grounds activities. The 2-mile study area is comprised of more than 50 percent private land and less than 50 percent SEDA lands.

Within the smaller study area, which included the site and an area 0.5 mile from the site perimeter, the major vegetative communities, wildlife species associated with each cover type, and the value of the habitats to the associated wildlife were identified. Observations for signs of overt symptomology were conducted in the 0.5 mile study area. Approximately 90 percent of this study area is within the SEDA. The remaining portion is private farmland on the western edge of SEDA.

2.7.3.1 Drainage Swale Study Area

The drainage swale on the OB grounds selected for a macroinvertebrate sampling program during Phase II is located between Wetland #6 and Reeder Creek (Figure 2-4). The swale is approximately 1400 feet in length and 100 feet in width and carries runoff from Wetland #6 and the surrounding area. A culvert located beneath the OB grounds access road connects the swale with Reeder Creek. It is estimated that standing or flowing water may be present within the swale during five to ten percent of the year, generally associated with snowmelt or periods of heavy rain. For the remainder of the year, the water content within the swale appears to range between moist and dry conditions. When present, water drains in a northeasterly direction toward Reeder Creek.

TABLE 2 – 17

BIOTA SAMPLING SUMMARY

SENECA ARMY DEPOT
OB GROUNDS

SAMPLE LOCATION	FISH COLLECTIONS	SAMPLE METHOD	INVERTEBRATE COLLECTIONS	SAMPLE METHOD
SW110	1	(ES)	3	(SU)
SW120	1	(ES)	3	(SU)
SW130	1	(ES)	3	(SU)
SW140	1	(ES)	3	(SU)
SW150	2	(ES), (SE)	3	(SU)
SW196	1	(ES)	3	(SU)
TOTAL	7		18	

Notes:

1) (ES) = Backpack Electroshocker sampling method

2) (SE) = 25–foot Seine sampling method

3) (SU) = Surber Sampler

The vegetation within the swale differs very little from that of the surrounding upland. The swale is vegetated predominately by various upland grasses and forbs with few hydrophytic plant species. Together with the infrequency of flowing water within the swale and the filtering effect of the grassy vegetation, the liklihood of macroinvertebrates reaching Reeder Creek is minimal, thereby providing very little, if any, food source to the fish and amphibians in Reeder Creek.

Benthic macronivertebrates were collected within the drainage swale in May, 1993. Two replicate samples were collected at each of the three locations, one near monitoring well labelled MW-17, one at the "midpoint" location approximately 150 feet downgradient from MW-17 and one at the "culvert"just upgradient of Reeder Creek (Figure 2-4). There was no water in the swale at the time of sampling.

The sampling location selected near MW-17 consisted of mostly grass and mossy growth with shallow pools of stagnant water. The soil at MW-17 was a solid wet grey clay with a small percentage of shale chips. The "midpoint" location was a flat area covered by approximately four to six inches of grass with no visible standing water. The soil at "midpoint" consisted of a moist brown clay pebbles in the topsoil mixed with approximately 30 to 40 percent shale chips. The "culvert" station was a flat bottomed drainage area which had no standing water at the time of sampling and very little vegetation. There was evidence of recent water flow from past snowmelt and heavy rain. The soil was uniform in appearance and consisted of approximately 80 percent shale chips embedded in moist dark gray clay.

Each sample was collected utilizing a one foot square quadrat and the upper three inches of ground surface soil and vegetation were removed with a trowel. Samples collected were stored on ice until initial screening and preservation were performed. All samples were individually placed into a five-gallon bucket and enough water was added to create a slurry with the clay particles. The sample was then poured into a 0.5 mm mesh brass sieve and rinsed down with a hand held water sprayer. All sample portions remaining in the sieve were placed into appropriately labelled one-liter jars and preserved with 70 percent isopropyl alcohol. Samples were sorted in the laboratory under 10X magnification and identified to the lowest practical taxon.

2.7.4 Benthic Invertebrate Sampling

The benthic macroinvertebrates sampling in Reeder Creek utilized a Surber sampler. The Surber sampler used was designed to sample a one square foot portion of stream bottom. The mesh of the net is 1mm square. Temperature and pH were measured with an Orion pH meter, Model 230A, dissolved oxygen was measured with a YSI Model 57 DO meter and conductivity was measured with a YSI Model 33 conductivity meter.

Samples were collected at a sampling site that was representative of the stream reach. The depth of water at the sampling site did not exceed one foot. When the site was selected, the sampler was placed flat on the stream bed in such a manner that a minimum of flow was allowed to wash under the sampler. Large rocks within the confines of the sampler were manually lifted from the substrate and scrubbed at the mouth of the sampler to dislodge attached or clinging invertebrates which were then carried downstream into the net by the current. If only a portion of a rock was within the one square foot area, only the portion within the sampling area was scrubbed. When all rocks within the sampling area were scraped, any silt, sand or gravel within the sampling area was disturbed to a depth of approximately four inches by hand or with a probe to dislodge burrowing invertebrates and allow them to wash back into the net. After all materials within the sampling area were thoroughly disturbed, the net was quickly lifted out of the water and any debris or organisms adhering to the side of the net were rinsed into the bottom of the net. The net was then carefully inverted and the sample placed into a jar. Subsequent replicates were taken upstream of the previous sample to avoid the possibility of disturbances to the stream bed by sampling personnel influencing the sampling results. Samples were preserved in 70 percent ethanol and returned to the laboratory for sorting and identification.

Samples were sorted in the laboratory under magnification provided by a dissecting microscope. All invertebrates were placed in vials and identified to the lowest practicable taxon by an aquatic ecologist.

2.7.5 Fish Sampling

Fish sampling along Reeder Creek was performed using electroshocking. One additional sample was collected by seine at Station SW-150. Electroshocking was accomplished by using a Coffelt BP-2 backpack electroshocker. The seine used for fish sampling was a 25-foot. straight beach seine with ½ inch stretch knotless nylon mesh. Temperature, pH, dissolved oxygen and conductivity were measured with the same instruments used during benthic sampling.

A single collection was made by seine at Station SW-150 because this was the only station on Reeder Creek where the stream bed was not clearly visible throughout the length of the station. Water depth was deeper at this location due to a small beaver dam. This collection was used to obtain voucher specimens for positive identification so that the majority of fish collected in subsequent collections could be returned alive at the station where they were collected. The seine collection at Station SW-150 was obtained on November 1, 1991, three weeks prior to the electroshocking sampling at this same location. A total of three seine hauls were made, which effectively sampled approximately a 75-foot reach of Reeder Creek.

Electroshock samples were collected beginning at the downstream segment of the station and proceeding upstream for a distance of approximately 75 feet. Both pool and riffle habitat were sampled at all stations except SW-150. The electrodes of the electroshocker were swept back and forth across the entire stream, with one crew member occasionally releasing the deadman's switch to interrupt the current field. Stunned fish were netted and placed in a bucket of streamwater for later processing.

Processing of fish collected by both seining and electroshocking consisted primarily of identification and enumeration. An indication of the size range of fish in each collection was obtained by measuring at least the smallest and largest individual of each species. If field identification of a specimen was uncertain, voucher specimens were preserved in formalin and returned to the laboratory for confirmation of the identification. In addition, any individuals with overt symptomology (such as tumors) were preserved for documentation purposes. All other specimens collected were returned alive to the stream at the location that they were collected.

2.7.6 Terrestrial Assessment Methods

The presence of significant terrestrial biotic resources within the 2-mile study area was determined by contacting the NYSDEC Information Services for locations of significant habitats, rare, threatened and endangered species and species of concern. New York State regulated wetland maps were reviewed for the location of these significant wetland resources in the study area. The location of all significant resources occurring in the study area were mapped at a scale of 1 inch = 2000 feet. Information on the hunting, agricultural and forestry use of the terrestrial resources in the study area was obtained from the SEDA, local residents, field reconnaissances and review of current (1991) aerial photography (scale 1 inch to 500 feet).

The aerial photography was reviewed to delineate the major upland and wetland vegetative cover types in the 0.5 mile study area. These major cover types were mapped at a scale of 1 inch = 1000 feet. Existing wetland maps were reviewed for freshwater wetland locations. Field surveys were performed to confirm or revise the cover type identification and boundaries and determine plant species composition, relative abundance, and density. Existing information was reviewed to confirm species presence (Cowardin, 1965, SEDA, 1992). Freshwater wetlands on the OB grounds were identified and delineated using the Unified Federal Routine Method (Federal Interagency Committee for Wetland Delineation, 1989). These wetlands were surveyed and mapped at a scale of 1 inch = 200 feet.

Wildlife species, including amphibians, reptiles, birds and mammals, expected to inhabit the study areas' identified cover types, were determined primarily from existing information obtained from the SEDA and the nearby Montezuma National Wildlife Refuge (U.S. Fish and Wildlife Service, 1990, 1991, U.S. Fish and Wildlife Service and NYS Department Environmental Conservation, 1991). In addition, all wildlife observed during the course of the late fall ecological and surface water/sediment field programs were recorded to species, when possible. The habitat value of the cover types to wildlife was assessed during these field surveys. Any signs of wildlife and vegetation stress or alterations observed during the above surveys were also noted.

3.0 DETAILED SITE DESCRIPTION

3.1 INTRODUCTION

The OB grounds comprise an area of approximately 30 acres within the northern section of the Seneca Army Depot (SEDA). There are no permanent structures within the OB grounds other than small concrete bunkers and access to the site is limited to a locked gate near the southern portion of the site. Access to and across the site is provided by a group of looping crushed shale roads that allow access to the individual burning pads. Access to SEDA is controlled by fencing and security patrols around the entire depot. Located within the OB grounds are nine separate burning pads upon which munitions waste were open- burned until 1987. After 1987, munitions were destroyed by burning them within a steel-encased structure to minimize the impact of the burning on the environment.

The burning pads at the site are built on top of the natural glacial till soils. Each burn pad has from 1/2 to 2 feet of broken shale at the surface. Below this are natural soils and/or glacial till. The berms are composed of soils and burn wastes and they surround each burn pad on three sides. There are a total of nine burning pads located within the OB grounds and these range in size from approximately 100 by 100 feet for Pad D to 300 by 800 feet for Pad G. In general, each of the burning pad surfaces are approximately 2 to 3 feet above the surrounding land surface.

Within the OB grounds the land surface drops in elevation from the west towards the east. The overall surface relief is approximately 15 feet over a west to east distance of approximately 4,000 feet. Surface water drains through a series of ditches and surface swales. Due to the nature of the activities at the site these drainages are poorly defined and may be blocked and/or reworked in some areas. On the eastern side of the OB grounds is Reeder Creek into which flows surface water runoff from the OB grounds. This is a perennial creek that is generally less than 1 foot deep and does not exceed 15 feet in width. In places the creek is ponded due to beaver and other natural dams.

The surficial soils at the site are composed of clay, silty loams. These soils are poorly drained and range in thickness from 0 to 18 inches across the site. Due to the poorly drained nature of these soils numerous low lying wet areas exist within the OB grounds. A total of 38 wetland areas have been identified in and around the OB grounds and these range in size from less than 1,000 square feet to 140,000 square feet. These wetlands are widely distributed across the site and are primarily formed within topographic lows.

A total of 35 monitoring wells have been installed, of which 33 are within or directly adjacent to the OB grounds. These monitoring wells have been installed to characterize the subsurface geologic environment, the direction of groundwater flow and the chemistry of the groundwater at the site. In addition to these wells, 87 soil borings and 63 berm excavations have been completed to assist in characterizing the subsurface geology and the chemical composition of the soils at the site. A complete Phase I Ecological Assessment has also been completed.

The surficial geologic deposits present at the OB grounds are composed of glacial tills. The tills range in composition from clayey to sandy and have a high percentage of larger coarse materials within some area of the OB grounds. The till has a relatively low hydraulic conductivity which is consistent with the poorly sorted and dense nature of the unit.

The bedrock at the OB grounds is composed of Devonion age Hamilton Group shale. This Hamilton Group is subdivided into four formations all of which are primarily fossiliferous, calcareous shales. According to the Geologic Map of New York - Finger Lakes Sheet (1970), the bedrock beneath the OB grounds is the Ludlowville Formation. This formation is characterized by gray, calcareous shales and mudstones, and thin limestones with numerous zones of abundant fossils. At the surface the shale is slightly to moderately weathered and fissil. The thickness of the weathered shale zone below the till ranges from approximately 1 foot to as much as 15 feet across the site but is generally only a few feet thick. The depth to the competent shale is generally no more than 15 feet at the site.

Based upon water level measurements made in the on-site monitoring wells, groundwater flow is primarily from west to east across the site. The water table surface drops in elevation from a high of 636 feet above MSL on the west, to a low of 618 feet above MSL on the eastern side of the site adjacent to Reeder Creek. Groundwater flow directions within the till/weathered shale aquifer are also primarily from the west to the east.

3.2 TOPOGRAPHY

SEDA lies on the western side of a series of north to south trending rock terraces which separate Cayuga Lake on the east and Seneca Lake on the west. The rock terraces range in elevation from 490 feet above MSL in northern Seneca County to 1,600 feet above MSL at the southern end of the lakes. Elevations on SEDA range from 450 feet above MSL on the western boundary to 760 feet above MSL in the southeast corner. The Depot's land surface generally slopes to the west and north.

A topographic map of the OB area is presented as Figure 2-1. This plate includes (1) 2-foot surface contours, (2) 1 inch = 200 feet scale, (3) Reeder Creek, (4) tree lines, (5) protective dirt mounds, and (6) protective bunkers. The OB area is situated on gently sloping terrain, vegetated with grasses and brush. Drainage is generally to the east-northeast via a series of drainage ditches and culverts into Reeder Creek. There are several seasonally poor drainage areas where water collects. Low surface gradients, less than 40 feet in 2,500 feet, a high fine content in the surface soil and underlying till contribute to the poor drainage conditions at the site.

3.3 CLIMATE

Table 3-1 summarizes climatological data for the SEDA area. The nearest source of climatological data is the Aurora Research form in Aurora, New York which is approximately ten miles east of the OB grounds on the east side of Cayuga Lake. This research farm is administered by the Northeast Regional Climate Center located at Cornell University in Ithaca, New York. However, only precipitation and temperature measurements are available from this location. The remainder of the data reported in Table 3-1 have been taken from isopleth drawings from a climatic atlas, or from data collected at Syracuse, New York, 40 miles northeast of SEDA. Meteorological data collected from 1965 to 1974 at Hancock International Airport in Syracuse, New York, were used to prepare the wind rose. The airport is located approximately 60 miles northeast of SEDA, and the data can be considered representative of wind patterns at SEDA. The wind rose is presented in Figure 3-1.

A cool climate exists in the locality of SEDA with temperatures ranging from an average of 23°F in January to 69°F in July. Marked temperature differences are found between daytime highs and nighttime lows during the summer and portions of the transitional seasons. Precipitation is uncommonly well-distributed, averaging approximately 3 inches per month. This precipitation is derived principally from cyclonic storms which pass from the interior of the county through the St. Lawrence Valley. Lakes Seneca, Cayuga, and Ontario provide a significant amount of the winter precipitation and moderate the local climate. The annual

TABLE 3 – 1

CLIMATOLOGICAL DATA FOR SENECA ARMY DEPOT

SENECA ARMY DEPOT
OB GROUNDS

MONTH	TEMPERATURE[1] (°F)			PRECIP[1] (in)	RH[3] (%)	SUN–	MEAN NUMBER OF DAYS[4]		
	MAX	MIN	MEAN	MEAN	MEAN	SHINE[3] (%)	CLEAR	PTLY. CLDY.	CLOUDY
JAN	30.9	14.0	22.5	1.88	70	35	3	7	21
FEB	32.4	14.1	23.3	2.16	70	50	3	6	19
MAR	40.6	23.4	32.0	2.45	70	50	4	7	20
APR	54.9	34.7	44.8	2.86	70	50	6	7	17
MAY	66.1	42.9	54.5	3.17	70	50	6	10	15
JUN	76.1	53.1	64.6	3.70	70	60	8	10	12
JUL	80.7	57.2	69.0	3.46	70	60	8	13	10
AUG	78.8	55.2	67.0	3.18	70	60	8	11	12
SEP	72.1	49.1	60.7	2.95	70	60	7	11	12
OCT	61.2	39.5	50.3	2.80	70	50	7	8	16
NOV	47.1	31.4	39.3	3.15	70	30	2	6	22
DEC	35.1	20.4	27.8	2.57	70	30	2	5	24
ANNUAL	56.3	36.3	46.3	34.33	70	50	64	101	200

PERIOD	MIXING HEIGHT[2] (m)	WIND SPEED[2] (m/s)
Morning (Annual)	650	6
Morning (Winter)	900	8
Morning (Spring)	700	6
Morning (Summer)	500	5
Morning (Autumn)	600	5
Afternoon (Annual)	1400	7
Afternoon (Winter)	900	8
Afternoon (Spring)	1600	8
Afternoon (Summer)	1800	7
Afternoon (Autumn)	1300	7

Mean Annual Pan Evaporation[3] (in) : 35
Mean Annual Lake Evaporation[3] (in) : 28
Number of episodes lasting more than 2 days (No. of episode–days)[2] :
  Mixing Height < 500 m, wind speed < 2 m/s : 0 (0)
  Mixing Height < 1000 m, wind speed < 2 m/s : 0 (0)
Number of episodes lasting more than 5 days (No. of episode–days)[2] :
  Mixing Height < 500 m, wind speed < 4 m/s : 0 (0)

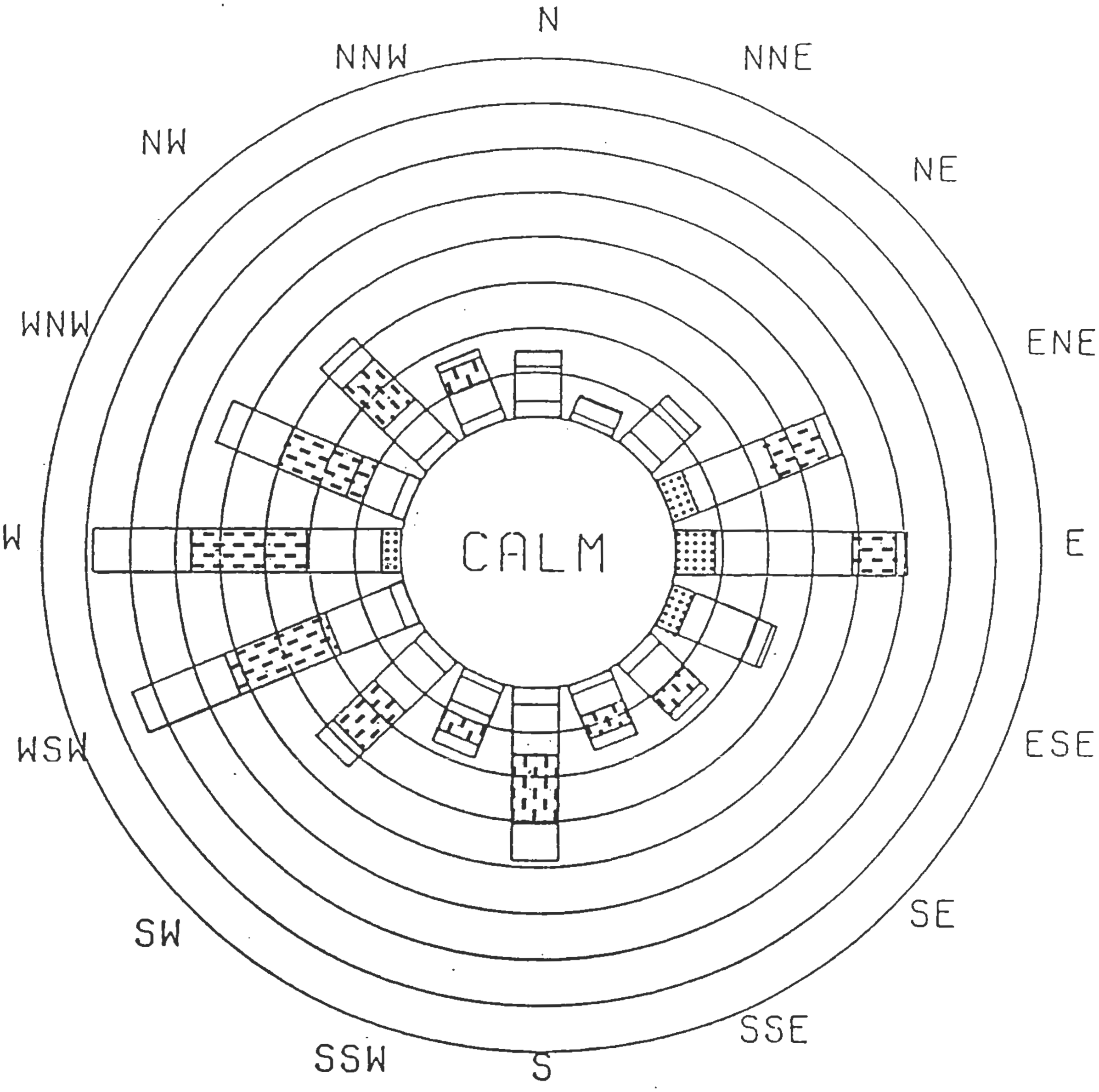
Notes:

[1] Climate of New York Climatography of the United States No. 60. National Oceanic and Atmospheric Administration, June 1982. Data for Ithaca Cornell University, NY.

[2] Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the Contiguous United States. George C. Holzworth, Jan. 1972.

[3] Climate Atlas of the United States. U.S. Department of Commerce, 1983.

[4] Climate of New York Climatography of the United States No. 60. National Oceanic and Atmospheric Administration, June 1982. Data for Syracuse, NY.



0-3	4-7	8-12	>12
▒		▤	

KNOTS

Installation:
Seneca Army Depot, NY
Location of Data:
Syracuse, NY
Source:
US Army Environmental Hygiene Agency

NOTE : EACH DIVISION IS 2% OF TOTAL TIME .

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 3-1

WIND ROSE
SYRACUSE, NEW YORK

SCALE

average snowfall is approximately 100 inches. Wind velocities are moderate, but during the winter months, there are numerous days with sufficient winds to cause blowing and drifting snow. The most frequently occurring wind directions are westerly and west-southwesterly.

Daily precipitation data measured at the Aurora Research Farm for the period (1957-1991) were obtained from the Northeast Regional Climate Center at Cornell University. The average monthly precipitation during this 35-year period of record is summarized in Figure 3-2. The maximum 24-hour precipitation measured at this station during this period was 3.9 inches on September 26, 1975. Values of 35 inches mean annual pan evaporation and 28 inches for annual lake evaporation were reported.

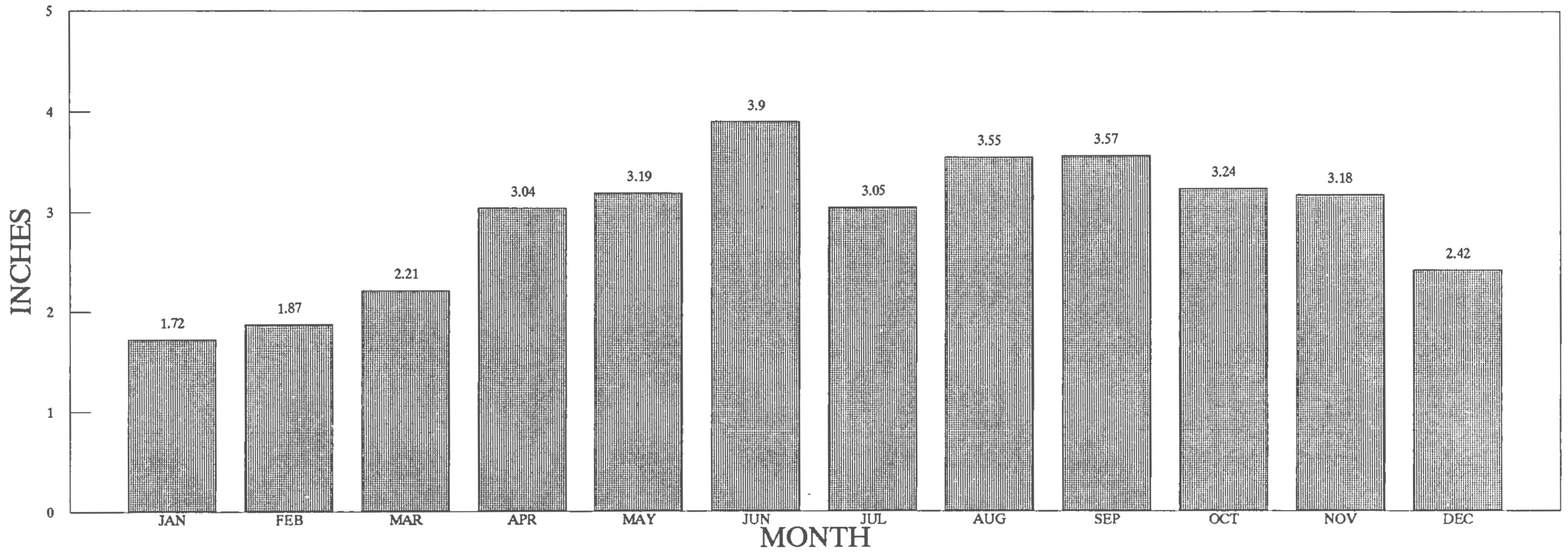
Information on the frequency of inversion episodes for a number of National Weather Service stations is summarized in "Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States" (George C. Holzworth, US EPA, 1972). The closest stations at which inversion information is available are Albany, New York and Buffalo, New York. The Buffalo station is nearer to SEDA but almost certainly exhibits influences from Lake Erie. These influences would not be expected to be as noticeable at SEDA.

SEDA is located in the Genesee-Finger Lakes Air Quality Control Region (AQCR). The AQCR is designated as "non-attainment" for ozone and "attainment" or "unclassified" for all other criteria pollutants. Data for existing air quality in the immediate area surrounding the SEDA, however, can not be obtained since the nearest state air quality stations are 40 to 50 miles away from the army depot (Rochester of Monroe County or Syracuse of Onondaga County). A review of the data for Rochester, which is in the same AQCR as SEDA, indicates that all monitored pollutants (sulfur dioxide, particulates, carbon monoxide, lead, ozone) are below state and federal limits, with the exception of ozone. In 1987, the maximum ozone concentration observed in Rochester was 0.127 ppm. However, this value may not be representative of the SEDA area which is a more rural environment.

3.4 SURFACE WATER AND SEDIMENT INVESTIGATIONS

3.4.1 <u>Physical Characteristics of Reeder Creek</u>

Reeder Creek is a small, second order perennial stream that originates on the SEDA (Figure 2-1). Reeder Creek flows in a northwesterly direction past the OB grounds and then turns



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ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING	NO. 720446-01000

FIGURE 3-2

AVERAGE MONTHLY PRECIPITATION
1958-1991

SCALE

sharply to the west after leaving the SEDA property where it discharges into Seneca Lake. The total drainage basin of Reeder Creek is 3,211 acres (5.02 square miles). Approximately 71 percent (of the drainage basin) is within the confines of the Depot. The drainage area upgradient of the OB grounds is approximately 1,503 acres. The 30-acre OB grounds comprises 0.9 percent of the total Reeder Creek drainage basin.

Prior to the late fall of 1980, the headwaters of Reeder Creek and Kendaia Creek were the same. Flow was split into these two streams downstream of a wetland that serves as part of the treatment system for effluent from a sewage treatment plant at SEDA. Drainage into Reeder Creek from this wetland was totally blocked during the fall of 1980 (USAEHA, 1981).

The normal width of Reeder Creek is 4 to 10 feet, and typical maximum depths range from 1 to 7 inches. Sections of the stream which have been influenced by beaver dams are up to 15 feet wide and 3 feet deep. During high flow events width and depth increase, although the steep banks along much of the stream adjacent to the OB grounds limit the width of the flood plain as shown in (Figures 3-3 and 3-4).

The substrate of Reeder Creek is heavily influenced by the occurrence of shale near and at the surface. Most of the stream bottom consists of coarse, angular gravel as well as angular cobbles. There is some deposition of interstitial silt and also a small amount of sand. In some places, the stream bed consists of exposed bedrock. Nearly all components of the substrate are dark gray. The average depth of sediment, including gravel, is approximately 3 inches. In general, the stream bottom which usually comes in contact with the stream water of Reeder Creek is characteristic of mountain streams with loose cobbles. Such streams usually have Manning's N values (a measure of "stream resistance") of 0.040 to 0.050 (Milhouse, et al., 1984).

The velocity of water in a stream is a function of width, depth, and gradient. The minimum depth at which velocity measurements could be obtained with the Marsh McBirney flowmeter was approximately 3 inches, so velocity in shallow, riffle areas could not be determined. Transects where stream velocity was measured were chosen because stream flow was laminar. The highest water velocity measured at any transect was 0.11 feet per second (fps) at Station SW-196. The lowest stream velocity of 0.03 fps was measured at the widest transect SW-130. Average stream velocities ranged from 0.02 fps at SW-130 to 0.06 fps at SW-140.

The discharge measured at each transect was 0.1 cubic feet per second (cfs). Discharge was measured on November 19 and 20, 1991. Rainfall during and prior to these measurements was sparse. This suggests that there is little discharge of groundwater or surface water via tributaries into Reeder Creek near the OB grounds during the relatively dry base flow conditions.

The surface water elevation of Reeder Creek showed little variability during field studies near the OB grounds (Table 3-2). The maximum change in surface water elevations that was directly measured at any station was 2.90 inches at Station SW-150. Since the drainage area upstream of the OB grounds is relatively small (1,503 acres or 2.35 square miles), Reeder Creek is likely to return to base flow conditions shortly after any precipitation event.

Precipitation data from the nearest monitoring station, Aurora Research Farm, was reviewed to gain a perspective on the seasonal and historical variations in the water surface elevations of Reeder Creek. This data indicates that November 1991 was the second wettest month of the year with 3.63 inches of precipitation. April was the wettest month with 4.60 inches of precipitation. Consequently, the stream elevations measured in Reeder Creek during November may have been somewhat higher than for most of the rest of the year. Average monthly precipitation based on data collected from 1958 through 1991, as shown in Figure 3-2, indicates that the highest rainfall amounts normally occur during June and the lowest amount of precipitation occurs during January. Seasonal stream flow would be expected to mimic the precipitation data. Historically maximum stream flows are expected to occur during maximum rainfall events. Based on data from the Aurora Research Farm, a precipitation event of 3.25 inches per 24 hours occurs once every 5 years; 3.8 inches per 24 hours every 10 years; and 5 inches per 24 hours every 100 years. Minimum stream flow would be expected during prolonged dry spells. The lowest monthly precipitation value recorded at Aurora was 0.10 inches during October 1963.

3.4.2 Surface Water Runoff

Figure 3-5 has been developed to show the suspected surface water runoff patterns at the site. Runoff directions are primarily from the west to the east, with 13 culverts and the various roads at the site significantly channeling the surface water runoff. Based upon the surface

TABLE 3 – 2

STREAM SURFACE ELEVATIONS

SENECA ARMY DEPOT
OB GROUNDS

STATION	11/07/91	11/08/91	11/12/91	11/14/91	11/19/91	11/20/91	11/21/91	11/22/91	12/10/91
SW–110 Gauge Reading (in.) Surface Elevation (ft.) SGT = 594.54 ft (2)(3)	25.81 593.39					25.69 (1) 593.40		25.12 593.45	
SW–120 Gauge Reading (in.) Surface Elevation (ft.) SGT = 604.97 ft (2)	33.81 601.85				33.94 601.85	33.81 (1) 601.85		33.25 601.90	33.00 601.92
SW–130 Gauge Reading (in.) Surface Elevation (ft.) SGT = 607.07 ft (2)				32.40 604.37	33.64 (1) 604.27		33.39 604.29		
SW–140 Gauge Reading (in.) Surface Elevation (ft.) SGT = 608.23 ft (2)		34.38 605.37			34.59 (1) 605.35		33.44 605.36		
SW–150 Gauge Reading (in.) Surface Elevation (ft.) SGT = 611.57 ft (2)		34.06 608.73		31.56 608.94	33.28 (1) 608.80		33.00 608.82	32.56 608.86	
SW–196 Gauge Reading (in.) Surface Elevation (ft.) SGT = 618.51 ft (2)			26.12 616.33		28.38 (1) 616.15		28.00 616.18		
Nature of Field Study (4)	S	S	S	S	D	D	F	F, B	S

Notes:

(1) Discharge measurement associated with this surface water elevation.

(2) SGT = Elevation of staff gauge top in feet.

(3) Staff gauge destroyed prior to survey; top of staff gauge estimated from water surface elevation determined during discharge measurements. Staff gauge located in same pool as discharge transect.

(4) S = Sediment and surface water sampling; F = Fish sampling; B = Benthic invertebrate sampling; D = Stream discharge measurements.

water runoff patterns depicted on Figure 3-5, a large percentage of runoff from Pads D, E, F, G, H and J is expected to drain through wetland W-3 north of Pad B. Surface water runoff from Pads A, B and C would be expected to drain partially through wetland W-3, but primarily would drain eastward through the two surface swales located north and south of Pad A. A small percentage of runoff from the south side of Pad G would also drain through the swale south of Pad A.

Based on a detailed topographic survey in the southwestern portion of the site, some surface water is likely to drain to the southwest away from Pads J and G. However, the majority of the surface water in this area eventually flows to the east toward Reeder Creek.

3.5 SITE GEOLOGY

Four distinct geologic units have been identified at the OB grounds. These include artificial fill, till, weathered calcareous shale and competent calcareous shale. With the exception of the artificial fill these units are distributed across the entire site. The fill materials are primarily associated with the burning pad construction and comprise each burning pad surface and the berms surrounding each burning pad. Two cross-sections of the site geology (A-A' and B-B') have been developed using the stratigraphic information acquired during the pad and grid soil boring and monitoring well installations. The cross-section locations are shown on Figure 3-6 and the two cross-sections A-A' and B-B' are presented on Figures 3-7 through 3-9. Cross-section A-A' has been split between Figures 3-7 and 3-8. Cross-section A-A' has been drawn approximately parallel to the direction of groundwater flow, while cross-section B-B' has been drawn approximately perpendicular to the direction of groundwater flow.

Artificial fill is present at the individual burning pad surfaces and within the berms that surround each burning pad. At each pad surface the fill is composed of crushed and broken shale. The thickness of the fill ranges from 6 inches to as much as 2 feet. Within the berms surrounding each pad, the fill is composed of local soils, till, crushed and broken shale, and remnant munitions waste from the burn events. The berms range in height from as little as 3 feet to as much as 8 feet.

The predominant surficial geologic unit present at the site is the till. The till is distributed across the entire site and ranges in thickness from less than 2 to as much as 10 feet although it is generally only a few feet thick. The thickest section of glacial till was encountered in well MW-30 while the thinnest till section was found at MW-32. Grain size analyses performed by Metcalf & Eddy (1989) on glacial till sediments collected during the installation of monitoring wells MW-8 through MW-17 show a wide distribution of sediment sizes. These tills have a high percentage of silt and clay with trace amounts of fine gravel. The porosities of five gray-brown silty clay (i.e., till) samples from just below the crushed shale beds that make up the burn pad surface range from 34.0 percent to 44.2 percent with an average of 37.3 percent (USAEHA Hazardous Waste Study No. 37-26-0479-85). Test pits conducted during the geophysical investigation showed the till to vary from a silty, clayey till to till with trace amounts of gravel and boulders. The minimum, maximum, average, standard deviation and the 95th UCL of the mean for background concentrations of selected inorganic constituents in the soil and groundwater located at the SEDA are shown in Table 3-3. In addition to the statistical summary information the actual data points have also been included in this table. Non-detect values have been adjusted to one-half the detection limit. The soil sample locations and the sample depths are also presented in the table. The data presented has been compiled from the samples collected at both the Ash Landfill site and the OB grounds site. The Ash Landfill site involves another similar CERCLA investigation and is located approximately 3 miles south of the OB grounds. The geologic overburden material glacial till was deposited under identical geological conditions at the same time and is therefore derived from the same glacial source. As would be expected, soil borings performed at both sites have confirmed the chemical similarity of this glacial material at the two sites. In order to provide a larger number of valid soil samples to account for the variations in the chemical composition of this geological material and to provide a sufficient database for calculating the statistics required, background samples collected from both sites have been combined into one database. This is considered valid since the geologic material at both sites is chemically identical. However, for groundwater, this is not considered true and background quality was determined on a site specific basis.

This was done because of the chemical quality of the groundwater at each site is influenced by site specific factors that will affect the chemical equilibrium between the elemental soil constituents and groundwater. These factors include the amount of carbonates present in the soil, the soil redox potential (Eh), the amount of organic matter in the soil, the density of the soil, the depth to groundwater and the soil pH. Consequently, the site background for groundwater quality has been determined for the OB ground only. For the OB ground, six (6) wells were selected, based upon the location of these wells, as representing background quality.

TABLE 3-3

AVERAGE AND INDIVIDUAL BACKGROUND CONCENTRATIONS OF METALS IN SOILS AND GROUNDWATER AT SEAD

SENECA ARMY DEPOT
OB GROUNDS

INORGANICS	MINIMUM SOILS	MAXIMUM SOILS	AVERAGE SOILS	STANDARD DEVIATION SOILS	B8-91 0-2 SOIL	B8-91 2-4 SOIL	B8-91 2-4 SOIL	B8-91 6-8 SOIL	B9-91 0-2 SOIL	B9-91 2-4 SOIL	B9-91 6-8 SOIL	BK-1 0-2 SOIL	BK-2 0-2 SOIL
Metals					(ASH)	(ASH)	(ASH)	(ASH)	(ASH)	(ASH)	(ASH)	(ASH)	(ASH)
Aluminum	7160	20500	15796	3771	19200	20500	17700	12700	14800	8880	7160	19400	14400
Antimony	2.9	6.8	4.62	1.20	5.15	4.4	4.1	4.2	4.95	4.95	3.5	3.95	3.6
Arsenic	2.7	9.7	5.08	1.87	5.1	6.1	6	4.2	4.3	3.8	4.4	3	2.7
Barium	39.9	159	86.92	32.89	136	98.9	86.7	56.2	101	110	39.9	159	106
Beryllium	0.52	1.4	0.89	0.23	1.4	1.2	1	0.78	1.1	0.76	0.52	1.1	0.81
Cadmium	0.15	2.9	1.26	1.10	2.6	2.9	2.4	1.9	2.3	1.7	1.5	0.225	0.205
Calcium	1370	104000	30082	36991	5390	4870	3560	85900	45600	104000	101000	4590	22500
Chromium	11.2	30.1	24.05	5.56	27.4	30.1	26.9	19.8	22.5	13.8	11.2	30	22.3
Cobalt	8.1	20.4	13.75	3.36	13.8	18.4	14	14.2	13.7	10.7	8.1	14.4	12.3
Copper	16.2	32.7	21.89	4.82	22.3	27.6	26	16.2	22.6	21.6	19.3	26.9	18.8
Iron	17300	38600	29887	6210	37200	36100	32500	27400	31000	19600	17300	38600	26600
Lead	5.4	19.1	12.18	4.06	14.5	11.4	13.6	10.1	10.8	10.1	7.8	15.8	18.9
Magnesium	3850	17000	7555.33	3348.83	5850	7300	6490	6720	8860	17000	12600	5980	7910
Manganese	426	2380	855.40	464.80	1130	956	832	926	903	532	514	2380	800
Mercury	0.015	0.13	0.06	0.03	0.09	0.06	0.06	0.05	0.08	0.04	0.05	0.13	0.11
Nickel	19	49.3	36.63	10.35	42.3	48.7	44.4	30.4	38.4	23.8	19	47.7	31
Potassium	975	2110	1371.67	348.81	1910	2110	1760	1430	1320	1080	1050	1720	1210
Selenium	0.085	0.94	0.23	0.26	0.085	0.105	0.1	0.305	0.105	0.325	0.105	0.73	0.94
Silver	0.155	0.87	0.46	0.28	0.8	0.65	0.6	0.65	0.75	0.75	0.55	0.235	0.215
Sodium	31.3	116	63.30	28.92	39.6	33.75	31.3	75.3	84.2	112	116	49.1	61.1
Thallium	0.17	0.335	0.24	0.04	0.235	0.29	0.285	0.17	0.295	0.18	0.3	0.21	0.19
Vanadium	12.9	32.2	23.17	5.12	32.2	25.4	26.4	15.7	19.7	19.5	12.9	28	22.4
Zinc	53.1	126	80.48	19.13	85.1	94.2	85	75	126	84.3	74.8	98.6	63.7
Cyanide	0.27	0.41	0.33	0.04	0.3	0.315	0.335	0.29	0.35	0.315	0.31	0.285	0.305

Notes:

1) All soil results are expressed in mg/kg.
All groundwater results are expressed in ug/L.
2) All detects (no qualifier or J qualifier) were taken at full value.
All non-detects (U or UJ qualifier) were taken at half value.
3) 15 Background soil samples colleced from Phase I and II RI/FS investigations at the Ash Landfill (9 samples) and the Open Burning Grounds (6 samples).
4) The "H" statistic was used to calculate the 95th UCL of lognormally distributed data (see Section 6).
5) "R" qualifier indicates datum rejected during data validation.

TABLE 3-3

AVERAGE AND INDIVIDUAL BACKGROUND CONCENTRATIONS OF METALS IN SOILS AND GROUNDWATER AT SEAD

SENECA ARMY DEPOT
OB GROUNDS

INORGANICS	MINIMUM SOILS	MAXIMUM SOILS	AVERAGE SOILS	STANDARD DEVIATION SOILS	MW-34 0-2 SOIL	GB35-1 0-2 SOIL	GB35-2 2-4 SOIL	GB35-6 0-2 SOIL	GB36-1 0-2 SOIL	GB36-2 2-4 SOIL
Metals					(OB)	(OB)	(OB)	(OB)	(OB)	(OB)
Aluminum	7160	20500	15796	3771	16100	18000	17600	16200	18100	16200
Antimony	2.9	6.8	4.62	1.20	5.7	2.9	6.8	6.3	5.9	2.9
Arsenic	2.7	9.7	5.08	1.87	3.15	6.2	7.7	5.3	4.6	9.7
Barium	39.9	159	86.92	32.89	67.5	93.6	61.7	61.7	74.8	50.8
Beryllium	0.52	1.4	0.89	0.23	0.86	0.85	0.74	0.77	0.77	0.65
Cadmium	0.15	2.9	1.26	1.10	2.3	0.165	0.155	0.175	0.15	0.165
Calcium	1370	104000	30082	36991	28600	1590	17700	1370	1660	22900
Chromium	11.2	30.1	24.05	5.56	26.6	23.5	29.3	25.1	24.8	27.4
Cobalt	8.1	20.4	13.75	3.36	17	9.4	16.3	10.3	20.4	13.2
Copper	16.2	32.7	21.89	4.82	32.7	17.5	24.5	17.2	17.7	17.5
Iron	17300	38600	29887	6210	35000	25200	34200	30800	26100	30700
Lead	5.4	19.1	12.18	4.06	11.9	14.4	5.4	19.1	12.7	6.2
Magnesium	3850	17000	7555.33	3348.83	6850	3850	7790	4490	4490	7150
Manganese	426	2380	855.40	464.80	803	701	646	775	426	507
Mercury	0.015	0.13	0.06	0.03	R	0.06	0.015	0.07	0.02	0.02
Nickel	19	49.3	36.63	10.35	49.3	26.3	48.7	28.3	28.3	42.8
Potassium	975	2110	1371.67	348.81	1290	1110	1110	975	1400	1100
Selenium	0.085	0.94	0.23	0.26	0.09	0.115	0.115	0.105	0.1	0.09
Silver	0.155	0.87	0.46	0.28	0.87	0.17	0.16	0.18	0.155	0.17
Sodium	31.3	116	63.30	28.92	55.2	35.6	77.5	34.6	46.6	97.6
Thallium	0.17	0.335	0.24	0.04	0.255	0.275	0.27	0.25	0.23	0.215
Vanadium	12.9	32.2	23.17	5.12	22.3	27.1	22.3	26.1	27.8	19.7
Zinc	53.1	126	80.48	19.13	95.7	55	83.4	53.1	59.2	74.1
Cyanide	0.27	0.41	0.33	0.04	0.27	0.39	0.355	0.41	0.35	0.34

TABLE 3–3

AVERAGE AND INDIVIDUAL BACKGROUND CONCENTRATIONS OF METALS IN SOILS AND GROUNDWATER AT SEAD

SENECA ARMY DEPOT
OB GROUNDS

INORGANICS	MINIMUM GROUND WATER	MAXIMUM GROUND WATER	AVERAGE GROUND WATER	STANDARD DEVIATION GROUND WATER	03/01/93 MW–5 GROUND WATER	03/01/93 MW–21 GROUND WATER	03/12/93 MW–34 GROUND WATER	03/12/93 MW–35 GROUND WATER	03/12/93 MW–35(Dup) GROUND WATER	03/11/93 MW–36 GROUND WATER
Metals										
Aluminum	31.25	13000	2835.71	5041.56	2180	31.25	13000	600	1100	103
Antimony	26.95	27.05	26.98	0.07	27	27	26.95	26.95	27.05	26.95
Arsenic	0.85	3.3	1.26	1.00	0.85	0.85	3.3	0.85	0.85	0.85
Barium	32.6	103	72.70	23.92	69.4	32.6	103	80.2	86.7	64.3
Beryllium	0.15	0.89	0.27	0.30	0.15	0.15	0.89	0.15	0.15	0.15
Cadmium	1.55	1.55	1.55	0.00	1.55	1.55	1.55	1.55	1.55	1.55
Calcium	84700	117000	96950.00	12162.36	106000	92100	117000	88700	93200	84700
Chromium	1	21.5	5.34	9.05	R	1	21.5	1	2.2	1
Cobalt	2.5	11.1	3.93	3.51	2.5	2.5	11.1	2.5	2.5	2.5
Copper	0.95	21.1	5.99	10.08	R	0.95	21.1	0.95	R	0.95
Iron	155	19700	4781.20	8384.49	2420	R	19700	501	1130	155
Lead	0.445	7.2	1.78	2.63	0.55	0.45	7.2	0.91	1.1	0.445
Magnesium	11500	26100	15800.00	5228.38	26100	12900	15100	14200	15000	11500
Manganese	10.1	403	121.05	147.91	51.2	10.1	403	46.6	49.4	166
Mercury	0.03	0.03	0.03	0.00	0.03	0.03	R	R	R	0.03
Nickel	1.75	30.1	6.90	11.41	4.3	1.75	30.1	1.75	1.75	1.75
Potassium	1170	3220	1755.00	818.94	1170	1370	3220	1290	1240	2240
Selenium	0.55	1.2	0.66	0.27	0.55	1.2	0.55	0.55	0.55	0.55
Silver	1.6	1.6	1.60	0.00	1.6	1.6	1.6	1.6	1.6	1.6
Sodium	3560	21500	10721.67	7045.92	17400	21500	3560	7390	7880	6600
Thallium	1.3	1.3	1.30	0.00	1.3	1.3	1.3	1.3	1.3	1.3
Vanadium	1.05	20.1	5.17	8.37	R	1.05	20.1	1.05	2.6	1.05
Zinc	76	86.3	82.17	5.44	R	R	76	84.2	86.3	R
Cyanide	5	5	5.00	0.00	5	5	5	5	5	5

Monitoring wells MW-21, MW-34, MW-35, MW-36, MW-37 were installed during the remedial investigation field program to be used as background monitoring wells. MW-5 was considered as an acceptable existing background well based upon its upgradient location. Groundwater quality data from MW-37 was not available because of insufficient volume.

MW-35 was analyzed in duplicate for QA/QC purposes and both datapoints have been included in establishing groundwater background quality. Figure 3-12 depicts the location of these monitoring wells at the site.

Below the glacial till unit is weathered shale which was encountered at all of the monitoring well locations. The weathered bedrock is composed of clay with thin, lamina pieces of unweathered shale present within a primarily clay matrix. The thickness of the weathered shale ranges from less than one foot at grid borings GB-03 and GB-10, to as much as 14 feet at MW-22.

Figure 3-10 presents an isopach map of the thickness of the weathered shale. The central section of the OB grounds shows a broad area of thin weathered bedrock. In the vicinity of Pads G and F, the weathered shale unit is less than 2 feet thick. East of Pads C and D the thickness of the weathered shale increases appreciably to where 9 feet of weathered bedrock was encountered in monitoring well MW-18. In this area of the site the weathered shale isopach has been drawn by incorporating information from the bedrock topographic map as described below. East of MW-18 the weathered layer thins. In borings PB-A-1 and PB-A-1 only 1 foot of weathered bedrock was encountered. This zone of thin weathering corresponds to a bedrock high as described below. Northeast of burning Pad A the thickest section of weathered bedrock was identified at MW-22 where a 14 foot section of weathered shale was encountered.

The bedrock underlying the site is composed of the Ludlowville formation of the Devonian age Hamilton Group shale. Three predominant joint directions, N60°E, N30°W, and N20°E are present within this unit (Mozola, 1951). These joints are primarily vertical. The Hamilton Group is a gray-black, calcareous shale that is fissile and shows partings along bedding planes. The bedding plane partings are from 1 inch to 8 inches apart based upon rock cores described in the "Criteria Development Report for Closure of Nine Burning Pads" (Metcalf & Eddy, 1989). Figure 3-11 shows the topography of the competent shale surface at the site. This map was developed based upon hollow stem auger refusal depths, blow counts from the various borings and monitoring wells, and visual observations of the drilling supervisors. Information from all of the available boring and well logs were used. In some instances the determination of the elevation of the competent bedrock interface is subjective although generally, blow counts increased from 20 to 30 per 6 inches to over 100 per 6 inches when competent bedrockwas encountered. In other instances auger refusal was considered to be the top of the competent shale.

The bedrock elevation varies across the site from a high of 633 feet above MSL at pad boring PB-J-1 to a low of 605 feet above MSL at MW-22. The overall bedrock surface undulates considerably across the site due to differential weathering processes. On the western side of the site a broad bedrock plateau underlies Pad J at an elevation of approximately 630 feet MSL. Between Pads J and F the bedrock surface drops approximately 10 feet in elevation. Another broad plateau is present in the area between Pads F and E where the bedrock surface changes by less than 2 feet in elevation. A narrow northwest to southeast trending bedrock trough has been identified between Pads D and B on the north and between Pads C and A on the south. This trough parallels the present course of Reeder Creek and may represent an ancient surface drainage channel. This trough is also parallel to one of the major joint sets, N30°W, measured in the bedrock. East of this trough a narrow bedrock knob has been identified underneath Pads A and B. East of burning Pad A the bedrock surface drops again in elevation to a low of 605 feet MSL at monitoring well MW-22. This is the lowest bedrock elevation identified at the site.

3.6 SITE GEOPHYSICS

3.6.1 UXO Site Clearance

Figure 2-3, presented earlier, provide the locations of the geophysical surveys conducted at the OB grounds. As described in Section 2.3.1, unexploded ordnance (UXO) specialists performed UXO geophysical investigations at the site. The first phase of UXO site clearance was conducted by the Explosives Ordnance Division (EOD) of Human Factors Applications, Inc. (HFA). HFA performed a UXO search of selected areas at the OB grounds. The complete details of the work conducted by HFA are included within the HFA report presented in Appendix B. The second phase of site clearance was performed by UXB International, Inc. (UXB).

The project site was found to contain both surface and subsurface metallic objects during the HFA survey. These objects were the result of decades of ordnance destruction by open burning and detonation. Some areas such as Pads J and G were nearly covered with metallic litter making it virtually impossible to conduct standard magnetometery surveys of those areas. A work area of 10 feet by 10 feet for each pad boring and an access lane 25 feet wide to each site was cleared by HFA. During the 33 days of EOD operations, a total of 4,037 subsurface objects were located and excavated. Due to the large volume of metallic objects located and excavated only the UXO or significant and/or potentially hazardous items were catalogued. These objects are described in Table 3-4. A large quantity of the metallic material located consisted of hinges, nails, banding material and other hardware associated with ammunition packaging. No attempt was made to account for this material.

With the exception of the small wooded and brush covered areas located behind the long berm at the southern end of the open burning and demolition grounds, the site was relatively open and easily searched with magnetometers.

Pads G and J were the most heavily impacted with metallic objects. Both had large amounts of surface and subsurface contamination, which interfered significantly with the Mk 26 Ordnance Locator (Forster Ferex 4.021) and the Whites Eagle II all metals detector. Each area cleared for soil sampling was raked to remove as much surface debris as possible and the soil was removed by hand until there was no longer an appreciable signal from the Mk 26 Ordnance Locator. After checking the loose soil to insure it held no hazardous material (i.e., ordnance) it was placed back into the hole. Each 10-foot square site was flagged and the ground marked, with florescent paint. Two sites on Pad J were moved to avoid an area which was completely covered with metal debris. One site was eliminated on Pad G because of a large metal structure that prevented access. The average depth dug for each site was approximately 16 inches, with some isolated deeper excavations to investigate larger metallic contacts.

A 50-foot square work area, was cleared for each of sixteen proposed monitoring well locations. An access lane 25 feet wide was cleared to each work site. The access to each site was generally clear and presented little or no obstacle for sweeping or clearing, with the exception of a small area behind the long berm at the southern end of the OB Grounds. This area was cleared using a backhoe and when possible the access route was modified to minimize damage to the brush and or small trees. Some access lanes were widened or their course slightly modified to facilitate entry and egress of the well drilling rig. Additional lanes were cleared for access to existing wells, wetlands, and to provide work areas for the grid borings. Some additional walkways were cleared to allow easier access to some wells for purging and collecting water samples. Approximately 37,500 square feet was cleared for work areas and 173,750 square feet for access to work areas and well sites.

Berm excavations began on December 2, 1991. Each berm was excavated to the mid depth of the berm and soil samples collected at the points preselected in the workplan. Berm excavations were essentially uneventful and were completed on December 10, 1991.

3.6.2 Ground Penetrating Radar Survey

The geophysical investigation at the OB grounds consisted of a Ground Penetrating Radar (GPR) survey of each burning pad during the Phase I field work. The objective of this investigation was to identify the locations of any burn pits or trenches within the subsurface. ES contracted with Blasland and Bouck Engineers, Inc. (B&B) of Syracuse, New York to conduct this geophysical survey. Figure 2-3 shows the locations of the geophysical profiles surveyed. In general, the GPR profiles were spaced at 25-foot intervals although for the smaller burn pads, i.e. Pads A, B, C, D and E, the GPR profiles were spaced at 10 or 15 foot intervals.

Table 3-5 summarizes the results of the GPR investigation. The investigation identified numerous areas of fill with small debris present. This type of radar response is not considered to be unusual given the land use history of each burning pad. Of particular interest were the anomalies identified on Pads G (lines, 1, 13 and 14) and J (line 15) where the source of the anomaly was characterized as a small pit. In general, the radar response of a trench or pit is quite distinct with the walls of the pit seen as steeply dipping reflection events on the radar records. In order to further characterize these geophysical anomalies, test pit excavations with cross-sectional sampling were conducted at these locations.

3.6.3 Cross-Sectional Sampling

Cross-sectional sampling was performed at three locations as shown on Figure 2-3. The sampling included two test pit excavations on Pad G (GAE-G-1 and GAE-G-2) and one test pit excavation on Pad J (GAE-J-1). The procedures used to perform the excavations are described in Section 2.3.3. The logs of the individual test pits are in Appendix D.

No evidence of previous trenches or pits were identified at the three geophysical anomaly excavation locations. In addition, no ordnance was encountered during the excavations. The

TABLE 3 – 5

GPR ANOMALY REVIEW AND CHARACTERIZATION

SENECA ARMY DEPOT
OB GROUNDS

BURNING PAD	LINE #	PROFILE DIRECTION	ANOMALY LOCATION	CHARACTERIZATION
A	2	West to East	3’ to 37’E	fill area – small debris
A	3	West to East	13’ to 21’E 43’ to 51’ E	fill area – small debris
A	1	South to North	21’N; 27’ to 37’N	fill area – small debris
A	2	South to North	11’ to 18’N	fill area – small debris
A	4	South to North	16’ to 28’N	fill area – small debris
B	1	West to East	4’ to 36’E	fill area – small debris
B	2	West to East	50’ to 58’E and 66’E	fill area – small debris
B	3	West to East	3’ to 63’E	fill area – small debris
B	1	South to North	2’ to 32’N	fill area – small debris
B	2	South to North	2’ to 33’N	fill area – small debris
B	3	South to North	2’ to 30’N	fill area – small debris
B	4	South to North	2’ to 30’N	fill area – small debris
C	1	West to East	37’ to 44’E	fill area – small debris
C	2	West to East	2’ to 19’E	fill area – small debris
C	3	West to East	2’ to 12’E	fill area – small debris
C	4	West to East	2’ to 18’E	fill area – small debris
C	2	South to North	12’N	small unknown
C	3	South to North	16’ to 30’N	fill area – small debris
C	4	South to North	5’ to 21’N	fill area – small debris
D	2	South to North	10’ to 30’N	fill area – small debris
D	3	South to North	23’ to 27’N	small unknown
D	4	South to North	2’ to 18’N	fill area – small debris
D	2	West to East	20’ to 43’E	fill area – small debris
D	3	West to East	16’ to 50’E	fill area – small debris
D	4	West to East	17’ to 52’E	fill area – small debris
E	1	West to East	12’E’; 22’E & 24’E	small unknown
E	2	West to East	35’ to 65’E	fill area – small debris
E	3	West to East	20’ to 40’E	fill area – small debris
E	4	West to East	27’ to 45’E	fill area – small debris
E	1	South to North	2’ to 14’ & 28’to 34’N	fill area – small debris
E	2	South to North	12’ to 28’N	fill area – small debris
E	3	South to North	6’ to 15’N	fill area – small debris
F	1	West to East	3’ to 46’E	disturbed area(?)
F	2	West to East	60’ to 70’E	disturbed area(?)
F	4	West to East	17’E; 23’E; and 30’ to 55’E	fill area – small debris
F	5	West to East	66’ to 68’E	small fill area
F	6	West to East	3’ to 35’E	fill area – small debris
F	7	West to East	12’ to 14’E	small fill area
F	2	North to South	72’ to 132’S	fill area – small debris
F	3	North to South	62’ to 130’S	fill area – small debris
F	4	North to South	57’ to 145’S	fill area w/2 small unknowns @ 116’S & 129’S
G	1	East to West	53’ to 65’W 112’ to 138’W 195’ to 213’W 313’ to 349’W	small pit(?) disturbed area disturbed area fill area
G	2	East to West	45’ to 58’W & 188’ to 203’W	disturbed area(?)
G	3	East to West	27’ to 42’W 185’ to 265’W	fill area fill area w/several small(?)
G	4	East to West	22’ to 36’W & 152’ to 168’W	fill area (?)
G	5	East to West	127’ to 159’W 275’ to 305’W 318’ to 338’W 360’ to 370’W	fill area w/several (?) fill area w/several (?) fill area – small debris fill area – small debris
G	6	East to West	63’ to 80’W 175’ to 225’W	disturbed area(?) fill area w/several small(?)

TABLE 3 – 5

GPR ANOMALY REVIEW AND CHARACTERIZATION

SENECA ARMY DEPOT
OB GROUNDS

BURNING PAD	LINE #	PROFILE DIRECTION	ANOMALY LOCATION	CHARACTERIZATION
G	1	North to South	15’ to 25’; 43’ to 52’; & 63’ to 75’S 125’ to 132’S	3 possible fill areas fill area
G	2	North to South	40’ to 50’S 53’ to 65’S 71’ to 85’S	3 possible fill areas
G	3	North to South	26’ to 29’S	small unknowns
G	6	North to South	80’ to 110’S	fill area – small debris
G	7	North to South	80’ to 108’S	fill area – small debris
G	8	North to South	25’ to 40’S & 81’ to 109’S	fill area – small debris
G	9	North to South	5’ to 65’S & 84’ to 126’S	fill area(?)
G	10	North to South	5’ to 19’S & 42’ to 125’S	fill areas(?)
G	11	North to South	5’ to 10’S & 65’ to 130’S	fill areas(?)
G	12	North to South	3’ to 10’S; 31’ to 51’S; 75’ to 125’S	3 possible fill areas
G	13	North to South	5’ to 15’S & 31’ to 36’S 63’ to 78’S	small fill areas small pit(?)
G	14	North to South	56’ to 75’S 115’ to 130’S	small pit(?) fill area
G	15	North to South	40’ to 50’S & 85’ to 95’S	fill areas(?)
G	16	North to South	5’ to 30’S	small fill area(?)
H	1	North to South	35’ to 55’S	possible fill area
H	2	North to South	30’ to 50’S & 55’ to 125’S	possible fill areas
H	3	North to South	18’ to 120’S	fill area w/small(?) @ 70’S & 110’S
H	4	North to South	32’ to 90’S	possible fill area(?)
H	5	North to South	32’ to 48’S	possible fill area(?)
H	2	West to East	22’ to 64’E	possible fill area(?)
H	3	West to East	9’ to 85’E	possible fill area(?)
J	1	South to North	241’ to 249’N & 266’ to 288’N	possible fill area
J	2	South to North	135’ to 155’N; 175’ to 198’N 240’ to 260’N; 292’ to 296’N	possible fill areas
J	3	South to North	30’ to 47’N; 71’ to 86’N; 112’ to 119’N; 163’ to 185’N; 250’ to 285’N	possible fill areas
J	4	South to North	75’N; 145’N; & 210’ to 230’N	possible fill areas
J	5	South to North	70’ to 80’N; 102’ to 110’N; 212’ to 236’N	possible fill areas
J	6	South to North	20’ to 30’N & 253’ to 267’N	possible fill areas
J	1	East to West	60’ to 118’W	possible fill area – small debris
J	2	East to West	60’ to 90’W	possible fill area – small debris
J	3	East to West	75’ to 125’W	possible fill area – small debris
J	4	East to West	42’ to 70’W; 90’ to 110’W; 130’ to 142’W	possible fill area – small debris
J	5	East to West	60’ to 70’W; 90’ to 108’W; 112’ to 120’W	possible fill area – small debris
J	6	East to West	28’ to 54’W; 70’ to 80’W; 110’ to 122’W	possible fill area – small debris
J	7	East to West	56’ to 82’W	possible fill area – small debris
J	8	East to West	15’ to 25’W & 45’ to 67’W	possible fill area – small debris
J	9	East to West	15’ to 35’W	possible fill area – small debris
J	11	East to West	30’ to 55’W	possible fill area – small debris
J	13	East to West	15’ to 35’W	small fill area Note: debris at surface from @ 60’ to 83’W
J	15	East to West	5’ to 12’W 25’ to 34’W	small pit (?) possible fill area – small debris
J	16	East to West	2’ to 35’W	possible fill area – small debris
J	17	East to West	2’ to 28’W	possible fill area – small debris

two excavations performed on Pad G identified an 18-inch thick broken shale layer at the surface; this is considered to be fill material. At excavation location GAE-G-2, a 6-inch thick layer of various metal wastes including nails, hinges, and metal banding was encountereddirectly below the broken shale. Both of the excavations on Pad G encountered a brown-gray clayey, silty till below the broken shale and metallic waste layers. The till did not exhibit signs of previous trenching or pit activities. Soil samples were collected at the base of the broken shale layer at both locations and analyzed along with the soil boring samples. The results of the analytical testing are discussed in detail in Section 4.

3.7 SITE HYDROGEOLOGY

3.7.1 Objectives

The goals of the groundwater investigation conducted at the OB grounds were to confirm the direction of groundwater flow at the site, evaluate the degree of hydraulic communication between the till and the weathered shale, and evaluate the presence and extent of contaminants within the groundwater.

Twenty-two wells, composed of 10 overburden (till) and 12 weathered shale monitoring wells were installed as part of this RI. These wells supplement the thirteen wells previously installed. The 10 overburden monitoring wells were installed within the till while the 12 weathered bedrock wells were installed within the thin weathered shale layer present across the site. Well development was completed at each location and hydraulic conductivity measurements for the weathered shale and till have been determined. Six rounds of water levels (three for Phase I and three for Phase II) have also been completed to evaluate the direction of groundwater flow across the site. Five (till and weathered shale monitoring) well clusters comprised of the monitoring pairs MW-25/MW-26, MW-28/MW-29, MW-34/MW-35, MW-36/MW-37, and MW-39/MW-40 were installed in order to evaluate the degree of hydraulic communication between the till and weathered shale and to determine if the till and weathered shale media represent individual and separate aquifers.

3.7.2 Groundwater Flow Direction

Six rounds of depth to groundwater measurements were made for the RI. During each of the events an electronic water level meter was used to measure the depth to groundwater relative to the top of the PVC well casing. Each set of depth to groundwater measurements was madewithin a 10-hour period. Table 3-6 summarizes the depth to groundwater and water table elevations for the events.

Three rounds of ground water level measurements were made at wells MW-5 through MW-35 for Phase I. Water level measurements were made during January and February of 1992 when the depth to the water table was from 3 to 6 feet below the ground surface. Some of the wells were frozen during the late January and early February rounds of sampling. No wells were frozen during the January 7, 1992 round of sampling, therefore, the Phase I water table elevation maps presented here are based upon this round of measurements.

Figure 3-12 and 3-13 show the water table elevation for the overburden monitoring wells screened within the glacial till as measured in January 1992, and April 1993, respectively. Both maps indicate the predominant direction of groundwater flow in the till is from the west-southwest to the east-northeast toward Reeder Creek. The January 1992 map for the till monitoring wells shows the water table elevation high at MW-10 (636.27 feet above MSL) in the western portion of the site while the water table low occurred in MW-26 (617.71 feet above MSL). The total drop in elevation of the water table surface is 18.56 feet over a linear distance of approximately 1670 feet. This represents a horizontal gradient of 0.011 feet/feet The April 1993 map shows a very similar flow direction and gradient for the majority of the site; however, with the addition of MW-37 in Phase II, a groundwater divide is defined in the far western part of the site. The divide occurs near the long axis of Pad J and extends south past the western berm of Pad C. To the west of the divide it is likely that the groundwater gradient becomes less steep. Although only one dashed contour provides evidence of this.

Groundwater flow directions, based upon the January 7, 1992 and April 27, 1993 rounds of sampling, are primarily from southwest to northeast across the site. The horizontal gradients appear to be fairly uniform with the exception of the northwest corner of the site in the vicinity of MW-9. Here the horizontal gradients are somewhat steeper than the remainder of the site. This may reflect subtle variations within the subsurface material types. Based upon the present understanding of groundwater flow within the glacial till, the present monitoring well network appears to provide for complete monitoring well coverage downgradient of each burning pad.

Figures 3-14 and 3-15 shows the groundwater elevation for the monitoring wells screened within the weathered shale as measured in January 1992, and April 1993, respectively. According to the January 1992 data, within the weathered shale the water table elevation

TABLE 3 – 6

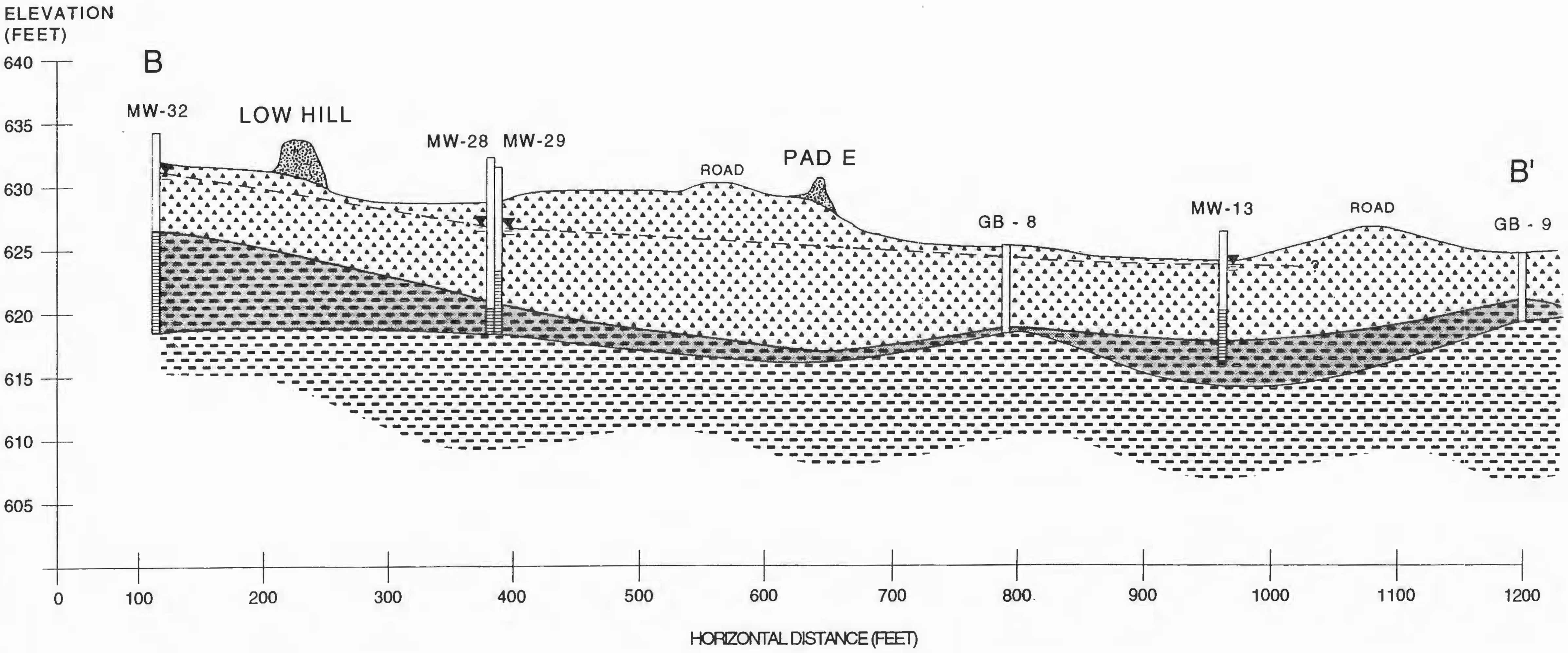
MONITORING WELL WATER LEVEL SUMMARY

SENECA ARMY DEPOT
OB GROUNDS

		PHASE I					PHASE II				
MONITORING WELL NUMBER	TYPE OF MONITORING WELL	1–7–92 DEPTH TO GROUND-WATER TOC (ft)	1–24–92 DEPTH TO GROUND-WATER TOC (ft)	2–4–92 DEPTH TO GROUND-WATER TOC (ft)	TOP OF PVC CASING ELEVATION (msl)	GROUND WATER ELEVATION BASED ON 1–7–92 DATA (msl)	2–16–93 DEPTH TO GROUND-WATER TOC (ft)	4–27–93 DEPTH TO GROUND-WATER TOC (ft)	7–21–93 DEPTH TO GROUND-WATER TOC (ft)	TOP OF PVC CASING ELEVATION (msl)	GROUND WATER ELEVATION BASED ON 4–27–93 DATA (msl)
MW–1	NA	NA	NA	8.48	634.22	NA	9.25	6.30	11.40	634.22	627.92
MW–5	NA	3.06	ND	3.52	637.99	634.93	4.00	2.94	7.01	637.99	635.05
MW–6	NA	4.12	3.75	4.17	630.31	626.19	4.50	3.14	8.04	630.31	627.17
MW–7	NA	3.16	3.25	4.95	622.94	619.78	FROZEN	3.04	DRY	622.94	619.90
MW–8	TILL	3.35	3.50	4.19	638.78	635.43	4.76	2.77	7.16	638.78	636.01
MW–9	TILL	2.19	FROZEN	FROZEN	634.95	632.76	FROZEN	1.40	5.70	634.95	633.55
MW–10	TILL	2.35	3.60	3.48	638.62	636.27	4.18	2.22	6.16	638.62	636.40
MW–11	TILL	2.72	2.70	3.37	630.65	627.93	3.31	2.46	6.75	630.65	628.19
MW–12	TILL	2.26	DRY	FROZEN	624.50	622.24	FROZEN	1.76	5.21	624.50	622.74
MW–13	TILL	2.38	2.80	FROZEN	627.09	624.71	FROZEN	1.88	5.64	627.09	625.21
MW–14	TILL	3.10	DRY	FROZEN	624.51	621.41	FROZEN	2.36	6.95	624.51	622.15
MW–15	TILL	2.44	2.70	FROZEN	621.99	619.55	FROZEN	NA	5.12	621.99	NA
MW–16	NA	2.09	2.50	FROZEN	622.60	620.51	FROZEN	1.99	6.94	622.60	620.61
MW–17	TILL	2.08	1.80	FROZEN	624.53	622.45	FROZEN	1.45	5.28	624.53	623.08
MW–18	WB	2.42	2.35	FROZEN	623.95	621.53	FROZEN	1.98	5.40	623.95	621.97
MW–19	TILL	2.20	FROZEN	FROZEN	636.34	634.14	FROZEN	2.19	7.33	636.34	634.15
MW–21	WB	3.02	3.10	3.93	637.88	634.86	3.35	3.05	6.82	637.88	634.83
MW–22	WB	3.13	3.25	4.56	623.15	620.02	5.08	2.75	7.98	623.15	620.40
MW–23	WB	3.45	3.35	3.83	622.87	619.42	4.27	NA	6.64	622.87	NA
MW–24	TILL	3.39	3.55	4.31	627.33	623.94	4.78	2.96	7.55	627.33	624.37
MW–25	WB	6.54	7.00	7.92	623.80	617.26	7.45	3.27	10.81	623.80	620.53
MW–26	TILL	6.60	6.60	7.58	624.31	617.71	7.52	3.50	7.47	624.31	620.81
MW–27	WB	3.29	3.20	3.80	625.94	622.65	3.94	2.82	6.54	625.94	623.12
MW–28	WB	4.26	4.45	4.61	631.90	627.64	4.64	3.48	8.54	631.90	628.42
MW–29	TILL	4.94	4.60	4.79	632.07	627.13	4.84	3.73	8.75	632.07	628.34
MW–30	WB	4.18	4.20	4.62	628.12	623.94	4.76	3.75	NA	628.12	624.37
MW–31	WB	2.88	2.87	3.42	634.57	631.69	4.83	2.62	7.29	634.57	631.95
MW–32	WB	3.39	3.90	2.99	634.81	631.42	3.35	2.42	7.93	634.81	632.39
MW–34	TILL	2.44	FROZEN	FROZEN	640.43	637.99	NA	2.25	DRY	640.43	638.18
MW–35	WB	2.97	2.80	FROZEN	640.97	638.00	NA	2.65	7.62	640.97	638.32
MW–36	WB	NA	NA	NA	NA	NA	6.46	5.69	9.50	640.55	634.86
MW–37	TILL	NA	NA	NA	NA	NA	6.65	6.68	6.96	640.81	634.13
MW–38	TILL	NA	NA	NA	NA	NA	5.02	4.38	6.38	620.67	616.29
MW–39	TILL	NA	NA	NA	NA	NA	6.00	3.39	7.52	620.14	616.75
MW–40	WB	NA	NA	NA	NA	NA	6.21	3.36	6.09	620.46	617.10
MW–41	TILL	NA	NA	NA	NA	NA	6.78	3.35	7.76	628.80	625.45

Notes:
1) NA = Not Available
2) Till = monitoring well screened in till
3) WB = monitoring well screened in weathered bedrock (shale)
4) MSL = Mean Sea Level

CROSS SECTION B - B'



LEGEND:

- ▨ FILL
- ▨ TILL
- ▨ WEATHERED SHALE
- ▨ COMPETENT SHALE
- — ⊻ — GROUNDWATER TABLE

NOTES:

1. Lithologic units are based on descriptions supplied by Engineering-Science, Inc. Interpretations are based on extrapolations between widely spaced boreholes, actual conditions may vary.
2. Groundwater table based on depth to water measurements made in January 1992.

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ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

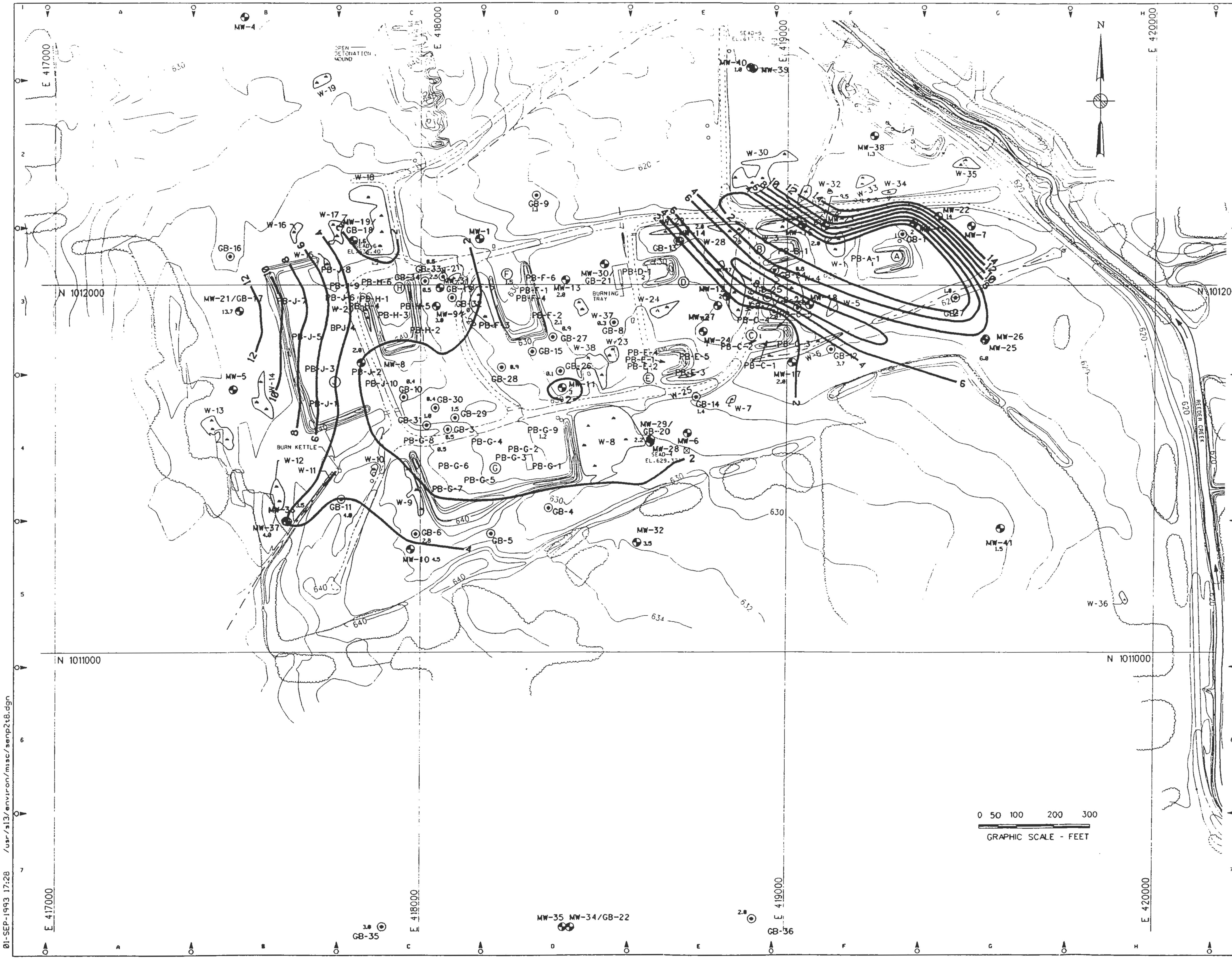
DEPT. ENVIRONMENTAL ENGINEERING NO 720446-01000

FIGURE 3-9

CROSS-SECTION B - B'

SCALE HORIZONTAL: 1" = 100' VERTICAL: 1" = 10'

ES'S DWG. NO 720446-01000-C6 REV A



LEGEND:

MW-27 517.6	MONITORING WELL, DESIGNATION, & TOP OF BEDROCK ELEVATION. (A GB LABEL AT A WELL INDICATE THAT A GRID BORING IS AT THE SAME LOCATION AS THE WELL)
	PAVED ROAD
	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
	UTILITY POLE
	TREE
	BRUSH
	WETLAND & DESIGNATION
	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
	CULVERT
☒ SEAD-4 EL.629.37'	MONUMENT AND DESIGNATION
PB-A-1 627.0 ⦿ GB-12 616.0	BORING & DESIGNATION & TOP OF BEDROCK ELEVATION
4	WEATHERED SHALE THICKNESS CONTOUR

REV	DATE	DESCRIPTION
B	[illegible]	PRE-DRAFT PHASE II- RI/FS
A	[illegible]	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN CHECKED DES.SUPV. RESP.ENGR. CH.DISC.ENG. PROJ. MGR.

DRAWN BY E.SCHACHT	CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAELIN	RESP.ENGR. M.N.DUCHESNEAU
CHIEF DISC.ENGR. M.E.BAKER	MGR.OF ENGR. J.P.CHAPLICK

PROJECT MANAGER M.N.DUCHESNEAU

MGR. OF PROJECTS J.P.CHAPLICK

IN CHARGE W.D.PATTERSON

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REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING NO. 720446-0100

FIGURE 3-10
WEATHERED SHALE
ISOPACH MAP

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-3-10 REV B

01-SEP-1993 17:28 /usr/s13/environ/misc/senp218.dgn

02-SEP-1993 09:15 /usr/s13/environ/misc/senp2t10.dgn

LEGEND:

MW-27 617.6	MONITORING WELL, DESIGNATION, & TOP OF BEDROCK ELEVATION. (A GB LABEL AT A WELL INDICATE THAT A GRID BORING IS AT THE SAME LOCATION AS THE WELL)
	PAVED ROAD
	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
	UTILITY POLE
	TREE
	BRUSH
W-1	WETLAND & DESIGNATION
	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
	CULVERT
☒ SEAD-4 EL.629.37'	MONUMENT AND DESIGNATION
PB-A-1 627.0 GB-12 616.0	BORING & DESIGNATION & TOP OF BEDROCK ELEVATION

REV	DATE	DESCRIPTION
B	[illegible]	PRE-DRAFT PHASE II- RI/FS
A	[illegible]	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

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DESIGN SUPV. G.A.KAELIN	RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. M.E.BAKER	MGR. OF ENGR. J.P.CHAPUCK

PROJECT MANAGER M.N.DUCHESNEAU

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DEPT. ENVIRONMENTAL ENGINEERING

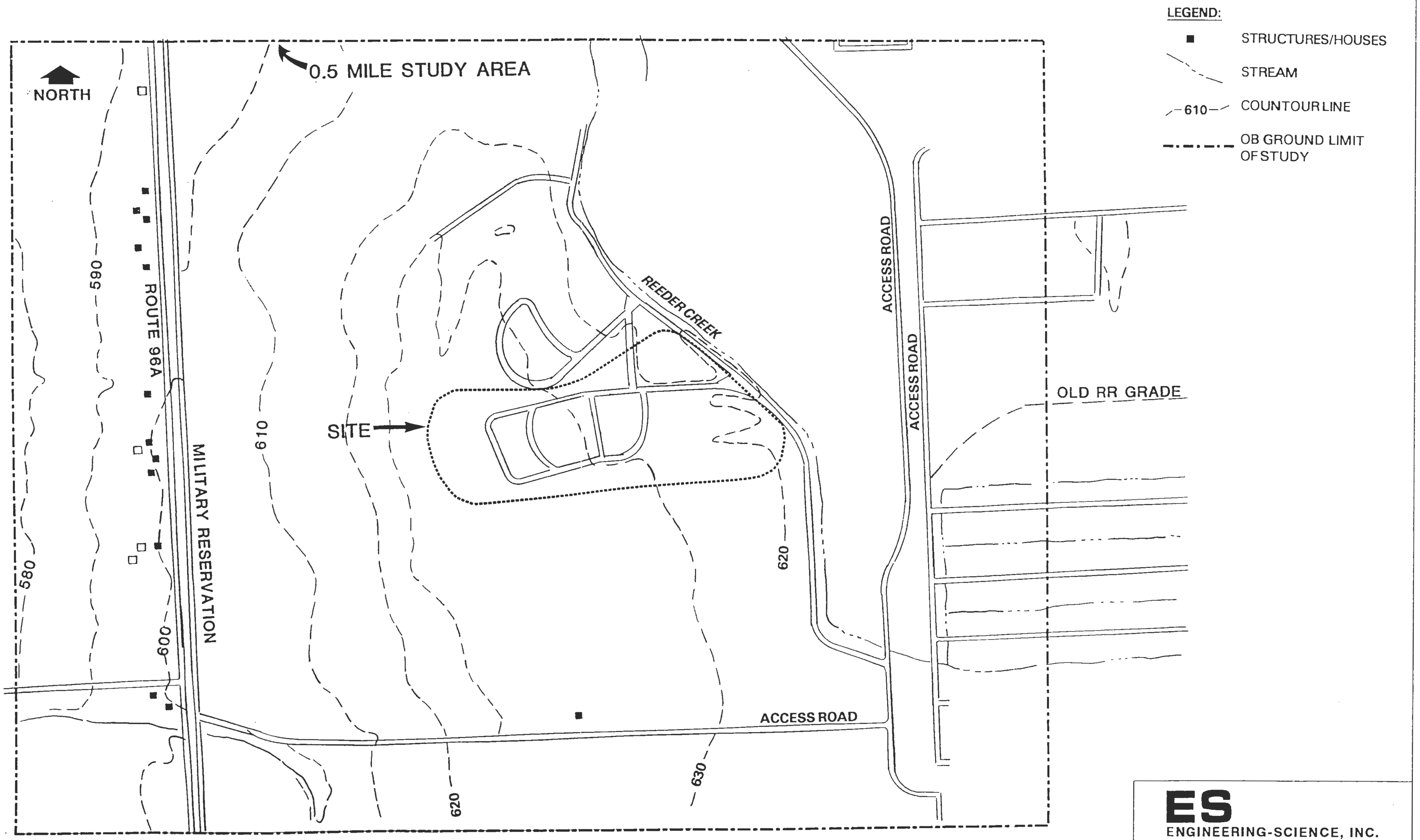
NO. 720446-0100

FIGURE 3-11
COMPETENT BEDROCK TOPOGRAPHY MAP

SCALE 1" = 250'

ES DWG. NO. 720446-01022-3-11

REV B



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REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

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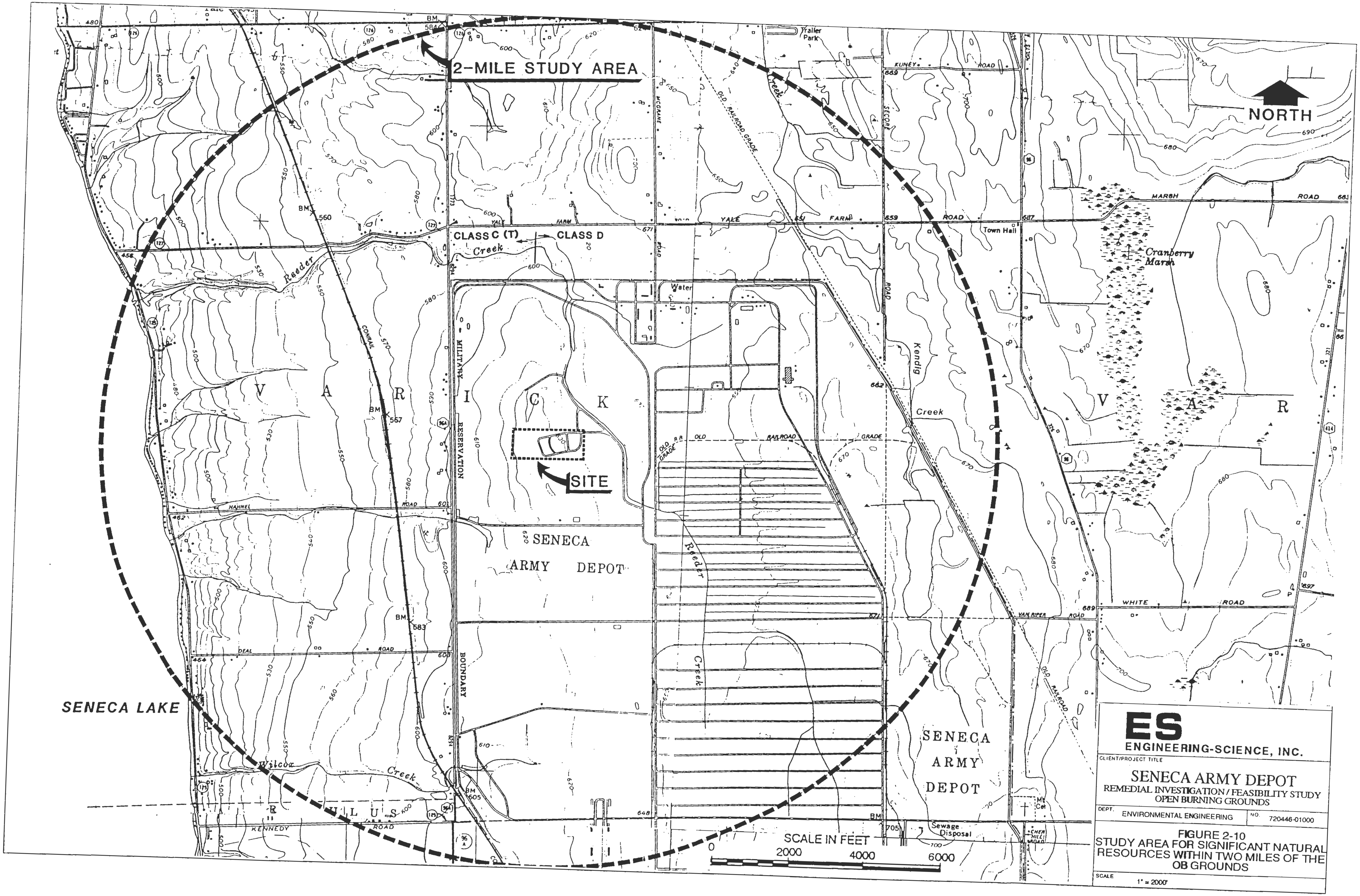
NO. 720446-01000

FIGURE 2-9

STUDY AREA OF NATURAL RESOURCES WITHIN 0.5 MILE OF OB GROUNDS

SCALE 1" = 700' (APPROXIMATE)



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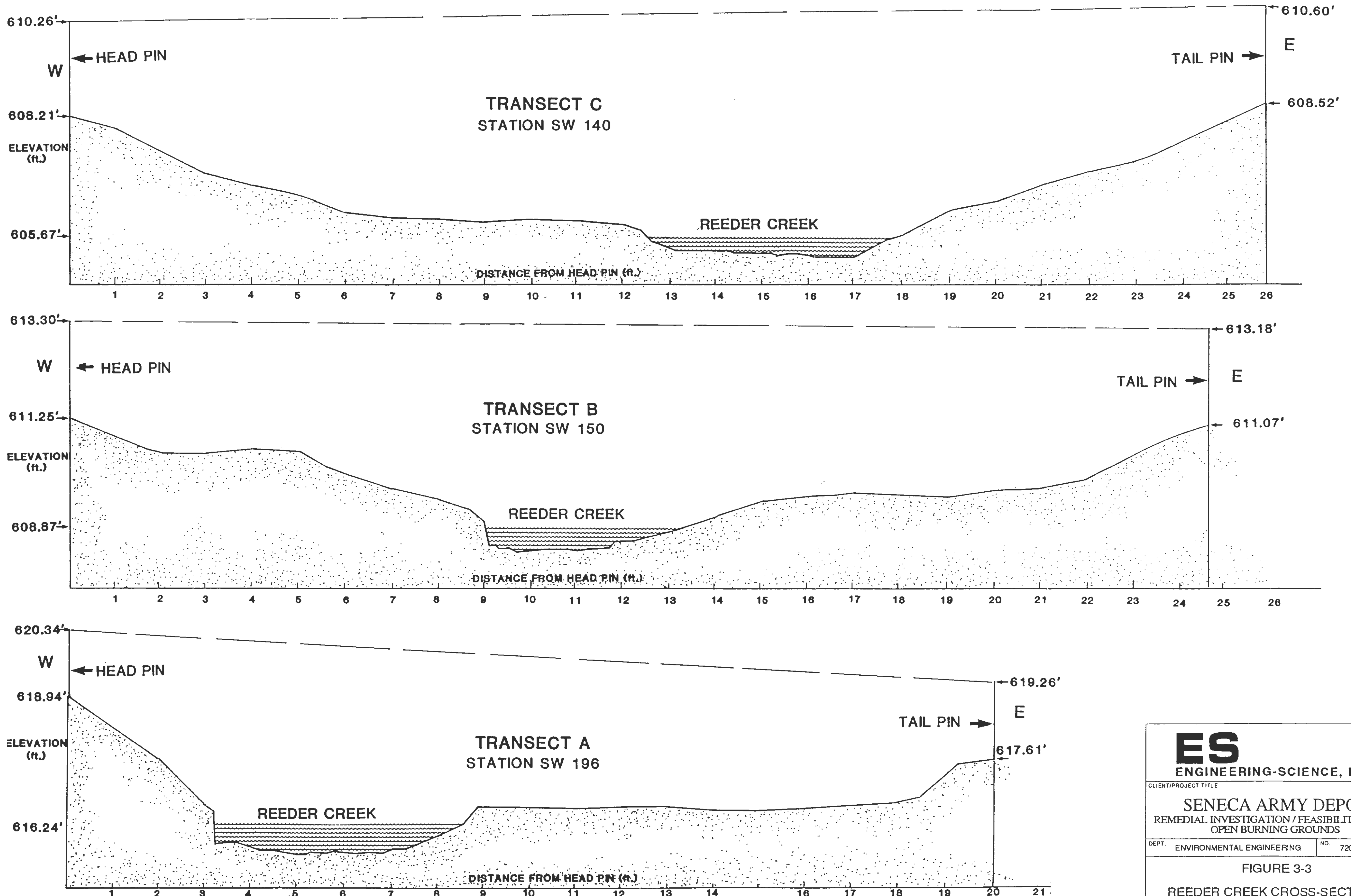
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING

NO. 720446-01000

FIGURE 2-10
STUDY AREA FOR SIGNIFICANT NATURAL RESOURCES WITHIN TWO MILES OF THE OB GROUNDS

SCALE 1" = 2000'



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REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

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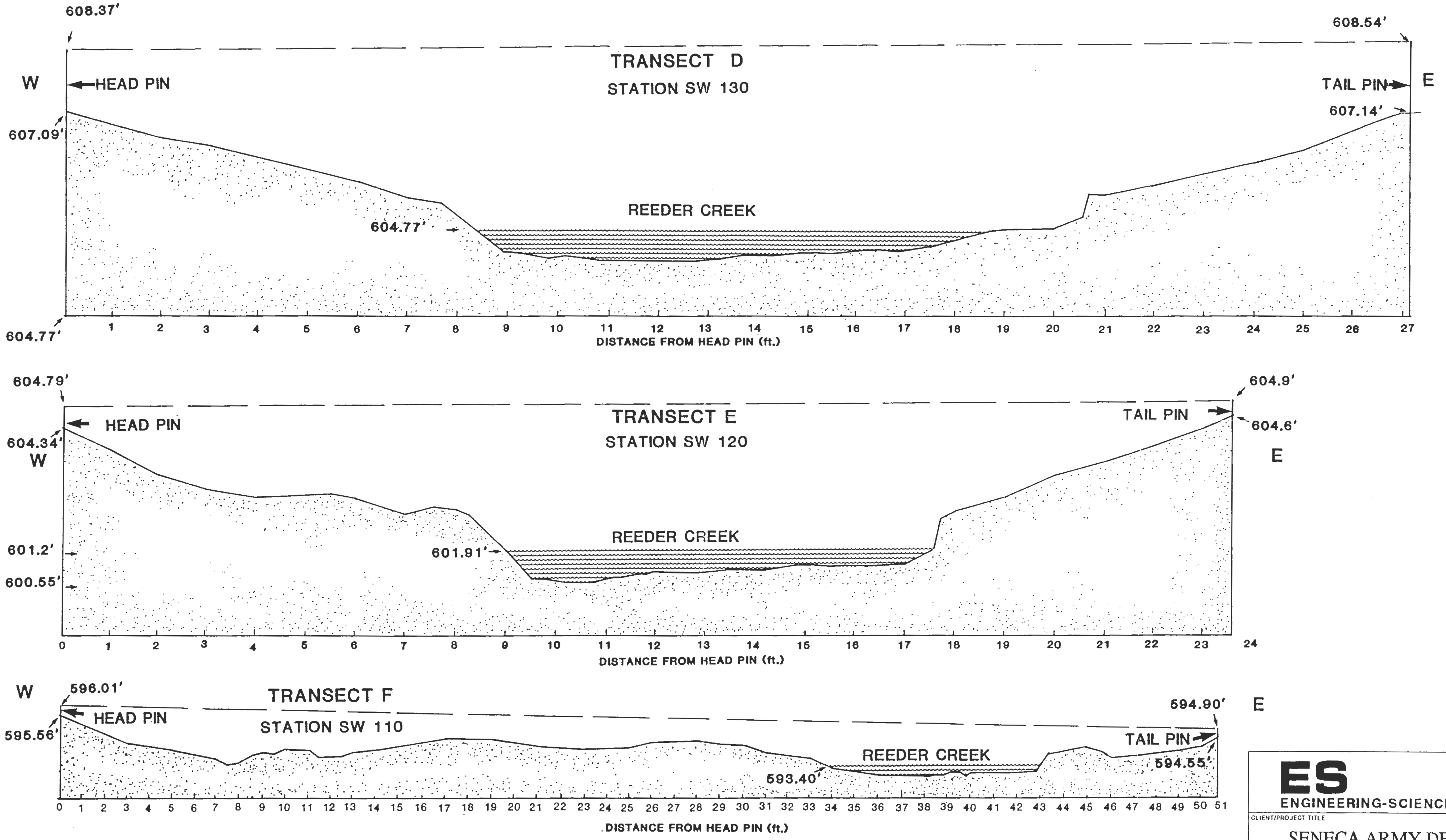
FIGURE 3-3

REEDER CREEK CROSS-SECTIONS
A, B, AND C

SCALE



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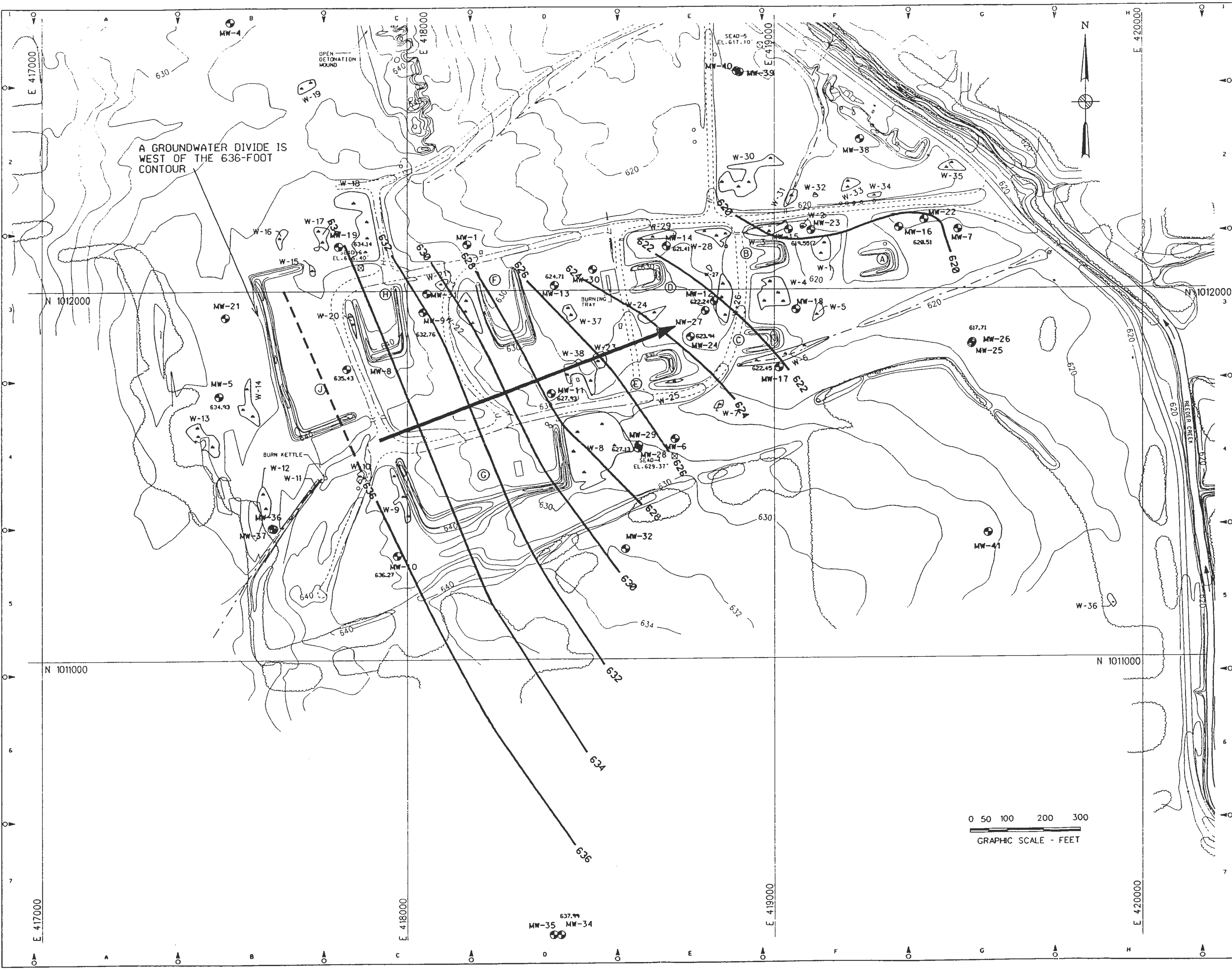
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING	NO 720446-01000

FIGURE 3-4

REEDER CREEK CROSS-SECTIONS
D, E, AND F

SCALE



LEGEND:

MW-27 617.71	MONITORING WELL & DESIGNATION & GROUNDWATER ELEVATION
	PAVED ROAD
	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
♦	UTILITY POLE
○	TREE
	BRUSH
W-1	WETLAND & DESIGNATION
	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
	CULVERT
☒ SEAD-4 EL.629.37'	MONUMENT AND DESIGNATION
632	GROUNDWATER ELEVATION CONTOURS, DASHED WHERE INFERRED
➡	GROUND WATER FLOW DIRECTION

REV	DATE	DESCRIPTION
	/ /	
	/ /	
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B	7/3/93	PRE-DRAFT PHASE II- RI/FS
A	2/20/93	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN BY E.SCHACHT	CHECKED BY W.E.BAKER
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DRAWN / CHECKED / DES.SUPV. / RESP.ENGR. / CH.DISC.ENG. / PROJ. MGR. / HF

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FIGURE 3-12
GROUNDWATER ELEVATIONS, TILL MONITORING WELLS
JANUARY 1992

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-3-12
REV

25-JAN-1994 16:43 /usr/si3/environ/misc/senp2t26.dgn

REV	DATE	DESCRIPTION
B	7/3/93	PRE-DRAFT PHASE II- RI/FS
A	7/2/92	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

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PROJECT MANAGER W.N.DUCHESNEAU	
MGR. OF PROJECTS J.P.CHAPLICK	
IN CHARGE W.D.PATTERSON	

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FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01030

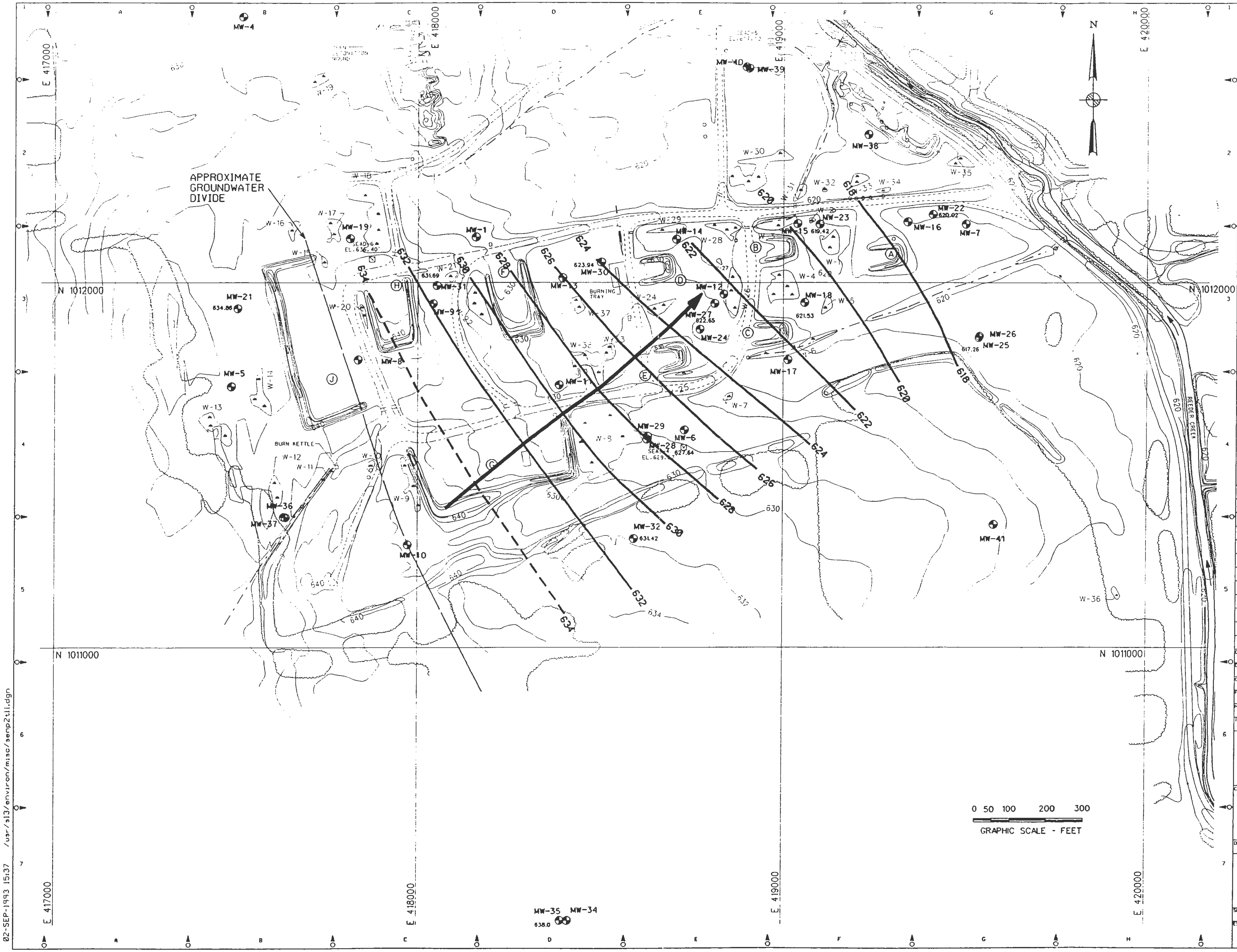
FIGURE 3-13
GROUNDWATER ELEVATIONS,
TILL MONITORING WELLS
APRIL 1993

SCALE 1" = 250'

ES DWG. NO. 720446-01022-3-13
REV B

/usr/s13/environ/misc/senp2t26o.dgn

25-JAN-1994 16:34



REV	DATE	DESCRIPTION
B	7/3/93	PRE-DRAFT PHASE II- RI/FS
A	1/29/92	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN BY E.SCHACHT
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REMEDIAL INVESTIGATION/ FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING NO. 720446-01000

FIGURE 3-14
GROUNDWATER ELEVATIONS,
WEATHERED SHALE
MONITORING WELLS
JANUARY 1992

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-3-14 REV B

02-SEP-1993 15:37 /usr/s13/environ/misc/senp2t11.dgn

drops from 631.42 feet above MSL at MW-32 on the western side of the site to 617.26 feet above MSL at MW-25 on the eastern side of the site. This represents a drop in elevation of 14.16 feet over a linear distance of approximately 1100 feet. Based upon these measurements a horizontal gradient of 0.013 ft/ft has been calculated for the weathered shale unit. This horizontal gradient is quite similar to the value determined for the glacial till unit (0.011 ft/ft) suggesting similar groundwater flow conditions exist within the two geologic units. Again data for the April 1993 water level measurements (Phase II) define a groundwater divide in the far western portion of the site.

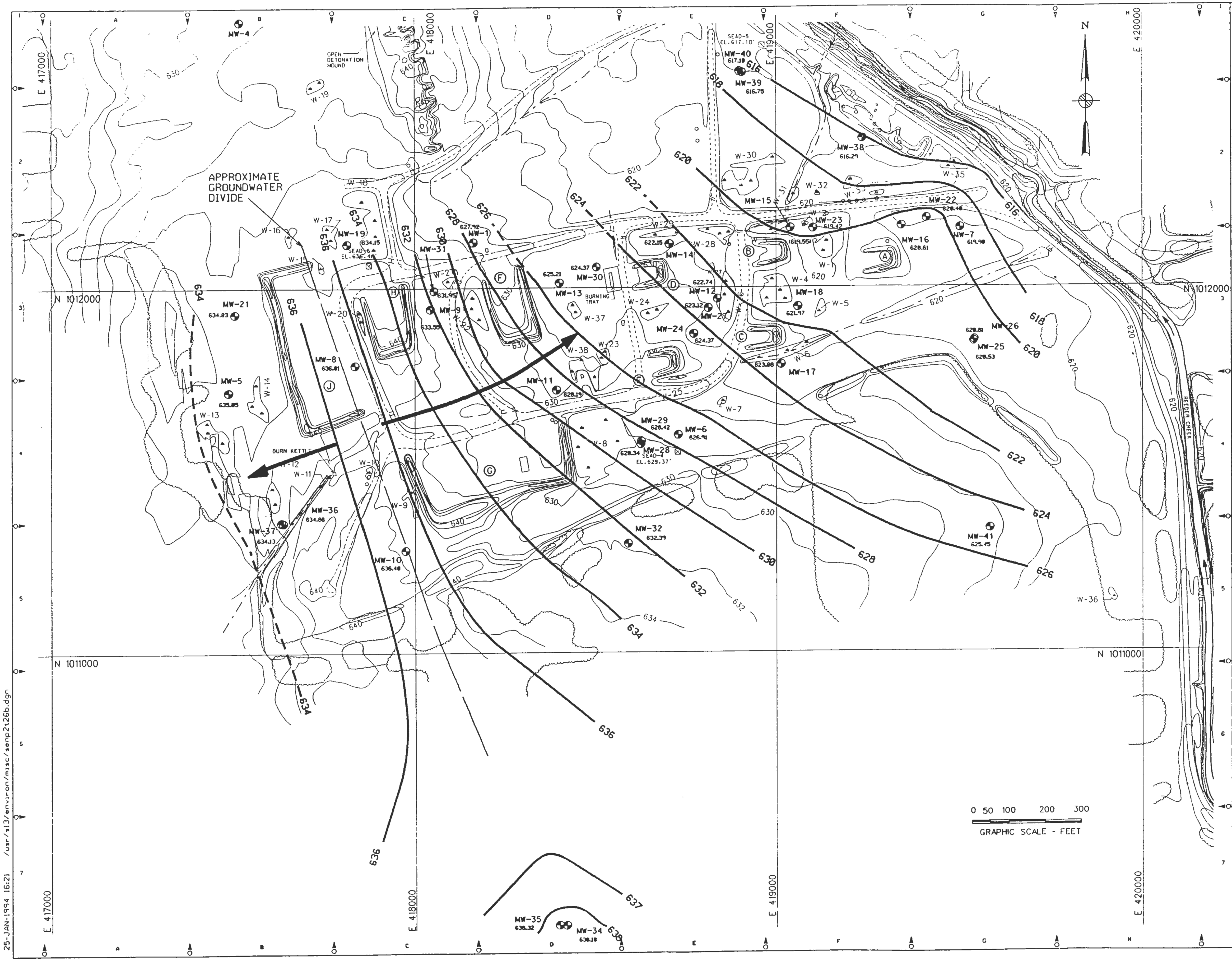
The investigation through Phase I and II was conducted to evaluate certain hydrologic characteristics including the possibility that the overburden (till) and the weathered shale are separate aquifers. The data, however, support the presence of only one aquifer, the till/weathered shale aquifer.

Figure 3-16 shows the groundwater elevations for wells screened in both the till and weathered shale and is similar to the previous groundwater maps. The compilation of all the till and weathered shale data on one map allows a more complete groundwater topography map to be constructed. The groundwater divide in the far western portion of the site is clearly defined on this map. Cross-section A-A' shows a competent bedrock high in the area of the divide, which is perhaps the reason for the existence of a divide in this area (Figure 3-7).

3.7.3 Hydraulic Conductivities

Hydraulic conductivity measurements were performed at only 20 of the monitoring wells at the OB grounds. In several instances a test could not be performed due to frozen groundwater in the well or a lack of a sufficient standing volume of water in the well. In addition, the slug test data for MW-25 was determined to be not well behaved and thus this anomalous test was not included in the calculation of the hydraulic conductivity averages. Rising head tests were performed at the wells and the results are presented in Table 3-7. The AQTESOLV program generated the hydraulic conductivities in units of ft/min and these were converted to cm/sec as shown in Table 3-7. The water level measurements for the hydraulic conductivity testing were made during January 1992 and April 1993. (Refer to Section 2.6.4 for a description of the methodology).

The calculated hydraulic conductivities for the till wells range from a high of $1.54\text{x}10^{-3}$ cm/sec at MW-29 to a low of $8.36\text{x}10^{-5}$ cm/sec at MW-6. The average hydraulic conductivity for all



LEGEND:

MW-27 617.71	MONITORING WELL & DESIGNATION & GROUNDWATER ELEVATION
	PAVED ROAD
	DIRT ROAD
650	GROUND CONTOUR AND ELEVATION
♦	UTILITY POLE
○	TREE
	BRUSH
W-1	WETLAND & DESIGNATION
	RUNOFF SWALE
Ⓓ	BURNING PAD DESIGNATION
	CULVERT
☒ SEAD-4 EL.629.37'	MONUMENT AND DESIGNATION
632	GROUNDWATER ELEVATION CONTOURS (DASHED WHERE INFERRED)
	GROUND WATER FLOW DIRECTION

REV	DATE	DESCRIPTION
B	3/3/93	PRE-DRAFT PHASE II- RI/FS
A	1/22/93	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN BY E.SCHACHT
CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAELIN
RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. M.E.BAKER
MGR. OF ENGR. J.P.CHAPLICK
PROJECT MANAGER M.N.DUCHESNEAU
MGR. OF PROJECTS J.P.CHAPLICK
IN CHARGE W.D.PATTERSON

DRAWN CHECKED DES.SUPV. RESP.ENGR. CH.DISC.ENG. PROJ.MGR.

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 3-16
GROUNDWATER ELEVATIONS,
TILL/WEATHERED SHALE
AQUIFER
APRIL 1993

SCALE 1" = 250'
ES'S DWG. NO. 720446-01022-3-16
REV B

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TABLE 3 – 7

HYDRAULIC CONDUCTIVITY VALUES FOR RISING HEAD SLUG TESTS

SENECA ARMY DEPOT
OB GROUNDS

MONITORING WELL	TYPE OF MONITORING WELL	STATUS	HYDRAULIC CONDUCTIVITY BOUWER AND RICE (1976)	
			(cm/sec)	(ft/min)
MW–5	NA	A test was performed.	1.719E–04	3.384E–04
MW–6	NA	A test was performed.	8.367E–05	1.647E–04
MW–7	NA	A test was performed.	2.545E–04	5.010E–04
MW–8	TILL	A test was performed.	5.634E–05	1.109E–04
MW–9	TILL	No test was performed.	NA	NA
MW–10	TILL	A test was performed.	1.148E–04	2.259E–04
MW–11	TILL	A test was performed.	1.675E–03	3.298E–03
MW–12	TILL	No test was performed.	NA	NA
MW–13	TILL	No test was performed.	NA	NA
MW–14	TILL	A test was performed.	2.077E–04	4.088E–04
MW–15	TILL	No test was performed.	NA	NA
MW–16	NA	No test was performed.	NA	NA
MW–17	TILL	No test was performed.	NA	NA
MW–18	WEATHERED SHALE	A test was performed.	4.771E–04	9.392E–04
MW–19	TILL	No test was performed.	NA	NA
MW–21	WEATHERED SHALE	A test was performed.	6.883E–05	1.355E–04
MW–22	WEATHERED SHALE	A test was performed.	4.306E–04	8.477E–04
MW–23	WEATHERED SHALE	A test was performed.	4.120E–03	8.110E–03
MW–24	TILL	A test was performed.	6.208E–04	1.222E–03
MW–25*	WEATHERED SHALE	A test was performed.	1.960E–02	3.859E–02
MW–26	TILL	No test was performed.	NA	NA
MW–27	WEATHERED SHALE	A test was performed.	1.139E–03	2.243E–03
MW–28	WEATHERED SHALE	A test was performed.	1.539E–04	3.030E–04
MW–29	TILL	A test was performed.	1.545E–03	3.041E–03
MW–30	WEATHERED SHALE	A test was performed.	4.689E–03	9.230E–03
MW–31	WEATHERED SHALE	A test was performed.	2.932E–04	5.771E–04
MW–32	WEATHERED SHALE	A test was performed.	6.010E–05	1.183E–04
MW–34	TILL	No test was performed.	NA	NA
MW–35	WEATHERED SHALE	No test was performed.	NA	NA
MW–36	WEATHERED SHALE	No test was performed.	NA	NA
MW–37	TILL	No test was performed.	NA	NA
MW–38	TILL	No test was performed.	NA	NA
MW–39	TILL	A test was performed.	4.089E–04	8.050E–04
MW–40	WEATHERED SHALE	No test was performed.	NA	NA
MW–41	TILL	No test was performed.	NA	NA
AVERAGE:				
SITE			8.721E–04	1.717E–03
TILL			6.612E–04	1.302E–03
WEATHERED SHALE			1.270E–03	2.500E–03

Notes:
1) NA = Not Available
2) * = Not included in the averages because data is not well behaved.

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of the till wells including MW-8 through MW-41 is $6.61\text{x}10^{-4}$ cm/sec. For the weathered shale monitoring wells the calculated hydraulic conductivities range from a high of $1.13\text{x}10^{-3}$ cm/sec to a low of $6.01\text{x}10^{-5}$ cm/sec. The average hydraulic conductivity for all of the weathered shale wells for MW-8 through MW-41 was $1.27\text{x}10^{-3}$ cm/sec. Based on these data, the till and weathered shale have similar average hydraulic conductivities and the range in these values is very similar. The overall average hydraulic conductivity for the till/weathered shale aquifer is $8.721\text{x}10^{-4}$ cm/sec. This value includes wells MW-5 through MW-41.

The hydraulic conductivities determined for the RI are in general agreement with conductivities for 10 wells on-site as determined by M&E (1989). The conductivities in the M&E (1989) investigation ranged from $7.06\text{x}10^{-6}$ cm/sec to $5.19\text{x}10^{-4}$ cm/sec and the average was determined to be $1.8\text{x}10^{-4}$ cm/sec.

Of the five monitoring well couplets, where both glacial till and weathered shale monitoring wells were installed (MW-25/MW-26, MW-28/MW-29, MW-34/MW-35, MW-36/MW-37 and MW-39/MW-40) only the MW-28/MW-29 couplet has hydraulic conductivity values available for both wells. Monitoring well MW-28, installed in the weathered shale, has hydraulic conductivity of $1.53\text{x}10^{-4}$ cm/sec, while the associated glacial till monitoring well, MW-29, has a hydraulic conductivity of $1.54\text{x}10^{-3}$ cm/sec. These data indicate that, in the vicinity of the monitoring well couplet MW-28/MW-29, the glacial till and weathered shale have similar (within approximately one order of magnitude difference) hydraulic conductivities.

Based on the Phase I and II hydrologic data (i.e.,hydraulic conductivities, water level data and water table topographies) the well clusters screened in the till and weathered shale aquifers are not believed to be separate and independent aquifers but are one aquifer.

3.7.4 Average Groundwater Flow Velocity

The average linear velocities of groundwater flowing through the till and weathered shale aquifer have been calculated. Velocities have been determined based upon the average hydraulic conductivities of $6.61\text{x}10^{-4}$ cm/sec in the glacial till and $1.27\text{x}10^{-3}$ cm/sec in the weathered shale as described in Section 3.7.3. Using Darcy's Law, the average linear velocity (**V**) of groundwater flow, based upon the hydraulic conductivity, the estimated effective porosity, and the horizontal gradient of the groundwater surface was obtained. The Darcy equation is:

$$V = \frac{K \frac{dh}{dL}}{n}$$

where **K** is the hydraulic conductivity, **n** is the effective porosity of the aquifer and **dh/dL** represents the horizontal gradient.

The velocity was determined using an effective porosity of 33 percent after de Marsily (1986), who indicates graphically that this is the value for a sediment composed of silt and clay. This reference also shows a total porosity value for the silt and clay at approximately 40%. The total porosity value is similar to the total porosity (porosity, n) determined for samples of till below several of the burn pads on the OB grounds in an AEHA study (Hazardous Waste Study No. 37-26-0474-85). The AEHA study indicates that the porosities for five till samples range from 34.0 percent to 44.2 perent with an average of 37.3 percent. Thus, the 33 percent effective porosity value used for the velocity calculation in the till is appropriate. Although no published data on the effective porosity of weathered shale were found, the characteristics of the weathered shale (fissility with a large amount of silt and clay in the interstices) allow a reasonable, although estimated, comparison to be drawn between the 33 percent effective porosity for the till and the weathered shale. Thus, the 33 percent effective porosity value was used to calculate the velocity in the weathered shale. Average linear velocities have been calculated using the average hydraulic conductivities for the two geologic units and the horizontal gradient of the groundwater surface.

The average linear velocity for the till was calculated to be 22.8 ft/year using a conductivity of $6.61\text{x}10^{-4}$ cm/sec, a horizontal groundwater gradient of 0.011 ft/ft, and an effective porosity of 33 percent (0.33). The average linear velocity for the weathered shale was calculated to be 51.8 ft/year using a conductivity of $1.27\text{x}10^{-3}$ cm/sec, a horizontal groundwater gradient of 0.013 ft/ft, an effective porosity of 33 percent (0.33). However, the value for the weathered shale is likely not constant as the weathered shale aquifer varies in thickness on the OB grounds and, in general, tends to be quite thin. For the till/weathered shale aquifer on the entire OB grounds the average linear velocity was calculated to be 32.8 ft/year using a conductivity of $8.721\text{x}10^{-4}$ cm/sec, a horizontal groundwater gradient of 0.012 ft/ft (an average for the till and weathered shale gradients) and an effective porosity of 33 percent (0.33).

These calculated velocities are considered slow and reflect the fine grained nature and associated low hydraulic conductivities of both the glacial till and weathered shale units. These low velocities also suggest that contaminants present within the groundwater are, on average, moving at slow rates, eastward towards Reeder Creek.

3.7.5 Vertical Gradients in Groundwater

At five locations both glacial till and weathered shale monitoring wells have been installed. Three rounds of groundwater level measurements were made at these locations during Phase I. These additional rounds were made during Phase II. Table 3-8 presents the vertical gradients calculated at these well couplets. Vertical gradients between the monitoring well pairs were calculated by dividing the head elevation difference between the two wells by the difference in the mid-point elevation of the respective well screens. This was done for the six rounds of water level measurements. In Table 3-8, positive vertical gradients indicate downward movement of water while negative gradients indicate upward movement of water within the aquifer.

There is a small downward vertical gradient at MW-25/MW-26 as expressed by the six calculated gradients, although the July 21, 1993 value is somewhat anomalous. Very small upward vertical gradients dominate the well pair MW-28/MW-29, although no vertical gradient was calculated for January 24, 1992.

The vertical gradients calculated for well pairs MW-36/MW-37 and MW-39/MW-40 show some variability in both the direction and the magnitude of the vertical gradients. The well pair MW-39/MW-40, though, does indicate an upward movement of groundwater.

3.8 LAND USE

The SEDA is situated just west of the village of Romulus, NY between Seneca Lake and Cayuga Lake and encompasses portions of Romulus Township and Varick Township. Land use in this region of New York is largely agricultural, with some forestry and public land (school, recreational and state parks). Figure 3-17 summarizes the regional and local land use.

The most recent land use report, issued by Cornell University (1967) classifies land uses and environments of this region. Agricultural land use is categorized as inactive or active use. Inactive agricultural land consists of land committed to eventual forest regeneration, land waiting to be developed, or land presently under construction. Active agricultural land surrounding SEDA consists of largely cropland and cropland pasture. The U.S. Geologic

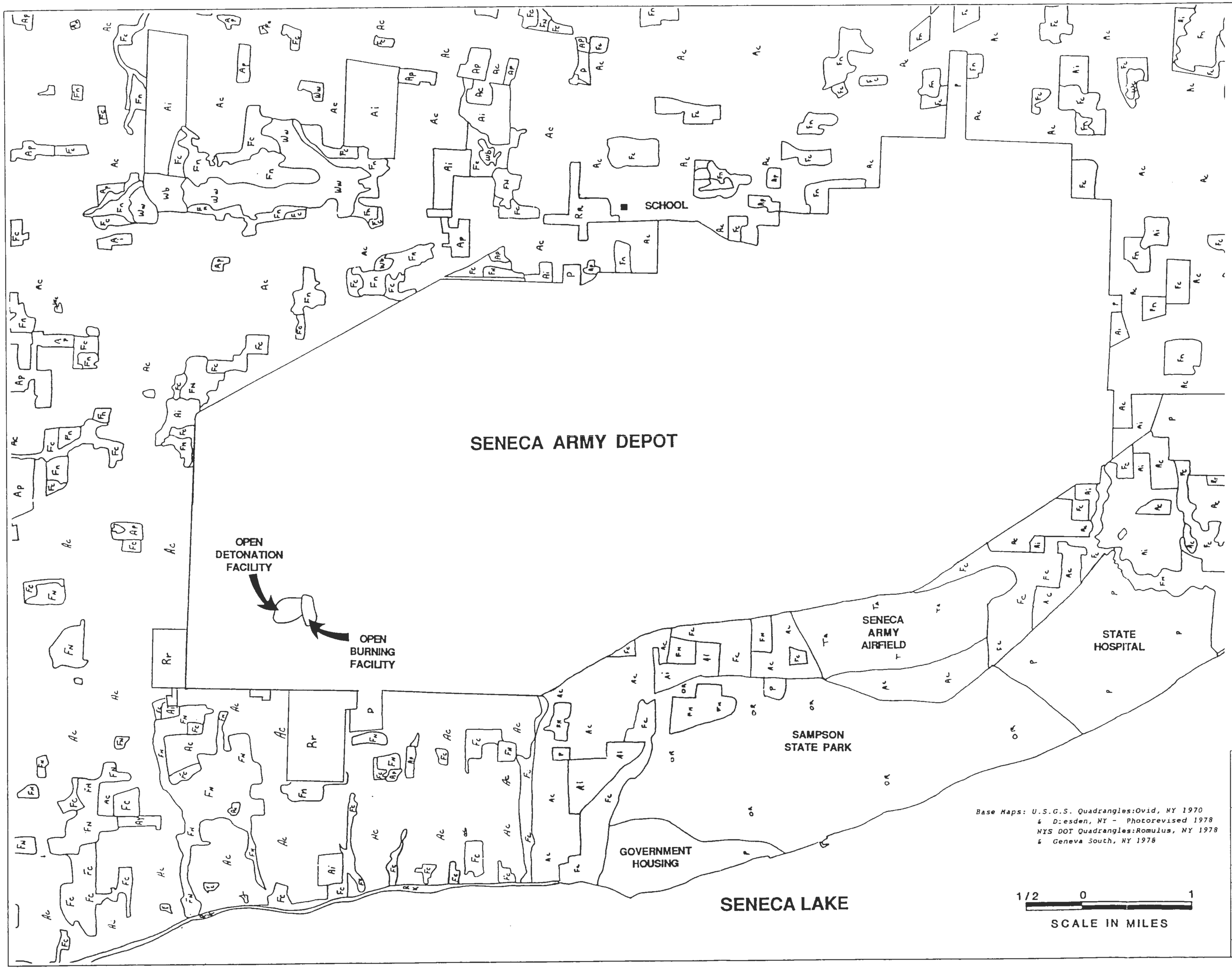
TABLE 3 – 8

VERTICAL GRADIENTS IN PAIRED MONITORING WELLS

SENECA ARMY DEPOT
OB GROUNDS

						PHASE I						PHASE II					
MONITORING WELL NUMBER	WELL TYPE	ELEVATION OF TOP OF PVC CASING (ft)	SCREENED INTERVAL REL. TO TOC (ft)	MID-POINT OF SCREEN REL. TO TOC (ft)	ELEVATION OF MID-POINT OF SCREEN (ft)	ELEVATION 07-JAN-92 (ft)	VERTICAL GRADIENT	ELEVATION 24-JAN-92 (ft)	VERTICAL GRADIENT	ELEVATION 04-FEB-92 (ft)	VERTICAL GRADIENT	ELEVATION 16-FEB-93 (ft)	VERTICAL GRADIENT	ELEVATION 27-APR-93 (ft)	VERTICAL GRADIENT	ELEVATION 21-JUL-93 (ft)	VERTICAL GRADIENT
MW-25	WB	623.80	12.0 – 14.0	13.00	610.80	617.26	0.07	616.80	0.13	615.88	0.12	616.33	0.07	620.53	0.04	612.99	0.57
MW-26	TILL	624.31	5.71 – 7.71	6.71	617.60	617.71		617.71		616.73		616.79		620.81		616.84	
MW-28	WB	631.90	14.1 – 16.1	15.10	616.80	627.64	–0.11	627.45	0.00	627.29	–0.00	627.26	–0.01	628.42	–0.02	623.36	–0.01
MW-29	TILL	632.07	8.17 – 13.17	10.67	621.40	627.13		627.47		627.28		627.23		628.34		623.32	
MW-35	WB	640.97	NA	NA	NA	NA	NA	2.80	NA	FROZEN	NA	NA	NA	2.65	NA	7.62	NA
MW-34	TILL	640.43	5.23 – 6.73	5.98	634.45	637.99		FROZEN		FROZEN		NA		2.25		DRY	
MW-36	WB	640.55	7.75 – 9.25	8.50	632.05	NA	NA	NA	NA	NA	NA	634.09	0.03	634.86	–0.26	631.05	1.00
MW-37	TILL	640.81	5.21 – 6.71	5.96	634.85	NA		NA		NA		634.16		634.13		633.85	
MW-40	WB	620.46	11.24 – 12.74	11.99	608.15	NA	NA	NA	NA	NA	NA	614.25	–0.02	617.10	–0.05	614.37	–0.27
MW-39	TILL	620.14	5.16 – 6.66	5.91	614.55	NA		NA		NA		614.14		616.75		612.62	

Notes:
1) Vertical gradients are shown as two significant digits only.
2) The anomalous vertical gradient for July 21, 1993, may be due to non-static water level conditions in MW – 36.
3) NA = Not Available



Source: New York State Land Use and Natural Resources Inventory

Base Maps: U.S.G.S. Quadrangles:Ovid, NY 1970
& Dresden, NY - Photorevised 1978
NYS DOT Quadrangles:Romulus, NY 1978
& Geneva South, NY 1976

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ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 3-17

REGIONAL/LOCAL LAND USE MAP

SCALE

Survey (USGS) quadrangle maps for the Towns of Ovid and Dresden, New York (1970), New York State Department of Transportation (DOT) quadrangles for Romulus, New York (1978) and Geneva South, New York (1978) do not indicate land designated for dairy production in the vicinity of SEDA.

SEDA is a government-owned installation under the jurisdiction of the U.S. Army Material Command (AMC). The total area of SEDA is 10,587 acres, of which 8,382 are designated storage areas for ammunition, storage and warehouse, and open storage and warehouse. On-Depot family housing is in two parcels, a 54-acre development adjacent to Route 96 and another 69 acres situated along Seneca Lake. Additionally, troop housing is available for 270 enlisted men (Buildings 703, 704, and 708). Bachelor officer quarters are located in Building 702, which is designated for 18 men. Other land uses include Administration, Community Services and an airfield. SEDA has a swimming pool at the north end of the facility, along with tennis courts, a gymnasium, and a sports field complex. Picnic and playground areas are found on the installation at Hancock Park, the Lake Area and the Family Housing Area. There is also a skeet and trap range at the field. There are no recreational facilities located within 1,000 feet of the OB grounds.

The OB grounds is situated in the northwest corner of SEDA. The closest SEDA property boundary is approximately 3,000 feet from the OB grounds. Land use adjacent to and off-site of the northwestern corner of SEDA is sparse residential areas with some farmland.

Forestland adjacent to SEDA is primarily under regeneration with sporadic occurrence of mature forestry. Public and semi-public land use surrounding and within the vicinity of SEDA includes Sampson State Park, Willard Psychiatric Center, and Central School (at the Town of Romulus). Sampson State Park entails approximately 1,853 acres of land and includes a boat ramp on Seneca Lake.

Historically, Varick and Romulus Townships within Seneca County have developed as agricultural centers supporting a rural population. However, increased population occurred in 1941 due to the opening of SEDA. Population has progressed since then largely due to the increased emphasis on promoting tourism and recreation in this area. Records provided by the Town of Varick show approximately 15 residences adjacent to the northwestern border of SEDA which are within 4,000 feet of the OB grounds. These residences all obtain drinking water from private water wells. Detailed information regarding the construction of these wells was not available.

3.9 ECOLOGY

3.9.1 Aquatic Assessment Program

3.9.1.1 Benthic Invertebrate Community

The benthic community of Reeder Creek is dominated by insects as indicated by the macroinvertebrate Surber sampling program at six stations as shown in Table 3-9 (Refer to Figure 3-20 for sampling locations). Insects comprised approximately 87 percent of the almost 3,000 specimens collected and identified. The remaining 13 percent was a combination of worms (Turbellaria and Oligochaeta), leeches (Hirudinea), snails (Gastropoda), clams (Bivalvia), seed shrimp (Ostracoda) and scuds (Amphipoda). Insects collected included stoneflies (Plecoptera), caddisflies (Trichoptera), hellgramites (Megaloptera), beetles (Coleoptera), mayflies (Ephemeroptera), true flies (Diptera) and damselflies (Odonata). This fauna is characteristic of stony, riffle/run habitat such as Reeder Creek (Hynes 1979).

The true flies dominated the combined collections (38.4 percent), closely followed by beetles (30.1 percent). Subdominant taxa in order of abundance include caddisfly larvae, stoneflies and snails. All seven remaining groups collected comprised a total of 7.8 percent of the overall collection. Thus, as frequently occurs in streams of this nature, the benthic macroinvertebrate taxa in Reeder Creek are unevenly distributed.

The relative abundance of taxa identified at the downstream stations was similar to that of the entire collection, where insects comprised 76.9 percent to 92.5 percent of the collection. True flies and beetles were the dominant insect groups at all downstream stations except SW-110. At the upstream reference station (SW196) beetles were the dominant macroinvertebrate group.

Species richness at each station was fairly similar. The number of taxa identified was the lowest at reference station SW-196 (22) and the highest at station SW-130 (29). Overall, 45 different taxa were identified at the six stations in Reeder Creek. If adverse effects of contaminants in Reeder Creek were affecting the water quality and thus the benthic community, lower species richness would be expected at the downstream stations rather than at the reference station. Since there is no apparent difference between species richness there is no evidence of adverse effects on the benthic community of Reeder Creek, based on the variety of organisms collected.

TABLE 3 – 9

TOTAL NUMBER AND RELATIVE ABUNDANCE OF MACROINVERTEBRATES COLLECTED DURING THE PHASE I AQUATIC ECOLOGICAL ASSESSMENT OF REEDER CREEK IN PROXIMITY TO THE SENECA ARMY DEPOT OB GROUNDS, NOVEMBER, 1991

SENECA ARMY DEPOT
OB GROUNDS

CLASS Order Family Genus species OBOD	STATION SW110 REPLICATE					STATION SW120 REPLICATE					STATION SW130 REPLICATE					STATION SW140 REPLICATE					STATION SW150 REPLICATE					STATION SW196 REPLICATE					GRAND ORDINAL TOTAL	COMBINED RELATIVE ABUNDANCE
	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance		
TURBELLARIA (flatworms)																																
Tricladida				3	0.86				21	2.19				1	0.17				1	0.45				23	4.65				2	0.67	51	1.76
Planaridae	1	2				2	3	16					1				1					21	2			2						
ANNELIDA																																
Oligochaeta (aquatic earthworms)				8	2.31				17	1.77				16	2.77				8	3.59				10	2.02				0		59	2.04
Lumberculidae		8				12		5			11	1	4			7	1				4	4	2									
Hirundinea (leeches)				0	0.00							3	1	4	0.69		1		1	0.45				0				1	1	0.34	6	0.21
MOLLUSCA																																
Gastropoda (snails)				14	4.03				15	1.56				15	2.60				26	11.66				0					102	34.34	172	5.94
* UNID Gastropod		1					2																									
Ancylidae											1	3	1					1									1					
Limnephilidae A							1																									
Lymnaeidae A	9		3														4									56		20				
Lymnaeidae B																		6									4	10				
Physidae	1						5				3	3					1	1								4		5				
Planorbidae A						1	5	1			3	1				12		1														
Planorbidae B																												2				
Bivalvia (clams)				3	0.86				11	1.15				7	1.21				1	0.45				3	0.61				33	11.11	58	2.00
Sphaeridae		1	2			8	2	1			1	6					1				1	2				1	26	6				
CRUSTACEA				**																												
Ostracoda (seed shrimps)				0		1	1	6	8	0.83			1	1	0.17		1		1	0.45		13	5	18	3.64		1		1	0.34	29	1.00
Amphipoda (scuds, sideswimmers)				0					0					3	0.52				0					1	0.20				0		4	0.14
Gammaridae																																
Gammarus sp.											1		2									1										
INSECTA																																
Plecoptera (stoneflies)				74	21.33				100	10.43				20	3.47				0					2	0.40				1	0.34	197	6.80
UNID Plecoptera	1	8	2			5		30					2															1				
Nemouridae	17	38	8			7	20	38			12	2	4									1	1									
Trichoptera (caddisflies)				15	4.32				176	18.35				13	2.25				3	1.35				20	4.04				2	0.67	229	7.90
UNID Trichoptera (larvae)	1					30		23				1										2				2						
Hydropsycidae	1	8	1								8	2	1																			
Hydropsychidae A (larvae)						88	3	30								1	2					16	2									
Hydropyschidae B (larvae)						1		1																								
Limnephleidae (larvae)												1																				
Phryganeidae (larvae)		3	1																													
Megaloptera (hellgramites)				0					6	0.63				6	1.04				0					0					1	0.34	13	0.45
Sialidae																																
Sialis sp.						3	3				2	4															1					

TABLE 3 – 9

TOTAL NUMBER AND RELATIVE ABUNDANCE OF MACROINVERTEBRATES COLLECTED DURING THE PHASE I AQUATIC ECOLOGICAL ASSESSMENT OF REEDER CREEK IN PROXIMITY TO THE SENECA ARMY DEPOT OB GROUNDS, NOVEMBER, 1991

SENECA ARMY DEPOT
OB GROUNDS

CLASS Order Family Genus species OBOD	STATION SW110 REPLICATE					STATION SW120 REPLICATE					STATION SW130 REPLICATE					STATION SW140 REPLICATE					STATION SW150 REPLICATE					STATION SW196 REPLICATE					GRAND ORDINAL TOTAL	COMBINED RELATIVE ABUNDANCE
	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance	A	B (#/ft²)	C	Ordinal Total	Relative Abundance		
Coleoptera (beetles)				58	16.71				281	29.30	4			174	30.16				132	59.19				104	21.01				122	41.08	871	30.06
Dytiscidae A (adult)			1																		1											
Dytiscidae B (adult)	4		2													3		7				1					1					
Elmidae A (adult)																	4					2										
Elmidae A (larvae)												3														6						
Elmidae B (adult)	1	3	30			38		15			2	7	14			1	2	7				3	3			69	2	2				
Elmidae B (larvae)		2	1			92	5	24			26	4	13			32	6	13			1	12	40			5	10					
Elmidae C (larvae)		1											1			1	3	1				1	1				9					
Hydrophilidae (larvae)			3									3						4									1					
Psephenidae																																
Psephenus herricki	2		2			31	40	28			31	34	18			11	8	2				5	9			2	2	8				
Ectopria nervosa	2		4			7		1				11	3			13	4	10				8	17				4	1				
Ephemeroptera (mayflies)				5	1.44				4	0.42				8	1.39				14	6.28				61	12.32				0		92	3.17
UNID Ephemeroptera																						1										
Baetidae	1		2			1		2			3					5		5				17	24									
Heptageniidae																																
Stenonema sp.	1		1					1			3	2				2		2			2	10	7									
Diptera (trueflies)				167	48.13				320	33.37				307	53.21				35	15.70				251	50.71				32	10.77	1112	38.37
Ceratopogonidae (biting midge)																						1					2	1				
Chironomidae (midge larvae)	36	65	59			107	20	189			44	179	82			12		22			24	84	134				16	13				
Culicidae (mosquito larvae)		3																														
Empididae B larvae																							1									
Empididae C larvae																							1									
Tabanidae (horsefly larvae)		2				1															2	1	1									
Tipulidae A (cranefly larvae)								3			1					1						1	1									
Tipulidae B (larvae)											1																					
Tipulidae C (larvae)			2																													
Odonata				0					0					2	0.35				1	0.45				2	0.40				0	0.00	5	0.17
Zygoptera (damselfly)																						1										
Coenagrionidae											2							1				1										
Total Specimens	78	145	124	347	100	435	110	414	959	100	159	270	148	577	100	101	39	83	223	100	35	209	251	495	100	147	80	70	297	100	2898 2898	100
Total Taxa	14	14	17	25		18	13	18	23		19	19	15	29		13	14	15	24		7	24	17	27		9	14	12	22		45	

Notes:

1) * UNID: unidentified

2) ** In addition to the listed Crustacea, one crayfish was collected at Station SW110 in an aborted Ponar dredge collection associated with sediment sampling.

The distribution of taxa among the downstream stations was fairly similar. At the reference station the distribution of taxa was somewhat different when compared to the downstream stations. At SW-196 no mayflies were collected, compared with two to three different families of mayfly reported at each downstream station. Combining all three replicates at each station, the total number of organisms collected at the downstream stations ranged from 223 at SW-140 to 959 at SW-120. The mean number of organisms collected at the five downstream stations was 520. The number of individuals collected at the reference station was within the range of all downstream stations (297).

Although organisms were not identified to the species level, it is possible to discuss guild structure in Reeder Creek in a generalized manner. Trophic relationships of all insect families identified are presented in Table 3-10. The functional feeding groups of insect families in Reeder Creek appear varied and incorporate virtually all types of feeding mechanisms. The overall hierarchy includes scrapers, herbivores, detritivores, predators and piercers, suggesting that no apparent vacancies in trophic relationships exist in Reeder Creek.

The macroinvertebrate community in Reeder Creek near the OB grounds offers little direct value to humans since they are not consumed by man. Many of the taxa collected in Reeder Creek are consumed by fish but the fish species that occur in the studied stream reach are generally not sought by anglers. The restricted access to the site further reduces the value of the fisheries to the general public.

The presence or absence of "indicator species" is commonly used to assess adverse effects to ecological communities. Pollution tolerance values for each of the aquatic arthropods identified in Reeder Creek are given in Table 3-11.

The pollution tolerance of the arthropods identified in Reeder Creek is wide and ranges from pollution tolerant organisms such as the Coenagrionidae, with a tolerance value of 9, to pollution intolerant organisms such as Nemouridae, with a tolerance value of 2. However, most of the individuals identified, are within the facultative classification (4 to 6). These are organisms that have a wide range of tolerance and are often associated with moderate levels of organic contamination (USEPA 1990b). The presence of an intolerant group, specifically Nemouridae, in relatively high abundance at stations SW-110, SW-120, and SW-130 provides evidence of favorable water quality at these downstream locations. The absence of this taxa at stations SW-140 and SW-196 does not necessarily imply degraded water quality at these locations. If the water quality at specific location were consistently degraded, tolerant taxa

TABLE 3 – 10

TROPHIC RELATIONSHIPS OF SELECTED MACROINVERTEBRATES

SENECA ARMY DEPOT
OB GROUNDS

CLASS ORDER FAMILY	TROPHIC RELATIONSHIP
Insecta	
Plecoptera	
Nemouridae	Generally shredders, detritivores
Trichoptera	
Hydropsychidae	Generally collectors, filterers, some engulfers (predators)
Limnephliedae	Generally shredders, detritivores (chewers) collectors, gatherers, and scrapers
Phryganeidae	Generally shredders, herbivores, engulfers (predators)
Megaloptera	
Sialidae	Engulfers (predators–one species reported to be collector–gatherer)
Coleoptera	
Dytiscidae (larvae and adult)	Generally piercers
Psephenidae (larvae)	Scrapers
Elmidae	Generally collectors, scrapers, and gatherers
Ephemeroptera	
Baetidae	Generally collectors, scrapers, and gatherers
Heptageniidae	Generally collectors, scrapers, and gatherers
Diptera	
Ceratopogonidae	Generally engulfers, predators, collectors–gatherers
Chironomidae	Generally of two types: 1. Collectors–gatherers and filterers 2. Engulfers (predators) and piercers–predators
Culicidae	Generally collectors–filterers (gatherers)
Tabanidae	Generally piercers–predators
Tipulidae	Generally shredders–detritivores, collectors, gatherers
Odonata	
Coenagrionidae	Engulfers, predators

Notes:
1. After Merritt and Cummins, 1978.

TABLE 3 – 11

POLLUTION TOLERANCE VALUES OF MACROBENTHIC ARTHROPODS

SENECA ARMY DEPOT
OB GROUNDS

ORDER FAMILY	TOLERANCE VALUE
Amphipoda	
Gammaridae	4*
Plecoptera	
Nemouridae	2
Trichoptera	
Hydropsychidae	4
Limnephleidae	4
Phryganeidae	4
Megaloptera	
Sialidae	4
Odondata	
Coenagrionidae	9
Coleoptera	
Elmidae	4
Psephenidae	4
Ephemeroptera	
Baetidae	4
Heptageniidae	4
Diptera	
Ceratopogonidae	6
Chironomidae	6
Empididae	6
Tabanidae	6
Tipulidae	3

Notes:
1. * = ranking from 0 – 10 with 0 being least tolerant
2. Source: USEPA 1990

such as Coenagrionidae would be expected to be especially common. Such was not the case at any Reeder Creek Station. Most healthy benthic communities have a mixture of tolerant, facultative and intolerant organisms.

An additional measure of pollution sensitivity is the presence and/or absence of mayflies, (Ephemeroptera), stoneflies, (Plecoptera), and caddisflies (Tricoptera), otherwise known as EPTs. These organisms are generally sensitive or facultative and are often first to suffer in a polluted environment (USEPA 1990b, USEPA 1989a). The abundance of all three of these groups ranges from 17 at SW-140 to 280 at SW-120 and is suggestive of good water quality. The total number of taxa within these groups generally increases with improving water quality (USEPA 1990b). The relative abundance of EPTs compared to the generally tolerant Chironomidae (i.e., EPT to Chironomid ratio) is also used as a measure of biotic conditions. The EPT to Chironomid ratio data are presented below in table format. Chironomids tend to increase in relative abundance along a gradient of increasing enrichment of heavy metals concentration (USEPA 1990b). There is no clearly defined trend of EPTs compared to chironomids at the six Reeder Creek stations based on the data collected in 1991.

Although the EPT to chironomid ratio for stations on Reeder Creek shows no clearly defined trend, the ratio did decline at station SW-130, which is located downgradient of a surface water input from the OB grounds. This decrease may be attributable to natural causes within Reeder Creek. Any change in the substream, such as a buildup of sediment (from either the tributary or from other cause), or a decrease in flow velocity that reduces the oxygen level in the water could be factors that contribute to a poor EPT ratio. EPTs are not tolerant of low oxygen levels and a decrease in EPT abundance would be expected. Data from field notes support this concept because the lowest stream velocity (.03 fps) was measured at station SW-130.

Generally, the more complex the substratum and the larger the sontes, the more diverse the invertebrate fauna. The presence of silt reduces the number of EPT. Field notes give a description of the stream bed at SW-130 as being a combination of cobbles, gravel, and some embedded sand and silt, which may be a less than suitable environment for these invertebrate.

The sediments samples collected from Reeder Creek (SW-120, SW-130, SW-140 and SW-150) do not exceed the NYSDEC Lot values, except for lead at station SW-120 (311 ug/Kg; Lot 250 ug/Kg). However, station 120 had the most favorable EPT ratio, suggesting that the concentrations of metals in the creek are not having an impact to the ecological community.

Elevated concentrations of metals in the sediment, combined with high EPT to chironomid ratios would be an indication of a stressed ecological community, however, this combination was not observed. This evidence suggests that the drop in the EPT to chironomid ratio is the result of natural causes rather than to exposure from the site. The tributary sediment data the OB grounds near station SW-130 (SW-160 and SW-190) indicates that concentrations of some metals are greater than the LOT values for the sediment stations in the tributary. The concentrations of nickel at station SW-160 (1520 ug/kg) is slightly higher than the LOT value (1100 ug/kg). The concentrations of mercury (2 ug/kg) and copper (416 ug/kg) at station SW-190 are equal to or higher than the LOT values (2 ug/kg and 114 ug/kg, respectively). EPT ratios were not determined for the on-site sediment samples.

Development of EPT: Chironomid Ratio

	Stations					
	SW-110	SW-120	SW-130	SW-140	SW-150	SW-196
Ephemetroptera	5	4	8	14	61	0
Plecoptera	74	100	20	0	2	1
Tricoptera	15	176	13	3	20	2
Total EPT	94	280	41	17	83	3
Chironomidae Total	160	216	305	24	242	29
EPT Ratio to Chironomid	1:2	1:1	1:8	1:2	1:3	1:10

3.9.1.2 Fish Community

According to the aquatic sampling program, the fish community of Reeder Creek is dominated by minnows (Table 3-12). Seven of the ten species collected were minnows. The related white sucker, which is often found in association with minnows, was also collected. Banded killifish and pumpkinseeds were the only non-Cypriniforme (suckers and minnows) fish collected. As is frequently the case in small streams, most of the fish were relatively small.

TABLE 3 – 12

COMMON AND SCIENTIFIC NAMES OF FISH COLLECTED DURING THE PHASE I AQUATIC ECOLOGICAL ASSESSMENT

SENECA ARMY DEPOT
OB GROUNDS

COMMON NAME	SCIENTIFIC NAME	LENGTH RANGE (mm)
White Sucker	Catostomus commersoni	44 – 137
Central Stoneroller	Campostoma anomalum	30 – 108
Creek Chub	Semotilus atromaculatus	32 – 161
Blacknose Dace	Rhinichthys atrarulus	27 – 85
Bluntnose Minnow	Pimephales notatus	28 – 65
Fathead Minnow	Pimephales promelas	34 – 58
Finescale Dace	Phoxinus neogaeus	37 – 51
Common Shiner	Notropis cornutus	28 – 103
Banded Killifish	Fundulus diaphanus	35 – 60
Pumpkinseed	Lepomis gibbosus	31 – 78

The largest fish collected was a 161 mm (6 inch) creek chub, though most fish collected ranged from 27 to 76 mm (1 to 3 inches) in length.

Overall, common shiners were the dominant species in Reeder Creek comprising 31.1 percent of the total catch (Table 3-13). Subdominant species and their relative abundances were: central stoneroller (12.1 percent), fathead minnow (11.1 percent), creek chub (10.8 percent), white sucker (10.4 percent), blacknose dace (10.2 percent) and bluntnose minnow (9.9 percent). The remaining three species (banded killifish, pumpkinseed and finescale dace) comprise relatively minor components of the Reeder Creek fish community. Taken as a whole, the Reeder Creek community appears to have an unusually high degree of species evenness. It is much more frequent for a fish community to have only one or two species comprising the majority of the overall community.

The catch data from each station frequently did not reflect the relatively even distribution of individuals among species, with different species being dominant at different stations (Table 3-13). The differences in species composition at each station may be due to slight habitat differences which could favor one species over another.

The total number of individuals collected at each station can only validly be compared using the electroshocking data. The most fish (79) were collected at SW-110. This station has a fairly deep (approximately 4 feet) plunge pool below two large culverts, which offers cover to resident fish. The fewest number of fish (16) were collected at the reference station, SW-196. This may not be truly indicative of the abundance of fish in this general reach of Reeder Creek, as several sizeable groups of fish were observed in pools approximately 1000 feet upstream of this location.

Species richness at each station was quite variable and showed little in the way of a defined trend. All ten species were collected at SW-150, although only seven were collected by electroshocking. Seven species were also collected at stations SW-140, SW-130 and SW-110. The least number of species (4) was collected at the reference station, SW-196.

As with many species of animals, fish often consume on several different trophic levels, as is evident in Table 3-14, with diet shifting as the fish grow, as the seasons change and as the availability of prey increases and decreases. The fish community of Reeder Creek consists predominantly of primary and secondary consumers. There are no fish that would be

TABLE 3 – 13

TOTAL CATCH AND RELATIVE ABUNDANCE OF FISH COLLECTED DURING THE PHASE I AQUATIC ECOLOGICAL ASSESSMENT

SENECA ARMY DEPOT
OB GROUNDS

	STATION AND COLLECTION METHOD								
	SW110	SW120	SW130	SW140	SW150			SW196	
SPECIES	E[1]	E[1]	E[1]	E[1]	S[1]	E[1]	S + E[3]	E[1]	TOTAL
White Sucker	7 (8.9)[2]	8 (17.0)	20 (30.8)	10 (14.5)	26 (5.5)	11 (30.5)	37 (7.2)		82 (10.4)
Central Stoneroller	32 (40.5)	3 (6.4)	19 (29.2)	13 (18.8)	18 (3.8)	7 (19.4)	24 (4.9)	3 (18.8)	95 (12.1)
Creek Chub	12 (15.2)		4 (6.2)	4 (5.8)	63 (13.3)	1 (2.8)	64 (12.5)	1 (6.2)	85 (10.8)
Blacknose Dace	15 (19.0)	23 (48.9)	5 (7.7)	20 (29.0)	6 (1.3)		6 (1.2)	11 (68.2)	80 (10.2)
Bluntnose Minnow					73 (15.4)	4 (11.1)	77 (15.1)	1 (6.2)	78 (9.9)
Fathead Minnow		7 (14.9)	5 (7.7)	6 (8.7)	66 (13.9)	3 (8.3)	69 (13.5)		87 (11.1)
Finescale Dace					3 (0.6)		3 (0.6)		3 (0.4)
Common Shiner	10 (12.7)	6 (12.8)	6 (9.2)	5 (7.2)	209 (44.0)	9 (25.0)	218 (42.7)		245 (31.1)
Banded Killifish	1 (1.3)		6 (9.2)	11 (15.9)		1 (2.8)	1 (0.2)		19 (2.4)
Pumpkinseed	2 (2.5)				11 (2.3)		11 (2.2)		13 (1.7)
Total (fish)	79 (100.1)	47 (100.0)	65 (100.0)	69 (99.9)	475 (100.1)	36 (99.9)	511(100.1)	16 (99.9)	787 (100.1)
Tadpoles (Rana sp.)			10	3					13
Temperature (°C)	8.6	13.4	8.4	8.3	8.8	7.9		8.7	
Dissolved Oxygen (mg/l)	10.5		10.6	11.0	6.7	9.2		11.8	
Conductivity (μmhos not corrected to 25°C)	450	510	475	465	405	450		400	
pH	8.1	8.2	7.8	7.6	8.1	7.4		7.6	

Notes:

[1] E = Electroshocking; S = 25–ft seine. Stations arranged sequentially with downstream–most station to the left. Station SW196 is upstream of OB/OD grounds site influence.

[2] Relative abundance values are presented in parenthesis after the total catch values.

[3] S + E = Seining + Electroshocking. These values are used to characterize the site and are included in the total fish count. Comparison of collection numbers between stations use only the electroshocking values.

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TABLE 3 – 14

TROPICAL LEVEL OF FISH COLLECTED IN REEDER CREEK

SENECA ARMY DEPOT
OB GROUNDS

	PRIMARY CONSUMERS			SECONDARY CONSUMERS			TERTIARY CONSUMERS				
DIETARY COMPONENT[1]	ALGAE	HIGHER PLANTS	MICRO–ZOOPLANKTON	WORMS	MOLLUSKS	SMALL INSECTS	SMALL CRUSTACEANS	LARGE INSECTS[2]	LARGE CRUSTACEANS	SALAMANDERS	FISH
<u>Species</u> White Sucker	X		X	X	X	X	X	X			
Central Stoneroller	X					X					
Creek Chub	X	X	X[3]			X[3]		X[3]	X[3]		X[3]
Blacknose Dace	X					X[3]					
Bluntnose Minnow	X	X	X			X					
Fathead Minnow	X[3]		X			X					
Finescale Dace					X[3]	X[3]	X				
Common Shiner	X	X	X			X[3]		X[3]			X
Banded Killifish			X[3]	X	X	X[3]		X			
Pumpkinseed					X	X	X	X		X	X

<u>Notes:</u>

1) [1] Based solely on published data, with some condensation for presentation purposes. Components of generalized categories are as follows: Algae (diatoms, desmids, bluegreen algae); higher plants (detritus); microzooplankton (protozoans, ostracods); worms (tubificids, flatworms); mollusks (small clams and snails); small insects (midges); small crustaceans (amphipods); large insects (odonates); and large crustaceans (crayfish).

2) [2] Some large aquatic insects are herbaceous. Therefore, fish containing these insects would be secondary consumers.

3) [3] Dietary preference for these food items indicated in the literature.

4) Source of dietary information: Lee et al. 1989 and Smith 1985.

considered strictly piscivorous (fish eating) and the three species known to consume fish (creek chubs, common shiners and pumpkinseeds) are considered to be omnivorous (opportunistic).

There does not appear to be an unexpected vacancy in the fish guilds found in Reeder Creek that would be indicative of adverse effects of contaminants. There is a paucity of piscivorous fish but the small size of the stream would not support more than a few tertiary consumers. Some of the species of fish collected (e.g. common shiner and blacknose dace) are typically found in cool streams (Lee et al. 1980) which suggests that at least parts of Reeder Creek remain cool for most of the year. This raises the possibility that a missing component of the Reeder Creek fish community could be brook trout, especially since this species is often found in association with blacknose dace. However, there were few, if any, areas of the stream that would support trout spawning, since the interstitial spaces of any gravel beds were heavily imbedded with silt. This silt would tend to smother any brook trout eggs deposited in these gravel beds. Even without the silt, Reeder Creek is too small to support a substantial population of brook trout near the OB grounds.

Any abnormalities observed in the fish collected were also documented. There was a degree of subjectivity in these observations, since the time spent examining each fish was by necessity brief in an effort to quickly return collected fish alive to the stream. The most commonly observed abnormality were tumors (Table 3-15). At least some fish at every station had tumors. There was not a consistent trend in the percentage of fish with tumors, as the highest incidence was at reference station SW-196 and the lowest incidence was immediately downstream at station SW-150. Differential species sensitivity was evident, as blacknose dace usually had more tumors than other species. The cause of observed tumors cannot be definitely stated but may be associated with parasitic cysts. Dissection of tumors on 16 fish revealed the presence of unidentified parasites within all tumors. Many fish at all stations also had varying degrees of infestations of "black spot", thought to be the "black grub" phase of parasitic trematodes. Parasitic infestations are not directly caused by chemical agents, although in some instances there may be an indirect relationship due to reduction of the immunosuppressive abilities of effected organisms.

The only other abnormality observed was one creek chub with an asymmetrical caudal fin. Such occasional occurrences are typically found in most populations of fish and are not considered to be unusual.

TABLE 3 – 15

ABNORMALITIES OBSERVED IN FISH COLLECTED DURING THE PHASE I AQUATIC ECOLOGICAL ASSESSMENT

SENECA ARMY DEPOT
OB GROUNDS

STATION	SPECIES	NATURE OF ABNORMALITY	NUMBER OF INDIVIDUALS AFFECTED	PERCENT OF INDIVIDUALS AFFECTED	PERCENT OF ENTIRE COLLECTION AFFECTED (ALL SPECIES)
SW–110	Blacknose Dace	Tumors	12	80	15
SW–120	Blacknose Dace	Tumors	22	96	47
SW–130	White Sucker	Tumors	1	5	12
	Creek Chub	Tumors	2	50	
	Banded Killifish	Tumors	1	17	
	Blacknose Dace	Tumors	4	80	
SW–140	Blacknose Dace	Tumors	13	65	20
	Central Stoneroller	Tumors	1	8	
SW–150(S)*	White Sucker	Tumors	1	4	
	Creek Chub	Tumors	30	48	
	Creek Chub	Asymetrical caudal fin	1	2	7
	Blacknose Dace	Tumors	1	17	
(E)*	Creek Chub	Tumors	1	100	3
SW–196	Creek Chub	Tumors	1	100	81
	Bluntnose Minnow	Tumors	1	100	
	Blacknose Dace	Tumors	11	100	
Total			103		13

Notes:
1) (S)* = Seine collection
2) (E)* = Electroshocker collection

The results of the Phase I aquatic assessment indicate that the fish species in Reeder Creek which are potential aquatic receptors of contamination from the OB grounds are predominantly white suckers and minnows. Most, if not all, fish collected normally have fairly localized home ranges.

Localized movements of all species collected are expected in response to environmental factors such as low flow conditions. Another normal response of fish populations that exceed the carrying capacity of a stream reach is for some individuals to move into a less crowded portion of the stream. It is therefore possible that some fish move from the portion of Reeder Creek adjacent to the OB grounds to off-site, downstream locations. This could result in a limited number of fish (most likely minnows) moving into a class C(T) portion of Reeder Creek, where they would be susceptible to predation by piscivorous fish that may inhabit these off-site stream segments. It is considered unlikely that downstream movement would extend to the impassable barrier on Reeder Creek, which is approximately two miles downstream of Station SW-110. Therefore, predation on minnows originating from Reeder Creek on the SEDA by steelhead or rainbow smelt is considered highly improbable, since these sportfish are not expected to occur above this barrier.

Movement of fish from lower stream reaches upstream onto the SEDA is not possible under normal stream flows due to the presence of a culvert at the Depot fence line. Under high flow conditions, strong swimming fish may be able to move through the culvert, but this is not considered to represent a significant source of additional fish joining the existing fish community near the OB grounds.

The primary value of the fish community in Reeder Creek near the OB grounds is to fish-eating wildlife. Examples of wildlife that could consume the fish in Reeder Creek, as well as other aquatic organisms, include the northern water snake, various turtles, wading birds such as herons and egrets, and occasional ducks that may use the small beaver ponds, or other pools on this portion of the creek. Use of this area of the creek by such wildlife is considered to be minimal due to the small size of the stream and the availability of more suitable habitat elsewhere.

3.9.1.3 Benthic Invertebrates in the Drainage Swale

Results of the macroinvertebrate sampling program at three stations (Culvert, Midpoint, MW-17) in the drainage swale between Wetland #6 and Reeder Creek indicate that the benthic community is diverse (Table 3-16). Refer to Figure 3-20 for sampling locations. Overall 86 specimens represented by 42 taxa were collected and identified. Arthropods dominated the collection comprising approximately 48 percent of the total specimens collected, closely followed by annelid worms (41.7 percent). The remainder of the specimens collected were represented by various mollusks (10.5 percent).

Combining both replicates at each station, the greatest number of individuals (44) were collected at Culvert, followed by MW-17 (25) and finally Midpoint (14). Again combining both replicates, Culvert also exhibited the greatest number of taxa (17). The number of taxa however, between Midpoint and MW-17 were reversed from their individual collection ranks, where Midpoint had a greater number of taxa (14) than did MW-17 (12).

The dipteran insects dominated the arthropod collection with 30 individuals (34.8 percent) representing 11 taxa. Among the dipteran insects were biting midge larvae, midge larvae, crane fly larvae and several unidentified muscomorph genera. The remaining arthropods in order of abundance were centipedes (Chilopoda = 7.0 percent), sow bugs (Isopoda = 4.7 percent) and a beetle (Coleoptera = 1.1 percent). The distribution of insects across all three locations was scattered and no pattern of dominance was evident.

The larval stages of all of the dipteran insect families represented in this collection have both aquatic and semiaquatic genera, exhibiting a diversity of habitat requirements ranging from lakes ponds, streams, pools of stagnant water and mud. (Merritt and Cummins, 1978). However, the remaining arthropods collected, sow bug (Oniscoidea) centipede (Geopilomorpha) and ground beetle (Carabidae), are almost exclusively terrestrial (Borror and White, 1970).

The annelid worms, represented by the three orders, Tubificida (22.0 percent), Lumbricida (18.7 percent) and Lumbriculida (1.1 percent) are all earthworms (Oligochaetea). Tubificid worms were collected predominately at the Culvert station (18 of 19 total individuals) whereas, all of the Lumbricidae were collected at Midpoint (4) and MW-17 (8). The only Lumbriculidae collected also occurred at Culvert. The Tubificidae and the Lumbriculidae, collected mainly at Culvert, are groups which are found in aquatic environments, whereas the Lumbricidae collected at Midpoint and MW-17 are almost entirely terrestrial. Tubificid worms can tolerate extended periods of low oxygen, which may occur during dry periods, as can most of the aquatic worm species (Pennak, 1978). Therefore it is plausible that the aquatic species collected would occur in a drainage swale which experiences a changeable, often dry, hydrologic regime.

TABLE 3 – 16

TOTAL NUMBER AND RELATIVE ABUNDANCE OF MACROINVERTEBRATES COLLECTED DURING THE PHASE II AQUATIC ECOLOGICAL ASSESSMENT OF THE DRAINAGE SWALE IN PROXIMITY TO WETLAND # 6 AND REEDER CREEK ON THE SENECA ARMY DEPOT OB GROUNDS, MAY 1993

SENECA ARMY DEPOT
OB GROUNDS

CLASS Order Family Genus species	STATION CULVERT Replicate			STATION MIDPOINT Replicate			STATION MW – 17 Replicate			GRAND ORDINAL TOTAL	COMBINED RELATIVE ABUNDANCE
TAXON	1	2	Ordinal Total	1	2	Ordinal Total	1	2	Ordinal Total		
ANNELIDA											
Oligochaeta (earthworms)											
Lumbricida			4			4			8	16	18.6
Lumbricidae	4			1	3		1	7			
Lumbriculida			1							1	1.1
Lumbriculidae	1										
Tubificida			18						1	19	22.0
Enchytraeidae	3										
Tubificidae	14	1						1			
ARTHROPODA											
Crustacea											
Isopoda (sow bugs)			1			1			2	4	4.7
Oniscoidea	1				1		1	1			
Chilopoda											
Geophilomorpha (centipedes)	1	5	6							6	7.0
Insecta											
Coleoptera (beetles)						1				1	1.1
Carabidae					1						
Diptera (true flies)			11			8			11	30	34.8
Nematocera											
Ceratopogonida (biting midges)	4	2			1			2			
Chironomidae (midge larvae)											
Tanypodinae								4			
Chironominae											
Tanytarsini	1	1									
Orthocladiinae				2	1		3				
Tipulidae (crane fly larvae)											
tipulid g. A	1										
tipulid g. B								1			
tipulid pupa					1						
Brachycera											
Muscomorpha											
g. A	2										
g. B					1						
g. C					1						
g. D							1				
Unknown dipteran (fragment)					1						
MOLLUSCA											
Gastropoda											
Pulmonata			3			3			3	9	10.5
Lymnophila											
Lymnaeidae (pond snails)	1							1			
Physidae (pouch snails)											
Physella sp.				1							
Planorbidae (orb snails)											
Gyraulus parvus	2										
Unknown terrestrial family					1		2				
Stylommatophora (land slug)					1						
Total Taxa	12	4		3	11		5	7		42	
Total Specimans	35	9		4	13		8	17		86	99.8

The gastropod mollusks collected were few in number (9 individuals) yet diverse in taxa (5 taxon). Of the nine individuals identified, four families of pulmonate mollusks (Pulmonata) were unevenly distributed among three stations. Orb snails (Planorbidae) were present only at Culvert, pond snails (lymaeidae) were present at Culvert and MW-17, and pouch snails (Physidae) occurred at Midpoint only. The pond, pouch and orb snails are typically found in aquatic habitats. One unknown terrestrial gastropod family was encountered at both MW-17 and Midpoint, along with one land slug (Stylommatophora) at Midpoint. Dissolved oxygen is a limiting factor among the pulmonate group, many of which require rather high dissolved oxygen concentrations (Pennak, 1978). Therefore the paucity of mollusks of this type that would inhabit a drainage swale that holds water (thereby providing available oxygen) only temporarily such as that between Wetland #6 and Reeder Creek is not unexpected.

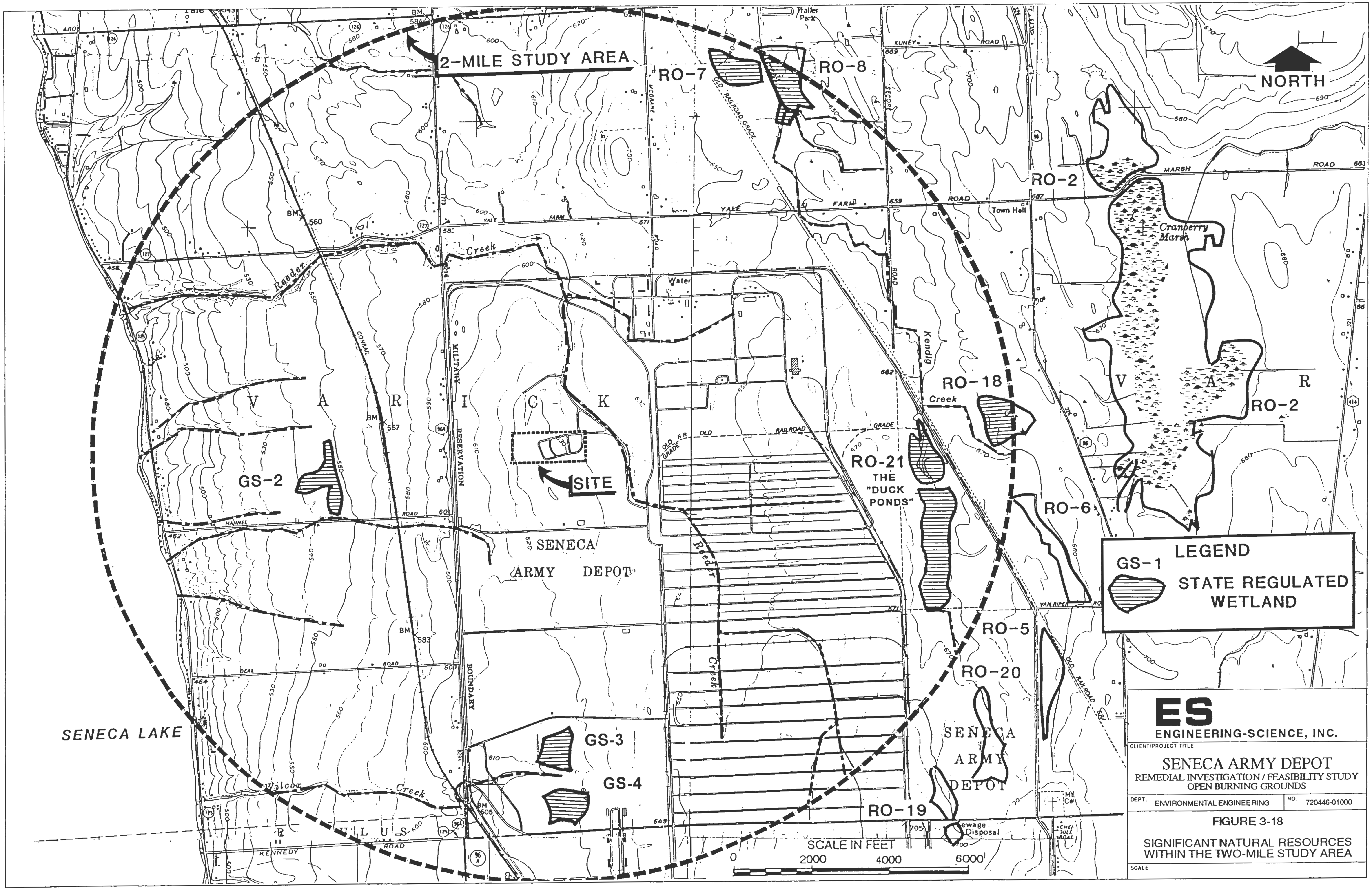
Although many of the taxa collected in this drainage swale are generally considered primary food sources to fish and amphibians, the potential for the macroinvertebrate community of this drainage swale providing a consistent or considerable food source to the fish and amphibians of Reeder Creek is low. The low potential to enter the aquatic food web is due to the short and infrequent periods during which water flows into the creek providing little transport to these organisms, in addition the habitat of Reeder Creek is much more suitable for aquatic invertebrates than the drainage swale.

The pollution indices utilized for the analysis of organisms in previous sections of this report, i.e. functional feeding groups of insect families, the absence or presence of indicator species through the use of pollution tolerance values and the relative abundance of EPT's compared to Chironomidae tolerance and other analyses, described in USEPA "Rapid Bioassessment Protocols For Use in Streams and Rivers: Benthic Macroinvetebrates and Fish" (1989) are inappropriate due the predominantly non-aquatic nature of this habitat.

3.9.2 Terrestrial Assessment Program

3.9.2.1 Significant Resources and Resources Used by Humans

According to the state regulated wetland maps there are seven New York State regulated wetlands within the 2-mile study area, but none are in close proximity to the site perimeter (Figure 3-18). The closest wetland is GS-2 which is over 4,400 feet west of the site perimeter. The other six regulated wetlands are over one mile from the site perimeter. GS-3 and GS-4 are to the south, RO-19 and RO-20 are to the east, while RO-7 and RO-8 are to the north-northeast. None of the seven regulated wetlands are hydrologically connected to Reeder Creek.



ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING NO. 720446-01000

FIGURE 3-18

SIGNIFICANT NATURAL RESOURCES WITHIN THE TWO-MILE STUDY AREA

SCALE

The only other significant terrestrial resource known to occur in the 2-mile study area is the rare population of white-pelaged white-tailed deer (Odocoileus virginiana), which inhabits the fenced SEDA (Buffington, 1991).

The white deer are rare but not unique. In discussions with state wildlife biologists, 2-3 white deer per year are aged at check stations in New York State. NYSDEC's harvest recommendations do not distinguish between white and brown, since the white deer are not a separate species. Designating the depot as a special habitat is not appropriate and will give rise to unnecessary comments from regulators. Historically, a white deer occurred during the 1950's, and was protected due to its uniqueness. Protection in the early years and inbreeding due to the fenced in areas gave rise to a white deer herd. The white coloration genetically is similar to white mice and white rabbits inbred in captivity, and in the wild, it is similar to arctic fauna.

The white deer are also not predominant; the deer herd is managed to keep the white to brown ratio to approximately 1/3. Since the whites are more easily seen, it appears that the whites are predominant. In close coordination with the NYSDEC wildlife biologists, annual harvests of the deer are managed using the NYSDEC deer herd size prediction model and aerial counts by Seneca. The whites are counted after the leaves fall, prior to the harvest, and the browns are counted after the harvest, when there is a good snow cover. The wintering herd for 1992-1993 included 123 whites and 213 browns.

In the 2-mile study area agricultural crops and deciduous forests comprise the vegetative resources used by humans. Although no crops are grown on the Depot, and therefore, the nearest crop land is over 1/2 mile from the site, farmland is the predominant land use in the surrounding private lands. Crops including corn, wheat, oats, beans and hay mixtures, are grown primarily for livestock feed. Deciduous forestland on the depot and surrounding private lands is under active forest management (Morrison 1992, SEDA 1992). Timber and firewood are harvested from private woodlots (Morrison, 1992). No timber harvesting occurs on the Depot (SEDA, 1992). Although there are woods and tree rows in proximity to the OB grounds these resources were observed to be in normal, healthy condition with no apparent impacts noted.

Within the 2-mile study area, there are several wildlife species which are hunted and trapped on private lands. Game species hunted include the eastern cottontail, white-tailed deer, ruffed grouse, ring-necked pheasant and various waterfowl. Gray squirrel and wild turkey are hunted to a lesser extent. Furbearing species trapped in this study area include red and gray fox and raccoon. Muskrat and beaver are trapped to a lesser extent (Woodruff, 1992). On the Depot, deer, waterfowl and small game hunting is allowed, although the designated waterfowl hunting area is outside the study area. Trapping is also permitted (SEDA, 1992).

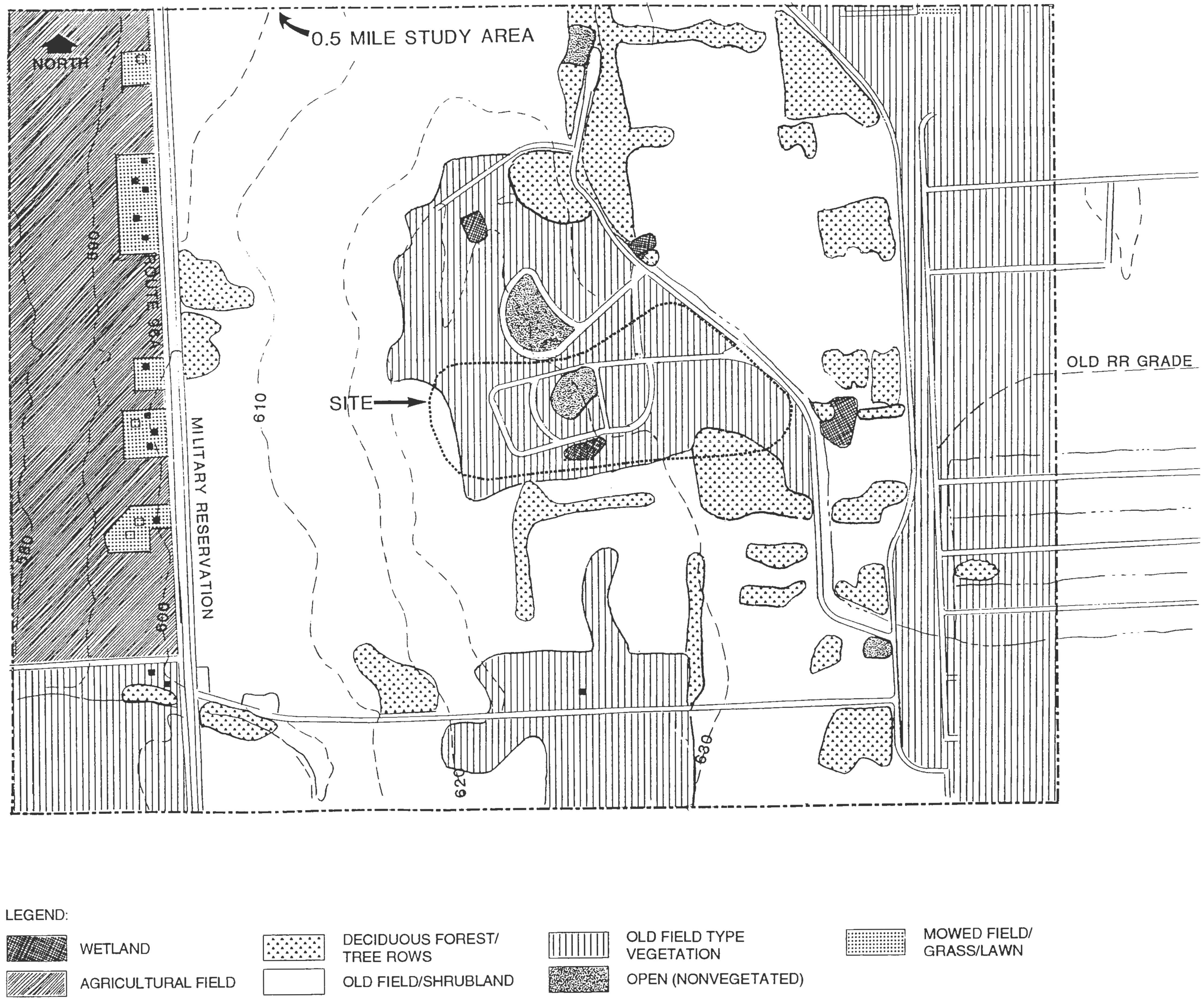
Due to the expected low population density of waterfowl in the OB grounds, no impact to these gamebirds is expected since few individuals are on the site. The same holds true for the populations of squirrel, gray fox, and ruffed grouse due to the limited forest habitat. The eastern cottontail, red fox and ring-necked pheasant would utilize the habitats (old fields) present on the OB grounds, although pheasant populations on the depot are low (SEDA, 1992). Raccoon would be found in all habitats on and adjacent to the OB grounds. Muskrat may occur in the wetlands and creek habitats, and beaver are known to inhabit nearby Reeder Creek. Those game and furbearing species with the most potential as receptors of OB ground contaminants would be the eastern cottontail, red fox, deer, raccoon and muskrat. Although deer have an average home range of a square mile, the other four species have more localized or smaller home ranges (Dalrymple, 1978).

In the future, any changes that may occur at the site (e.g., revegetation of the area and general improvement of habitat) could result in additional wildlife species being attracted to the site and exposure of these individuals to site contaminants would increase.

3.9.2.2 Vegetative Resources

The major vegetative communities in the 0.5-mile study area are primarily upland cover types. Some freshwater wetlands occur, principally on the OB grounds and along Reeder Creek. Reeder Creek, and another small unnamed tributary of Seneca Lake in the southwestern corner of the study area form the only aquatic environments. Figure 3-19 shows the location of the major cover types in the study area.

The upland cover types in the study area include old field type vegetation, shrubland, deciduous forests and agricultural fields. Old field and shrublands are the dominate cover types. Old fields are prevalent on the OB grounds and adjacent environs, as well as the ammunition storage area to the east and an area in the southern section of the study area. The old field type vegetation areas are sustained through periodic maintenance. Specifically, the old field area indicated in Figure 3-19 periodically bulldozed for fire control. These old fields are comprised of a mixture of herbaceous and shrub plant species with some small trees. Table 3-17 lists the various plant species associated with the four major cover types present



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ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO 720446-01000

FIGURE 3-19

NATURAL RESOURCES WITHIN 0.5 MILE OF THE OB GROUNDS

SCALE 1" = 700'

TABLE 3 – 17

PLANT SPECIES RECORDED IN THE VEGETATIVE COVER TYPES IN THE 0.5–MILE STUDY AREA

SENECA ARMY DEPOT
OB GROUNDS

PLANT SPECIES	VEGETATIVE COVER TYPE			
	OLD FIELD	SHRUBLAND	DECIDUOUS WOOD/ TREE ROWS	FRESHWATER WETLAND/ CREEK EDGE
TREES Eastern Red Cedar Juniperus virginiana		X	X	
Quaking Aspen Populus tremuloides	X	X	X	
Black Willow Salix niger				X
Staghorn Sumac Rhus typhina	X	X	X	
Smooth Sumac Rhus glabra	X	X	X	
American Elm Ulmus americana				X
Slippery Elm Ulmus rubra	X	X	X	
Sugar Maple Acer saccharum			X	
Red Maple Acer rubrum			X	X
Common Buckthorn Rhamnus cathartica		X		
Shagbark Hickory Carya ovata			X	
Bitternut Hickory Carya cordipormis			X	
Choke Cherry Prunus virginiana		X		
Black Locust Robinia pseudo–acacia		X	X	
Gray Dogwood Cornus racemosa	X	X		
Blue Beech Carpinus carolinana			X	
Yellow Birch Betula lutea	X	X		
Northern Red Oak Quercus rubra			X	
Black Oak Quercus velutina			X	
White Oak Quercus alba			X	
Chestnut Oak Quercus prinus			X	

TABLE 3 – 17

PLANT SPECIES RECORDED IN THE VEGETATIVE COVER TYPES IN THE 0.5–MILE STUDY AREA

SENECA ARMY DEPOT
OB GROUNDS

PLANT SPECIES	VEGETATIVE COVER TYPE			
	OLD FIELD	SHRUBLAND	DECIDUOUS WOOD/ TREE ROWS	FRESHWATER WETLAND/ CREEK EDGE
White Ash Fraxinus americana			X	
Hawthorn Crataegus sp.	X	X		
SHRUBS AND VINES Willow Salix sp.	X	X		X
Poison Ivy Rhus radicans			X	
Wild Grape Vitis sp.		X	X	
Red Raspberry Rubus idaeus	X	X		
Blackberry Rubus sp.	X	X		
Mulitflora Rose Rosa multiflora	X	X		
Wild Rose Rosa sp.	X	X		
Arrow–wood Viburnum recognition	X	X	X	
Bush Honeysuckle Lonicera sp.	X	X		
HERBACEOUS Sphagnum Moss Sphagnum sp.				X
Sensitive Fern Onodea sensibilis				X
Marsh Fern Dryopteris Thelypteris				X
Woodfern Dryopteris sp.			X	
Narrow–leaved Cattail Typha angustifolia				X
Panic Grass Panicum sp.	X	X		X
Common Reed Phragnites australis				X
Spike–rush Eleocharis sp.				X
Long Sledge Carex lonchocarpa				X
Rush Juncus sp.				X

TABLE 3 – 17

PLANT SPECIES RECORDED IN THE VEGETATIVE COVER TYPES IN THE 0.5–MILE STUDY AREA

SENECA ARMY DEPOT
OB GROUNDS

	VEGETATIVE COVER TYPE			
PLANT SPECIES	OLD FIELD	SHRUBLAND	DECIDUOUS WOOD/ TREE ROWS	FRESHWATER WETLAND/ CREEK EDGE
Wild Garlic Allium sp.	X			X
Sicklepod Arabis canadensis	X			
Treade Mustard Erysimum cheiranthoides	X			
Indian Strawberry Duchesnea indica	X			
Red Clover Trifolium Pratense	X			
Common Evening–primose Oenothera biennis	X			
Queen Anne's–lace Daucus carota	X			
Spreading Dogbane Apocynum androsaemifolium	X			
Blue Vervain Verbena hastala	X			
Common Mullein Verbascum thapsus	X			
Teasel Dipsacus sylvestris	X			
King Devel Hieracium pratense	X			
Canada Goldenrod Solidago canadensis	X			
Goldenrod Solidago sp.	X	X		
New England aster Aster noval–angliae	X			
Heath Aster Aster ericoides	X			
Beggerticks Bidens frontosa	X			
Yarrow Achillea millefolium	X			
Field Thistle Cirsium discolor	X	X		
Spotted Knapweed Centaurea maculosa	X			

in the area. Queen Anne's lace, panic grass, teasel, goldenrods, asters and field thistle are the most abundant species in these fields. Shrublands and old field type vegetation dominate much of the remaining Depot land surrounding the OB grounds in the study area. Shrublands are comprised primarily of shrubs and small trees with some herbaceous species. Gray-stemmed dogweed, raspberry and blackberry vines, multiflora rose, buckhorn, black locust, sumacs and wild grape are the most common shrubs and vines in this cover type. Prior to becoming part of the SEDA in 1941, most of the old fields and shrublands were active farmland. When they become part of the Depot and left fallow, these croplands succeeded to old fields and shrubland.

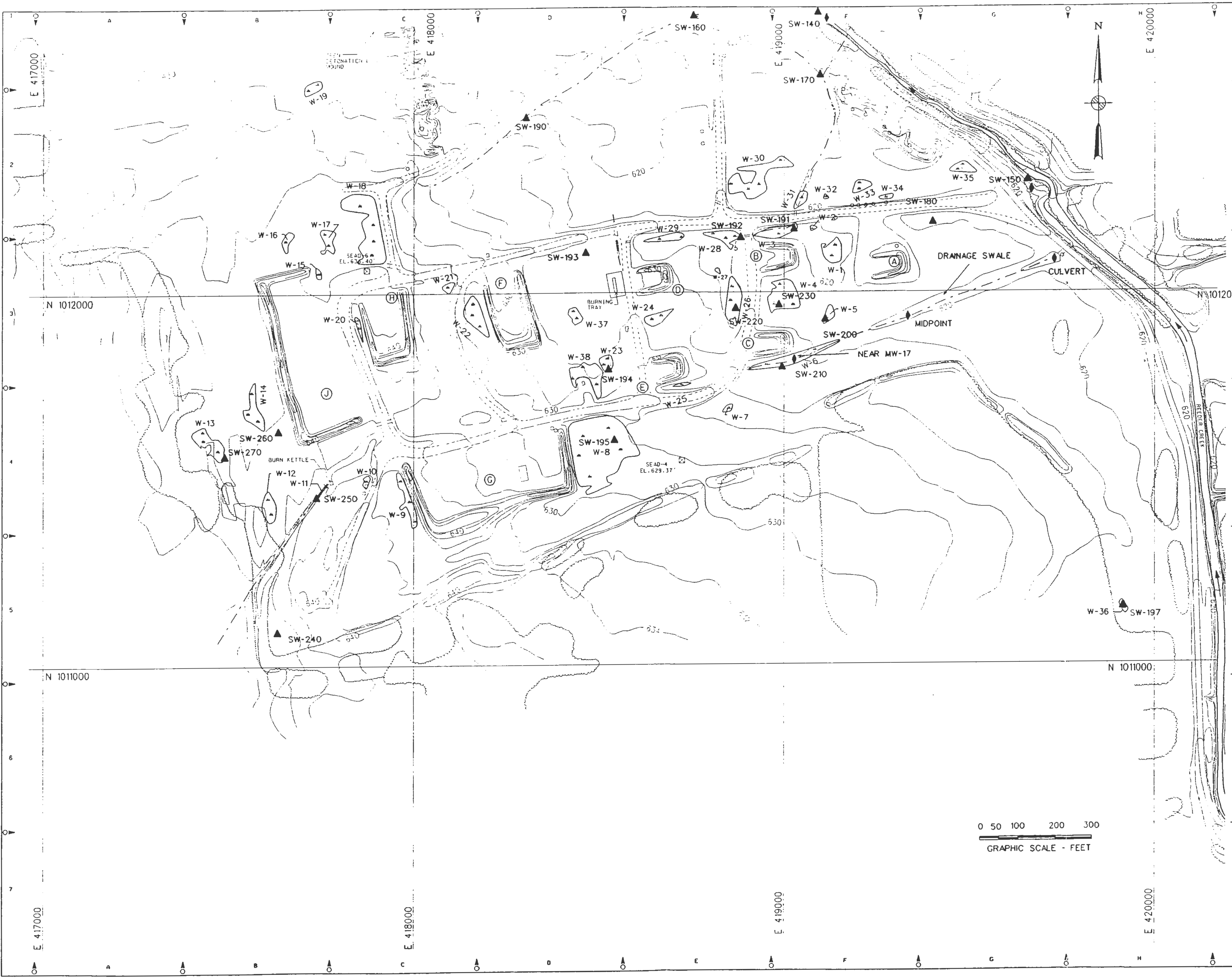
Agricultural fields are the next most prevalent cover type in the study area, but all occur on the privately owned farms in the western section. Crops typically grown in these cropfields surrounding the Depot include corn, wheat, soybeans, and various hay mixtures.

Deciduous forests comprise a relatively minor cover type in the study area and occur as woodlots and tree rows which line the fields, roads and the two streams. Various oaks, sugar maple, hickory, black locust, black cherry and aspens are the major overstory trees in these woodlots and tree rows.

Several non-vegetated areas occur on and near the OB grounds. The active demolition (bomb disposal) area is mostly bare ground because of the bulldozer earth moving and filling activities. The construction of the new ammunition incineration pad in the fall of 1991 resulted in some vegetative clearing and creation of bare soil conditions on and near the pad.

Several small freshwater wetlands are located on the OB grounds (Figure 3-20). Most of these emergent wetlands were created by soil excavation operations for the construction of the nine burn pad mounds. Several drainage ditches were also constructed to catch surface water runoff from the OB grounds and dirt roads. These ditches are also vegetated with emergent wetland plants. Narrow-leaved cattail is the most abundant and widely distributed emergent plant species in these areas. Rush and sphagnum moss also have wide distribution, but are not as abundant. Common reed has very limited distribution on the OB Grounds with only one dense stand of this tall emergent species located west of the active demolition area.

There are three other freshwater emergent wetlands within the study area, although all are small (0.3 to 1.2 acres) in size. Two of these wetlands are connected to the east side of Reeder Creek, directly east of the OB grounds, whereas the third wetland is to the northwest



LEGEND:

SW-197 SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION

PAVED ROAD

DIRT ROAD

650 GROUND CONTOUR AND ELEVATION

UTILITY POLE

TREE

BRUSH

W-1 WETLAND & DESIGNATION

RUNOFF SWALE

Ⓓ BURNING PAD DESIGNATION

CULVERT

☒ MONUMENT AND DESIGNATION
SEAD-4
EL.629.37'

♦ BENTHIC INVERTEBRATE SAMPLING DESIGNATION
CULVERT

NOTE: BENTHIC INVERTEBRATE SAMPLING WAS CONDUCTED ON REEDER CREEK AT STATIONS SW110, SW120, SW130, SW140, SW150, AND SW196. REFER TO FIGURE 2-4 FOR LOCATIONS OF SW110, SW120, SW130, AND SW196.

BENTHIC INVERTEBRATE SAMPLING WAS ALSO CONDUCTED IN THE DRAINAGE SWALE NEAR THE ROAD CULVERT, AT THE MIDPOINT, AND NEAR MW-17.

REV	DATE	DESCRIPTION	DRAWN	CHECKED	DES.SUPV.	RESP.ENGR.	CH.DISC.ENG.	PROJ. MGR.
B	[illegible]	PRE-DRAFT PHASE II- RI/FS						
A	[illegible]	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT						

DRAWN BY E.SCHACHT	CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAELIN	RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. M.E.BAKER	MGR. OF ENGR. J.P.CHAPLICK

PROJECT MANAGER
M.N.DUCHESNEAU

MGR. OF PROJECTS
J.P.CHAPLICK

IN CHARGE
W.D.PATTERSON

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 3-20
LOCATION OF FRESHWATER WETLANDS

SCALE 1" = 250'

ES DWG. NO.
720446-01022-3-20

REV

24-JAN-1994 17:44 /usr/s13/environ/misc/senp2t5.dgn of the active demolition area. Two of the wetlands are dominated by narrow-leaved cattail, while the third is comprised of narrow-leaved cattail and common reed. This latter wetland was artificially created since it is a former shale excavation pit.

3.9.2.3 Wildlife Resources

The wildlife species expected to inhabit the 0.5 mile study area would be those typically occurring in the central New York region including some 18 species of amphibians, 15 species of reptiles, 166 species of birds, and 48 species of mammals. The complete list of wildlife species potentially found within this area is in Tables 3-18 through 3-20. The most prevalent wildlife would be upland species, particularly those preferring old fields and shrublands, since these are abundant habitats in the study area. Such wildlife species would include the American toad, eastern garter snake, northern cardinal, and woodchuck. The mixture of these habitats with small woodlots and tree rows provides ideal habitat for the white-tailed deer which is common throughout the Depot. This combination of habitats is present within the study area, so it is expected that deer populations in the area would be high. The mixture of these upland habitats is also excellent for other wildlife such as the wood turtle, red-tailed hawk and raccoon. Reeder Creek provides a source of drinking water for deer and other wildlife, as well as permanent habitat to the northern water snake, pickerel frog and muskrat. The agricultural fields outside the Depot would serve as a source of food (grain, vegetation, insects) to many wildlife species, including deer, raccoon, mourning dove, common grackle and ring-billed gull. Since woodland habitat is relatively limited in the study area, populations of strictly forest-dwelling species such as the gray squirrel, blue jay and four-toed salamander would be small. However, species richness is usually high in forested habitats. The series of small emergent wetlands in the study area do not comprise significant wildlife habitat due to their size. Frogs, salamanders and a few ducks would use the study area's wetlands. Much larger, higher quality wetland habitats occur on and off the Depot to attract waterfowl and other waterbirds.

Overall, the mixture of old fields, shrublands, woodlots, tree rows, agricultural fields and two small streams provides valuable wildlife habitat in the study area, although similar habitats are abundant on and surrounding the Depot. Expected wildlife species diversity would be relatively high in the study area due to the variety of habitats present. The numbers and species of wildlife observed during the late fall surveys were actually low, but this was undoubtedly due to the time of year since many mammals, reptiles and amphibians would have gone into hibernation and only winter resident birds were present (Table 3-21). During the

TABLE 3 – 18

AMPHIBIANS AND REPTILES POSSIBLY OCCURRING IN THE O.5–MILE STUDY AREA FOR THE SENECA ARMY DEPOT OB REMEDIAL INVESTIGATION

SENECA ARMY DEPOT
OB GROUNDS

COMMON NAME	SCIENTIFIC NAME
AMPHIBIANS	
Mudpuppy*	Necturus maculosus
Red–spotted Newt**	Notophthalmus viridenscens
Jefferson Salamander*	Ambystoma jeffersonianum
Spotted Salamander*	Ambystoma maculatum
Northern Dusky Salamander*	Desmognathus fuscus
Northern Two–lined Salamander	Eurycea bislineta
Northern Spring Salamander*	Gyrinaphilus porphyriticus
Four–toed Salamander*	Hemidactylium scutalum
Red–backed Salamander*	Plethodon cinereus
Slimy Salamander	Plethodon glutinosus
American Toad**	Bufo americanus
Spring Peeper*	Hyla crucifer
Gray Treefrog	Hyla versicolor and H. chrysoscelis
Green Frog**	Rana clamitans
Bullfrog**	Rana catesbeiana
Pickeral Frog*	Rana palustris
Northern Leopard Frog*	Rana pipiens
Wood Frog*	Rana sylvatica
REPTILES	
Snapping Turtle*	Chelydra serpentina
Stinkpot*	Sternotherus odoratus
Spotted Turtle*	Clemmys guttata
Wood Turtle*	Clemmys insculpta
Midland Painted Turtle*	Chrysemys picta
Northern Water Snake*	Natrix sipedon
Eastern Garter Snake**	Thamnophis sirtalis
Northern Ribbon Snake*	Thamnophis sauritus
Northern Red–bellied Snake*	Storeria occliptomaculata
Northern Brown Snake*	Storeria dekayi
Northern Ringneck Snake*	Diadophis punctatus
Eastern Smooth Green Snake*	Opheodrys vernalis
Northern Black Racer*	Coluber constrictor
Black Rat Snake*	Elaphe obsoleta
Eastern Milk Snake*	Lampropeltis triangulum

Notes:

1) * Species known to occur at the nearby Montezuma Wildlife Refuge according to U.S. Fish and Wildlife Service and N.Y. State Department of Environmental Conservation (1991).

2) ** Species known to occur at Depot (U.S. AEHA 1980), in addition to Montezuma Wildlife Refuge.

TABLE 3 – 19

BIRD SPECIES POSSIBLY OCCURRING IN THE 0.5 MILE STUDY AREA FOR THE SENECA ARMY DEPOT OB REMEDIAL INVESTIGATION

SENECA ARMY DEPOT
OB GROUNDS

COMMON NAME	SCIENTIFIC NAME
Pied–billed Grebe*	Podilymbus podiceps
American Bittern*	Botaurus lentiginosus
Least Bittern*	Ixobrychus exilis
Great Blue Heron*	Ardea herodias
Great Egret	Casmerodius albus
Snowy Egret	Egretta thula
Little Blue Heron	Florida caeruea
Green–backed Heron	Butorides striatus
Black–crowned Night Heron	Nyciticorax nyciticorax
Canada Goose*	Branta canadensis
Wood Duck*	Aix sponsa
Green–winged Teal	Anas crecca
American Black Duck	Anas rubripes
Mallard*	Anas platyrhynchos
Northern Pintail	Anas acuta
Blue–winged Teal*	Anas discors
Northern Shoveler	Anas clypeata
Gadwall	Anas strepera
American Widgeon	Anas wigeon
Hooded Merganser*	Lophodytes cucculatus
Turkey Vulture*	Cathartes aura
Northern Harrier*	Circus cyaneus
Sharp–shinned Hawk	Accipiter striatus
Cooper's Hawk	Accipiter cooperii
Northern Goshawk*	Accipiter gentilis
Red–shouldered Hawk*	Buteo lineatus
Broad–winged Hawk	Buteo platypterus
Red–tailed Hawk*	Buteo jamaicensis
Rough–legged Hawk	Buteo lagopus
American Kestrel*	Falco sparverius
Ring–necked Pheasant*	Phasianus colchicus
Ruffed Grouse	Bonasa umbellus
Wild Turkey*	Melegris gallopavo
Virginia Rail	Rallus limicola
Sora	Porzana carolina
Common Moorhen*	Gallinula chloropus
American Coot	Fulica americana
Killdeer*	Charadrius vociferus ♀
Spotted Sandpiper*	Actitis macularia
Upland Sandpiper*	Bartramia longicauda
Common Snipe*	Capella gallinago
American Woodcock*	Philohela minor
Ring–billed Gull	Larus delawarensis
Herring Gull	Larus argentatus
Greator Black–backed Gull	Larus marinus
Rock Dove*	Columba livia
Mourning Dove*	Zenaida macroura
Black–billed Cuckoo*	Coccyzus erythropthalmus
Yellow–billed Cuckoo	Coccyzus americanus
Common Barn Owl*	Tyto alba
Eastern Screech Owl*	Otus asio
Great Horned Owl*	Bubo virginianus
Snowy Owl	Nytca scandiaca
Barrred Owl	Strix varia
Short–eared Owl	Asio flammeus
Long–eared Owl	Asio otus
Common Nighthawk*	Chordeiles minor

TABLE 3 – 19

BIRD SPECIES POSSIBLY OCCURRING IN THE 0.5 MILE STUDY AREA FOR THE SENECA ARMY DEPOT OB REMEDIAL INVESTIGATION

SENECA ARMY DEPOT
OB GROUNDS

COMMON NAME	SCIENTIFIC NAME
Whip–poor–will	Caprimulgus vociferus
Chimney Swift*	Chaetura pelagica
Ruby–throated Hummingbird*	Archilochus colubris
Belted Kingfisher*	Megaceryle alcyon
Red–headed Woodpecker*	Melanerpes erythrocephalus
Red–bellied Woodpecker*	Melanerpes carolinus
Yellow–bellied Sapsucker	Sphyrapicus varius
Downy Woodpecker*	Picoides pubescens
Hairy Woodpecker*	Picoides villosus
Common Flicker*	Colaptes auratus
Pileated Woodpecker*	Dryocopus pileatus
Eastern Wood Pewee*	Contopus virens
Acadian Flycatcher	Empidonax virescens
Alder Flycatcher	Empidonax alnorum
Willow Flycatcher*	Empidonax traillis
Least Flycatcher*	Empidonax minimus
Eastern Phoebe*	Sayornis phoebe
Great Crested Flycatcher*	Myiarchus crinitus
Eastern Kingbird*	Tyrannus tyrannus
Horned Lark*	Eremophila alpestris
Purple Martin*	Progne subis ♀
Great Crested Flycatcher*	Myiarchus crinitus
Tree Swallow*	
Northern Rough–winged Swallow*	Stelgidopteryx ruficollis
Bank Swallow	Riparia riperia
Cliff Swallow	Petrochelidon pyrrhonota
Barn Swallow*	Hirundo rustica
Blue Jay*	Cyanocitta cristata
American Crow*	Corvus brachyrhynchos
Black–capped Chickadee*	Parus atricapillus
Tufted Titmouse*	Parus bicolor
Red–breasted Nuthatch	Sitta canadensis
White–breasted Nuthatch*	Sitta carolinensis
Brown Creeper*	Certhia familiaris
Carolina Wren*	Thryothorus ludovicianus
House Wren*	Troglodytes aedon
Winter Wren	Troglodytes troglodytes
Marsh Wren*	Cistothorus palustris
Golden–crowned Kinglet	Regulus satrapa
Ruby–crowned Kinglet	Regulus calendula
Blue–gray Gnatchatcher*	Polioptila caerulea
Eastern Bluebird*	Sialia sialis
Veery*	Catharus minimus
Gray–cheeked Thrush	Catharus fuscescens
Swainson's Thrush	Catharus ustulatus
Hermit Thrush	Cathdrus guttatus
Wood Thrush*	Hylocichla mustelina
American Robin*	Turdis migratorius
Gray Catbird*	Dumetella carolenensis
Northern Mockingbird	Mimus polyglotto
Brown Thrasher*	Toxostoma rufum
Water Pipit	Anthus spinoletta
Cedar Waxwing*	Bombycilla cedrorum
European Starling*	Sturnus vulgaris
Solitary Vireo	Vireo solitarius
Yellow–throated Vireo	Vireo flavifrons
Warbling Vireo*	Vireo gilvus

TABLE 3 – 19

BIRD SPECIES POSSIBLY OCCURRING IN THE 0.5 MILE STUDY AREA FOR THE SENECA ARMY DEPOT OB REMEDIAL INVESTIGATION

SENECA ARMY DEPOT
OB GROUNDS

COMMON NAME	SCIENTIFIC NAME
Red–eyed Vireo*	Vireo olivaceus
Blue–winged Warbler*	Vermivora pinus
Golden–winged Warbler	Vermivora chrysoptera
Tennessee Warbler	Vermivora peregrina
Orange–crowned Warbler	Vermivora celata ♀
Yellow–throated Vireo	Vireo flavifrons
Nashville Warbler	Vermivora ruficapilla
Northern Parula	Parula americana
Yellow Warbler*	Dendroica petechia
Chestnut–sided Warbler*	Dendroica pensylvanica
Magnolia Warbler	Dendroica magnolia
Black–throated Blue Warbler	Dendroica caerulescens
Black–throated Green Warbler	Dendroica virens
Blackburnian Warbler	Dendroica fusca
Pine Warbler	Dendroica pinus
Cerulean Warbler	Dendroica caerulea
Black–and–white Warbler*	Minotilta varia
American Redstart*	Setophaga ruticilla
Ovenbird*	Seiurus aurocapillus
Northern Waterthrush*	Seiurus noveboracensis
Mourning Warbler*	Oporornis philadeplua
Common Yellowthroat*	Geothlypis trichas
Canada Warbler	Wilsonia canadensis
Yellow–breasted Chat*	Icteria virens
Scarlet Tanager*	Piranga olivacea
House Sparrow*	Passer domesticus
Northern Cardinal*	Cardinalis cardinalis
Rose–breasted Grosbeak*	Pheucticus ludovicianus
Indigo Bunting*	Passerina cyomea
Rufus–sided Towhee*	Pipilo erythrophtalmus
American Tree Sparrow*	Spizella arborea
Chipping Sparrow*	Spizella passerina
Field Sparrow*	Spizella pusilla
Vesper Sparrow*	Pooecetes gramineus
Savannah Sparrow*	Passerculus sandwichensis
Grasshopper Sparrow*	Ammodramus savannarum
Song Sparrow*	Melospiza melodia
Swamp Sparrow*	Melospiza georgiana
Sparrow	Zonotrichia albicollis
Henslow's Sparrow*	Ammodramus henslowii
Northern Junco	Junco hyemalis
Bobolink*	Dolichonyx oryzivorus
Red–winged Blackbird*	Agelaius phoeniceus
Eastern Meadowlark*	Sturnella magna
Common Grackle*	Quiscalus quiscula
Brown–headed Cowbird*	Molothrus ater
Northern Oriole*	Icterus galbula
Purple Finch	Carpodacus purpureus
House Finch	Carpodacus mexicanus
Common Redpoll	Carduelis flammea
Pine Siskin	Carduelis pinus
American Goldfinch*	Carduelis tristis
Evening Grosbeak	Hesperiphona vespertina
Fox Sparrow	Passerella iliaca

Notes:

1) * Observed on Seneca Army Depot (SEAD 1992, U.S. AEHA 1980); other species listings based on U.S. Fish and Wildlife Service and N.Y. State Department of Environmental Conservation (1991) and Peterson (1980).

TABLE 3 – 20

MAMMAL SPECIES POSSIBLY OCCURRING IN THE 0.5 MILE STUDY AREA FOR THE SENECA ARMY DEPOT OB REMEDIAL INVESTIGATION

SENECA ARMY DEPOT
OB GROUNDS

COMMON NAME	SCIENTIFIC NAME
Opossum*	Didelphis marsupialis
Masked Shrew**	Sorex cinereus
Longtail Shrew*	Sorex dispar
Northern Water Shrew*	Sorex palustris
Pygmy Shrew*	Microsorex hovi
Least Shrew*	Cryptotis parva
Short–tailed Shrew**	Blarina brevicauda
Starnose Mole*	Condylura cristata
Hairytail Mole*	Parascalops breweri
Little Brown Myotis*	Myotis lucifugus
Keen Myotis*	Myotis Keeni
Small–footed Myotis	Myotis subulatus
Silver–haired Bat*	Lasionycteris noctivagans
Eastern Pipestrel*	Pipistrellus subflavlus
Big Brown Bat*	Eptesicus fuscus
Red Bat*	Lasiurus borealis
Hoary Bat*	Lasiurus cinerius
Raccoon*	Procyon lotor
Short–tailed Weasel*	Mustela erminea
Long–tailed Weasel*	Mustela frenata
Mink*	Mustela vison
River Otter	Lutra canadensis
Striped Skunk*	Mephitis mephitis
Coyote*	Canis latrans
Red Fox*	Vulpes fulva
Gray Fox	Urocyon cinereoargenteus
Bobcat	Lynx rufus
Woodchuck*	Marmota monax
Eastern Chipmunk*	Tamias striatus
Eastern Gray Squirrel*	Sciurus carolinensis
Red Squirrel*	Tamiasciurus hudsonicus
Northern Flying squirrel*	Glaucomys sabrinus
Beaver*	Castor canadensis
White–footed Mouse**	Peromyscus leucopus
Deer Mouse**	Peromyscus maniculatus
Southern Bog Lemming*	Synaptomys cooperi
Boreal Redback Vole*	Clethrionomys gapperi
Meadow Vole**	Microtus pennsylvanicus
Pine Vole*	Pityms pinetorium
Muskrat*	Ondatra zibethica
Norway Rat	Rattus norvegicus
House Mouse**	Mus musculus
Meadow Jumping Mouse**	Zapus hudsonius
Woodland Jumping Mouse*	Napaeozapus insignis
Porcupine*	Erethizon dorsatum
Snowshoe Hare	Lepus americanus
Eastern Cottontail*	Sylvilagus floridanus
White–tailed Deer*	Odocoileus virginianus

Notes:

1) * Species known to occur in Upstate New York (SEAD 1992).

2) ** Species known to occur at or near Seneca Army Depot Ash Landfill area based on 1991 small mammal trapping and/or trapping at Wetland Wastewater Treatment area (U.S. AEHA 1980).

TABLE 3 – 21

BIRDS OBSERVED IN THE 0.5–MILE STUDY AREA DURING THE FALL 1991 SURVEYS

SENECA ARMY DEPOT
OB GROUNDS

BIRD SPECIES	NUMBER OBSERED BY HABITAT			
	OLD FIELD	DECIDUOUS WOODS	REEDER CREEK	OTHER
Mallard			2	
Sandpiper (unidentified)				6*
Ring–necked Pheasant	1			
Mourning Dove	2			
Blue Jay		1		1**
Common Crow				2**
Black–capped Chickadee		15		
American Robin		1		
Eastern Meadowlark	3			
Northern Junco		2		

Notes:
1) * Small water pool in active ammunition demolition area.
2) ** Flying over area.

surveys no reptiles were observed, and the only amphibians noted were a few salamanders and green frog tadpoles in Reeder Creek and the beaver ponds. White-tailed deer, woodchuck, gray squirrel, mice and voles (Cricetidae), and beaver comprised the only mammals that were observed at the site (Table 3-22).

3.9.2.4 Stressed or Altered Terrestrial Biota

No signs of stressed or altered terrestrial biota (vegetation and wildlife species) were observed during the surveys in the 0.5-mile study area. Due to late fall period of the surveys, many of the plant species had naturally lost their leaves or had been killed by frost and cold. However, there was no indications of unnatural die-off or stunted vegetation.

3.9.2.5 Potential Terrestrial Receptors

The results of the Phase I terrestrial assessment indicate that five vegetative communities are potential receptors of possible contamination from the OB grounds. The old fields and small wetlands, as well as some drainage ditches, presently occupy the OB grounds and would have the highest potential as terrestrial receptors. The other vegetative communities, including shrubland, deciduous wood lots and tree rows, and agricultural fields (off the Depot), as well as other old fields and small wetlands, would be less likely to be receptors due to their distance from the site. However, a field reconnaissance of the OB grounds and some of the adjacent environs indicated that the existing vegetative communities are all visibly healthy and appear normal in terms of species composition and density. No community that should be present was missing. The dominance of certain communities in the study area was due to past disturbances and activities associated with the burning and demolition, as well as wildlife management practices, and cannot be attributed to OB grounds contamination.

State regulated wetlands are the only significant vegetative resource in the vicinity of the OB grounds. Their far distance away from the grounds (0.8 mile or greater) probably precludes these large wetland communities from contamination influence. This is likely the case for the agricultural crops, one of the two vegetative resources used by man. The other, deciduous woods in the study area, are under SEDA forest management, but also appear to be in a healthy, normal condition.

The vegetative and wildlife species inhabiting the old fields, wetlands and ditches on the OB grounds would have the highest potential as receptors of contamination. Those having the lowest potential would be the plants and wildlife species inhabiting the shrublands, deciduous forest and tree rows, and agricultural fields, as well as other old fields and small wetlands, beyond the OB grounds. The white-tailed deer is the only big game species hunted in the study area, as well as being the only significant wildlife resource in its rare white-pelaged form. Deer utilize all habitat types in the study area, including those on the OB grounds. Observations of the deer herd in the study area showed this game population to be in healthy condition. Waterfowl and other small game species are hunted on the Depot, although waterfowl are not hunted in or near the OB grounds. In addition, waterfowl usage of the OB grounds and vicinity would be limited due to the small size of waterfowl habitat. The eastern cottontail, red fox, raccoon and muskrat are the game and furbearing species with the most potential as receptors since they would inhabit the OB grounds. Other game and furbearing species with less potential for exposure include the ruffed grouse, wild turkey, ring-necked pheasant, gray squirrel and beaver since these wildlife species would occur in habitats outside the OB grounds. Many non-game wildlife species are potential receptors, in particular those which are permanent residents and have localized home ranges such as amphibians, reptiles, small mammals, and some small non-migratory birds.

4.0 NATURE AND EXTENT OF CONTAMINATION

This section presents the results of the analyses of all media sampled during the OB grounds RI. The results of the Level II screening are presented, followed by a discussion of the geostatistical modeling of the grid borings, the low-hill, and the sediment sampling data.

Following these discussions, the Phase I and Phase II data are discussed on a pad by pad basis. Geostatistical modelling contours are then presented for the samples collected from the grid borings, the low-hill, and sediment samples. The geostatistical contours have been prepared using a technique called "kriging" which has been used to define the extent of impacts beyond the boundary of the individual burn pads. The final two sections presented describe the results of both the surface water and the groundwater sampling.

4.1 LEVEL II SCREENING ANALYSIS

4.1.1 Objective of Level II Screening

As described is the original workplan submitted by MAIN (1991), Level II screening was performed on all soil samples collected from the pad and grid borings and from the berm and low-hill excavations. At all pad and grid boring locations, the surface soil sample was sent for Level IV analysis and did not undergo any Level II screening. The surface soil samples were to be used to assess risk and a high degree of data quality (i.e. Level IV) was needed to achieve the data quality objectives for this project. Level II screening was also not performed on all surface water, sediment, and groundwater samples as these were submitted directly for Level IV analyses.

The reasons for performing Level II screening were as follows:

- Cost - Level II screening was approximately four (4) times less costly than Level IV analyses.
- Efficiency - It was determined that screening could provide a basis for selecting samples for vertical profiling.

- Applicability - Previous investigations had identified heavy metals and explosives as the s of concern which helped focused the choice of screening s. Methodologies were available to provide acceptable Level II data.

- Turnaround Time - Level II results were available within 24 to 48 hours enabling the field personnel to make decisions concerning field operations. Level IV analyses require up to 35 days to be completed.

4.1.2 Procedures Used For Level II Screening

Level II screening work was performed for lead, TNT and volatile organics. All sample screening was performed under controlled conditions in the laboratory. The method used for screening explosives (i.e., TNT) was developed by the U.S. Army Cold Regions Research & Engineering Laboratory (CRREL). The method is based upon written procedures published as a special report entitled "Development of a Simplified Field Method for the Determination of TNT in Soil." A review of existing data indicated that 2,4,6-TNT was a reasonable indicator compound for explosives screening.

The procedure for screening explosives in soils involves extracting the explosives in acetone. The red colored Jackson-Meisenheimer anion is produced by the addition of KOH, and Na_2SO_3. The absorbance of the anion is then determined by spectrographic analysis using a Spectronic 20 or equivalent.

A review of the existing data indicated that lead was a suitable indicator compound for the presence of heavy metals in soil. The screening methodology for lead followed the identical sample preparation steps as those which were required for Level IV analysis. The only difference between the screening method and the Level IV analyses is the amount of QA/QC supporting information performed. The screening of heavy metals in soil involved an acid extraction followed by analysis using Inductively Coupled Plasma Emission spectroscopy (ICP).

The screening of volatile organics was performed both in the field and in the laboratory. An organic vapor analyzer was used in the field to determine the presence of volatiles in the headspace. In the laboratory, soil was extracted using standard purge and trap techniques and was analyzed using a Gas Chromatograph equipped with both a PhotoIonization Detector (PID) and a Flame Ionization Detector (FID). The total volatile organics concentration determined from the PID was quantified relative to TCE, whereas, the total volatile organics concentration determined from the FID was quantified relative to benzene.

Section 4.2.2.3 of the original workplan summarized the procedures the laboratory followed to determine which of the soil samples would be analyzed using Level IV methods. The samples sent for Level II and Level IV analyses are summarized in Tables 2-7, 2-8, and 2-9. The Level II screening was performed on all soil samples collected from the grid and pad borings as well as the berms and the low-hill excavations.

As previously mentioned at each grid and pad boring location the surficial soil grab sample was sent directly for Level IV analysis. The remaining soil samples collected from the grid and pad borings were sent for screening. Based upon this data, one additional soil sample from each grid and pad boring was sent for Level IV analysis. For the berm and low-hill excavations, approximately one-half of all the samples were selected, based upon the screening results, for Level IV analysis.

4.1.3 Level II Versus Level IV Results

In order to evaluate the overall effectiveness of the Level II screening program, it was necessary to compare the Level II and Level IV results. Since samples with low concentrations reported by the Level II results were not included in the risk assessment, it was important to assure that these low results were accurate in comparison with the Level IV results in order to ensure that no samples which could add to the overall site risk were omitted from the risk assessment. In other words, a comparison of the Level II and Level IV results ensured that the Less II screening did not indicate false negative (no contamination) results.

A second step was necessary in evaluating lead results. For lead, it was also necessary to ensure that low lead results corresponded to low concentrations of the other metals of concern, barium, copper, and zinc. The results of this evaluation are described below.

The compound 2,4,6-trinitrotoluene (TNT) was chosen as the indicator compound to be used for Level II explosives screening. The results of the Level II screening, and the associated Level IV sample analysis results are presented in Table 4-1.

SENECA ARMY DEPOT
OB GROUNDS

TABLE 4–1
LEVEL II vs. LEVEL IV ANALYSES
EXPLOSIVES IN SOILS (mg/Kg)

PHASE	SAMPLE NUMBER	LEVEL II mg/kg	LEVEL IV mg/kg
II	LH–36–92	1.00	0.60
II	BE–B–3–92	1.00	1.45
I	PB–B1–5–91	1.01	1.18
I	BE–F–1–91	1.02	2.51
II	LH–9–92	1.10	0.60
I	PB–G1–6–91	1.11	NA
I	BE–C–2–91	1.11	1.05
I	BE–H–3–91	1.12	3.01
I	GB–5–2	1.15	1.16
I	BE–H–2–91	1.18	0.97
I	BE–B–2–91	1.27	1.50
II	BE–G–11–92	1.30	0.61
II	BE–F–5–92	1.30	4.00
II	LH–6–92	1.40	0.60
II	BE–C–5–92	1.40	1.78
I	BE–G–6–91	1.41	NA
I	BE–G–3–91	1.46	2.53
I	PB–A–2A–91	1.46	0.60
I	BE–G–1–91	1.47	1.90
I	BE–G–5–91	1.64	NA
I	PB–G1–2–91	2.60	NA
I	BE–G–2–91	3.40	9.93
I	BE–D–2–91	12.50	0.64
I	PB–G1–3–91	24.00	1.41
I	BE–F–2–91	29.00	39.38
I	BE–F–2A–91	69.00	91.65

NOTES:
1) Level II results reflects screening results for 2,4,6–Trinitrotoluene.
2) Level IV results reflect total explosives.
3) The shading indicates that there were no detects. The value is one half the sum of the detection limits for that sample.
4) NA = Samples did not undergo Level IV analyses.

A total of 295 soil samples were screened. The Level II screening analyses detected explosives, as TNT, in 1 grid boring, 5 pad borings, 3 low hill samples and 17 berm excavation soil samples. Of these 26 samples, 22 underwent Level IV analysis. Of the 22 samples analyzed using Level IV methods, 17 had explosive compounds present above the detection limits. The results of the Level II and Level IV analyses are presented in Table 4-1. The Level II data represent the screening results for TNT while the Level IV data presents the concentration of the total explosives found in each soil sample, as determined from the Method 8330 analysis for explosives. Although the screening method used was an indicator for TNT, the Jackson-Meisenheimer anion, produced during the analysis, will form in the presence of other aromatic nitrate compounds. Accordingly, the screening method probably detected the presence of other explosive compounds present and therefore the screening data is probably a better indicator of total explosive compounds rather than only TNT.

The highest concentrations of TNT were detected in the sample BE-F-2A taken from the berm surrounding Pad F. The Level II analysis indicated a concentration of 69 mg/kg of TNT, while the level IV explosive analysis determined 91.65 mg/kg of total explosives to be present. A regression analysis comparing the results of the Level II versus Level IV data has been performed. Figure 4-1 shows a plot of the Level II versus the Level IV data along with a plot of the best fit regression line. The regression analysis yielded an R-squared value of 0.875, which is indicative of a strong linear relationship existing between the Level II and Level IV results. The slope of the best fit regression line was determined to be 1.19 indicating that the Level II screening results predicted lower concentrations than the actual Level IV results by approximately 19 percent. Although these data show a high R squared value it should be noted that many of the Level II and Level IV results were in the concentration range of 1 to 2 mg/kg which was at or slightly above the screening method detection limit of 1 mg/kg. Nonetheless, the TNT screening correlated well with the locations that appear to have residual explosive material present.

For the analysis of metals within soils, lead was chosen as the Level II screening indicator compound for metals. Samples were prepared and analyzed in the laboratory using the same methodology as EPA method 6010, only with less stringent QA/QC. A total of 112 soil samples have both Level II and Level IV results for lead. Table 4-2 summarizes the Level II and Level IV analysis results for lead. The concentration of lead from the Level II analyses ranges from a low of 5 mg/kg to a high of 44,000 mg/kg. A regression analysis has been performed on the data in Table 4-2 to evaluate the relationship between the Level II and Level IV data. Figure 4-2 shows a plot of the Level II versus Level IV data along with

TABLE 4-2
COMPARISON OF LEVEL II AND LEVEL IV DATA FOR LEAD IN SOILS

SENECA ARMY DEPOT
OB GROUNDS

Sample ID	Concentration (mg/kg)	
	Level II	Level IV
GB-5-3	5.0	12.4
GB-16-2	5.0	10.8
MW37-2	5.0	17.8
MW36-3	10.1	20.2
GB24-2	10.6	17.9
GB33-2	14.1	8.7
GB-10-3	15.0	18.0
GB-11-3	15.1	13.5
PBJ-10-3	15.7	25.2
PBG-4-2	15.9	43.3
GB28-2	17.1	15.2
GB29-2	17.5	26.2
GB-4-5	19.1	18.1
GB30-3	19.3	23.1
GB-2-4	19.5	27.9
GB-6-5	19.9	22.0
MW41-2	20.0	32.2
GB32-3	21.0	26.1
GB-07-2	22.0	18.1
BE-J-4-91	22.0	32.4
GB-09-3	23.0	14.4
PBG-8-2	24.0	23.8
GB31-2	25.0	36.5
PBJ-9-2	25.0	17.2
GB25-2	26.0	22.1
PBG-9-2	27.0	38.1
MW39-3	27.0	34.1
MW38-3	29.0	38.6
BE-J-6-91	30.0	48.0
PBG-5-2	31.0	50.2
LH-04	32.0	45.8
LH-07	32.0	37.8
MW40-2	34.0	42.0
LH-14	36.0	41.3
LH-16	38.0	42.0
LH-02	38.0	42.8
LH-09	41.0	51.2
LH-18	42.0	46.6
PBG-6-4	44.0	37.5
LH-23	49.0	64.3
LH-17	50.0	60.2
PBJ-6-2	51.0	74.3
PBJ-8-2	55.0	34.9
LH-01	77.0	94.1
PBF-2-3	78.0	94.3
GB-14-2A	84.0	77.5
PBJ-4-2	85.0	105.0
GB-14-2	87.0	137.0
LH-40	88.0	112.0
PBH-1-2	92.0	58.8
PBJ-1-2	95.0	80.9
LH-37	102.0	115.0
GB23-2	138.0	163.0
GB-12-2	138.0	171.0
LH-26	140.0	162.0
PBF-1-4	141.0	59.6
BE-J-13	146.0	204.0
GB-12-2A	149.0	185.0
LH-27	153.0	177.0
LH-29	184.0	228.0
GB-3-2	230.0	252.0
PBJ-2-2	230.0	115.0
BE-J-8	260.0	363.0
PBG-7-2	280.0	332.0
LH-36	290.0	372.0
LH-28	340.0	415.0
PBG-3-2	350.0	65.7
PBC-1-4A	370.0	475.0
PBJ-7-2	400.0	453.0
LH-33	430.0	533.0
PBJ-5-2	450.0	530.0
BE-J-5-91	690.0	644.0
BE-E-3	820.0	1090.0
GB-15-2	830.0	985.0
PBJ-3-2	880.0	29.2
PBC-1-4	900.0	256.0
GB-13-2	910.0	1060.0
PBA-2A	940.0	1220.0
GB-1-3	970.0	481.0
PBE-1-3	970.0	205.0
LH-32	1010.0	1250.0
BE-E-1-91	1030.0	1260.0
BE-H-5	1170.0	1370.0
BE-A-3	1170.0	1380.0
LH-31	1230.0	1530.0
PBG-2-2	1250.0	7.7
BE-F-5	1800.0	2290.0
BE-F-6	1890.0	2320.0
GB-2-2	1940.0	3400.0
PBA-2	2100.0	2530.0
PBG-1-3	2100.0	3360.0
BE-F-1-91	2200.0	2350.0
PBH-2-2	2400.0	2760.0
PBD-1-3A	3600.0	3930.0
BE-F-2-91	4500.0	5310.0
BE-G-11	4800.0	5450.0
BE-C-6	4900.0	5730.0
BE-H-2-91	6000.0	6900.0
BE-B-4	6000.0	7210.0
BE-A-1-91	6600.0	7880.0
BE-G-3-91	7100.0	7800.0
BE-F-2A-91	7700.0	9340.0
BE-G-6-91	7900.0	8710.0
BE-D-3	8100.0	9380.0
GB-08-4	9800.0	182.0
BE-D-1-91	12000.0	14400.0
PBD-1-3	12400.0	16000.0
BE-H-3-91	17400.0	24200.0
BE-G-2-91	19700.0	22400.0
BE-C-3-91	22000.0	29000.0
BE-B-2-91	34000.0	41200.0
BE-C-2-91	44000.0	56700.0

FIGURE 4-1
LEVEL II vs. LEVEL IV SCREENING RESULTS, EXPLOSIVES IN SOILS

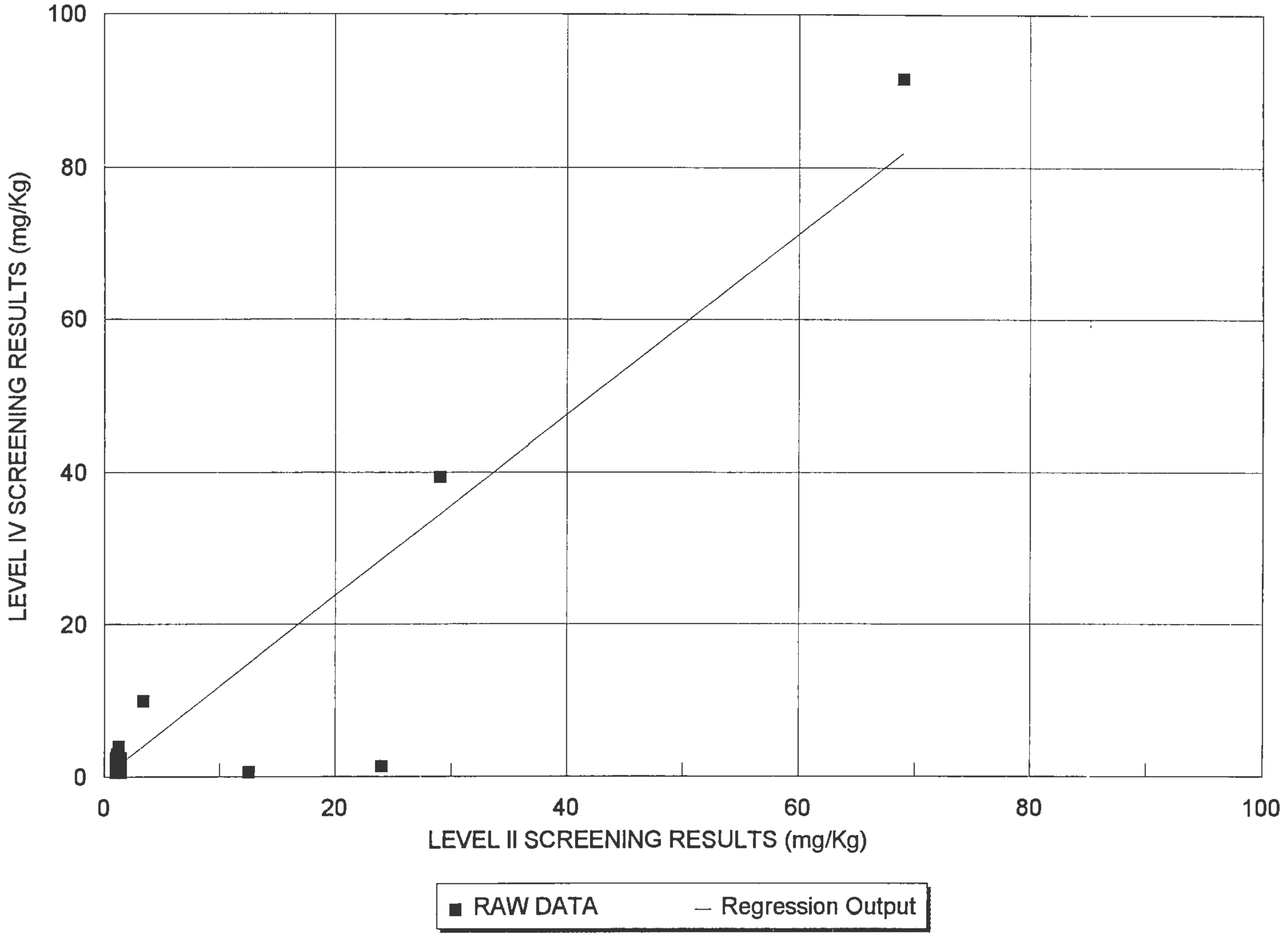
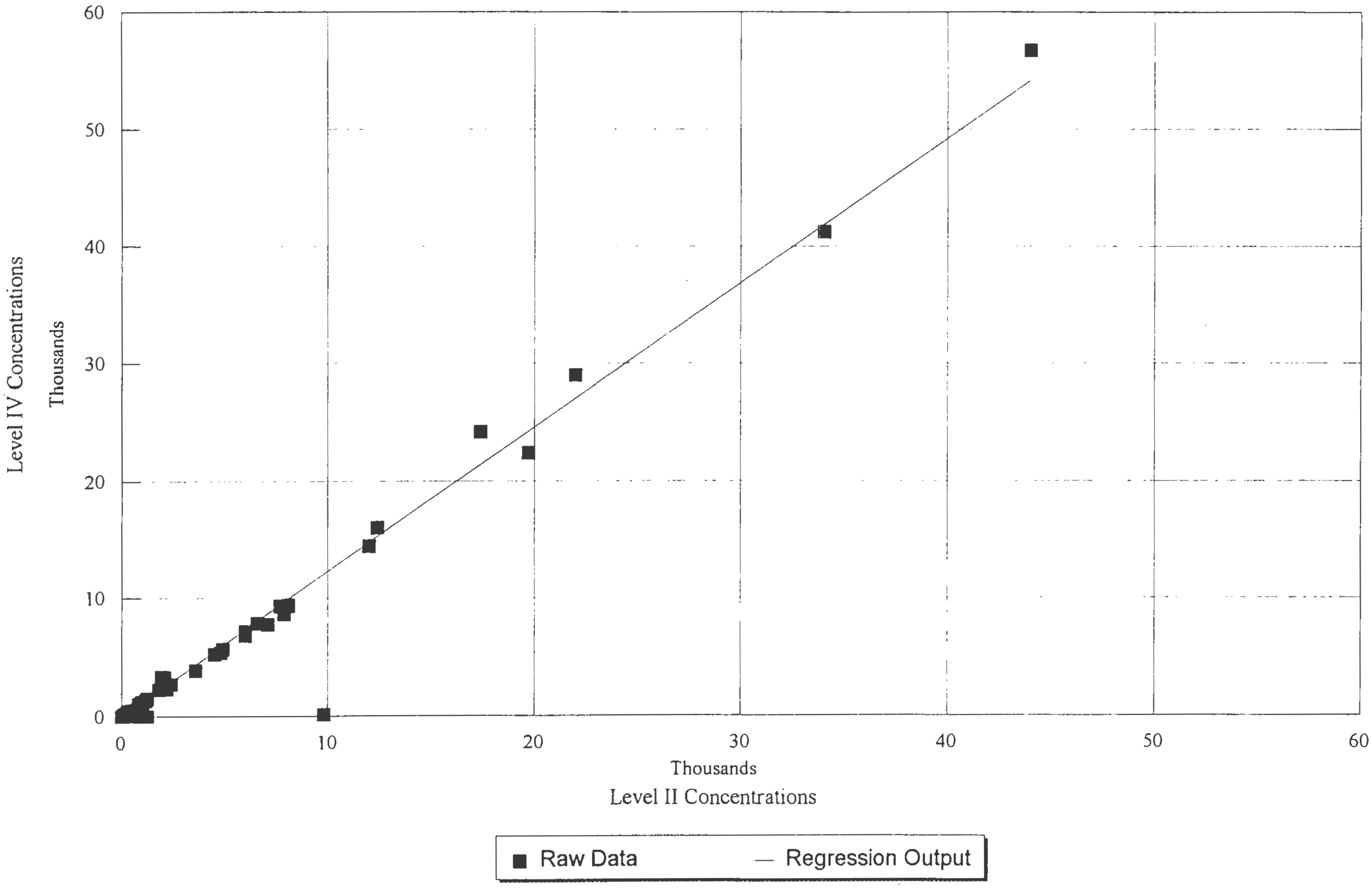


FIGURE 4-2
LEVEL II versus LEVEL IV ANALYSES OF LEAD IN SOILS (ppm)



a plot of the best fit regression line for these data. The regression analysis yielded an R squared value of 0.975, indicative of a strong linear relationship between these data. The slope of the regression best fit line was calculated to be 1.23 indicating that the Level II data predicted lower concentrations than the Level IV results by approximately 23 percent. This analysis suggests that the Level II screening method is capable of reliably predicting the concentrations of lead in soil samples.

Of particular interest during the data evaluation was whether or not lead was a good indicator of the presence of other metals. The basis for selecting lead as a good indicator of heavy metal impacts was that lead is a major part of the propellants and explosives burned at the OB grounds, and should be the most widespread metal present. If lead was detected then other metals should potentially be present since the munitions contained mixtures of other heavy metals in addition to lead.

To evaluate the relationship between Level IV lead concentrations in soils and the concentrations of other heavy metals, Table 4-3 has been developed which summarizes the soil data that contain lead at concentrations less than 30 mg/kg, which was the maximum site background concentration. A total of 59 soil samples collected during Phases I and II were found to have lead concentrations less than 30 mg/kg based upon Level IV results. This table presents the sample location and depth, and the concentrations of the metals barium, copper, lead, and zinc. The samples are shown in the order of ascending lead concentration. These data have been used to provide some insight into the relationship between the lead concentrations and the associated metal concentrations for barium, copper, and zinc.

Lead appears to be a good indicator especially in samples with low lead concentrations which coincide with samples that contain low barium, copper, and zinc concentrations. Generally, as lead concentrations increased, so did barium, copper and zinc concentrations.

In comparing the actual site data with site background it was discovered that only in a very few situations do samples with lead concentrations that are less than the site background coincide with barium, copper, and zinc concentrations that are outside the site background range. Table 4-3 highlights those samples which are greater. Therefore, there are very few occurrences of false negatives, which are low lead concentrations corresponding to high barium, copper, or zinc concentrations. Thus, although the relationship of lead with the associated metals is not linear and was not expected to be, it remains an excellent predictor for the presence of barium, copper, and zinc in soil.

TABLE 4–3
EVALUATION OF LEAD AS AN INDICATOR PARAMETER FOR METALS IN SOILS

SENECA ARMY DEPOT
OB GROUNDS

ES ID	DESCRIPTION	DEPTH	Concentration (mg/kg)			
			Lead	Barium	Copper	Zinc
GB35–2		2–4'	5.4	61.7	24.5	83.4
GB36–2		2–4'	6.2	50.8	17.5	74.1
PBG–2–2		0–2'	7.7	**481**	**75.4**	**297**
GB33–2		2–4'	8.7	75.4	20.7	75.2
GB30–1		0–2'	11.4	100	19.5	68.9
S2011121MW34		0–2'	11.9	67.5	32.7	95.7
GB–5–3		2–4'	12.4	73.9	16	56
GB06–1		0–6"	12.4	103	15.7	69.9
GB36–1		0–2'	12.7	74.8	17.7	59.2
GB28–1		0–2'	12.9	73.4	24.6	70.3
GB–11–3		2–4'	13.5	77.1	26.5	102
DW–02		0–0.2'	13.8	125	19	51.3
GB–11–1		0–6"	14.1	154	24.8	96.1
GB–09–3		2–4'	14.4	166	30.9	**120**
GB35–1		0–2'	14.4	93.6	17.5	55
MW36–1		0–2'	14.5	118	30.3	97.6
GB28–2		2–4'	15.2	72.9	30.3	84.9
PBH–2–1		0–2'	15.5	144	R	70
MW37–1		0–2'	15.7	58.6	20.1	63.3
MW36–6	dup MW36–1	0–2'	15.9	95.6	26.8	56
S1311106		2–4'	16.1	95.2	28.7	86.3
BKTL–2		0–0.5'	16.7	106	15.4	57.6
GB27–1		0–2'	16.8	90.9	32.3	99.4
GB33–1		0–2'	17.1	70.4	23.1	68.9
PBJ–9–2		2–4'	17.2	112	R	70.8
DW–06		0–0.2'	17.5	124	19.6	62
GB27–3		4–6'	17.7	71.5	33.1	93.9
MW37–2		2–4'	17.8	115	32	87
GB24–2		2–4'	17.9	42.5	27.4	45.4
GB–10–3		2–4'	18	81.3	23	65.6
GAE–G–1		2.0'	18	190	21.6	108
GB–07–2		0–2'	18.1	69.2	26.5	71.2
GB04–5		6' +	18.1	63.6	34.5	51
S110105		0–2'	18.5	77.1	28.1	71.2
MW38–1		0–2'	18.9	118	40.8	90.6
GB35–6	dup GB35–1	0–2'	19.1	61.7	17.2	53.1
BKTL–5	dup BKTL–3	0–0.5'	19.4	155	23.4	53.4
MW36–3		4–5.5'	20.2	46.9	19.2	34.7
PBJ–10–1		0–2'	20.2	91.7	R	62.3
BKTL–3		0–0.5'	20.3	130	24.2	58
DW–07		0–0.2'	20.6	82.5	14.8	56.4
GB26–2		2–4'	21.5	73.3	40.8	87.9
GB06–5		6'+	22	94.1	37.3	90.8
GB25–2		2–4'	22.1	75.9	41.7	56.7
S103104		5–5.5'	22.3	96.9	27	100
DW–12	dup DW–4	0–0.2'	22.4	94	15.9	72.8
GB34–4		6–8'	22.8	87.3	29	75.5
GB30–3		4–6'	23.1	56	36.5	**171**
DW–04		0–0.2'	23.2	93.8	15.2	71.8
PBG–8–2		2–4'	23.8	114	R	95.2
DW–03		0–0.2'	24	87.9	23.7	75.8
DW–05		0–0.2'	24.4	99.7	21.8	70.1
PBG–9–1		0–2'	24.4	141	R	77.5
PBJ–10–3		4–5'	25.2	116	R	56.2
DW–08		0–0.2'	26.1	127	28.5	84
PBE–4–1		0–2'	26.2	96.8	39.9	**187**
GB29–2		2–4'	26.2	44.6	27.5	83.8
GB02–4		4–6'	27.9	72.8	42.8	94.9
PBJ–9–1		0–2'	28.8	**407**	R	91.4
Site Background Range			5–30	40–153	15–56	53–126
Number of Samples Above Site Background Range				2	1	4

NOTES:
1) R = Data was rejected.
2) The values that are above the TAGM or site background are in bold text.

There were approximately 240 soil samples on which Level II and Level IV metals analyses were performed. Of these, only 59 samples were below the site background for lead (30 ppm). Of the 59 samples, only 1 was significantly above the site background concentration of copper (56 ppm). Only 2 samples were above the site background for barium (153 ppm). Four samples were above the site background concentration for zinc (126 ppm).

4.1.4 Comparison of Methods 8330 and NYSDEC CLP SV for Analysis of Explosives Compounds in Soil

The soil analytical results from the OB grounds were evaluated to determine if there was a significant difference between the results obtained from EPA method 8330 and NYSDEC CLP SV for the compounds 2,4-dinitrotoluene and 2,6-dinitrotoluene. These two compounds are included in the target analyte lists for both methods.

The first step was to determine if one method consistently yielded higher concentrations. This comparison focused on 2,4-dinitrotoluene, since 2,6-dinitrotoluene was detected in very few samples. A review of the data indicated no evidence that one method consistently yielded higher results.

The next step was to evaluate the comparability of the two sets of analytical results. This was accomplished by looking at each set of duplicate soil samples, and comparing the relative percent differences (RPDs) calculated for each method with those calculated between methods. Most of the duplicate sample results were nondetects, and these values were not used in the evaluation. Again, only the detected values for 2,4-dinitrotoluene results were used.

There was little difference between the RPD values. RPDs calculated for method 8330 ranged from 0 to 91 percent, with most RPDs greater than 50 percent. For NYSDEC CLP SV, the RPDs were worse, ranging from 41 to 190 percent. Between the methods, the RPDs ranged from 7 to 178 percent, again, with most RPDs greater than 50 percent. This indicates that the variability between results is likely due to the heterogeneous nature of the soil samples, and not to any differences between the methods.

4.2 GEOSTATISTICAL DATA EVALUATION

Data from the surface samples collected at grid borings and monitoring wells, along with the low hill and sediment samples were evaluated with a variety of geostatistical techniques. The goal of this geostatistical evaluation was to determine if the sample spacings proposed in the original workplan were sufficient for a statistically complete characterization of the OB grounds. Methods used in this evaluation included variogram models, cross-validation, cross checking of actual data versus modelled data, and kriging to contour the modelled data. The principles of the geostatistics method are discussed in detail in Section 3.5.3 of the Workplan (Revision 1, August 30, 1991).

4.2.1 <u>Geostatistical Methods.</u>

As stated above, a number of geostatistical tools were used to evaluate the data. The following is a brief summary of the technique. Myers (1990) provides and excellent discussion on the technique, and the application of this technique to environmental data.

Geostatistics is a method where the variability of data can be modelled based on its spatial relationship to other data points. Geostatistical models employ the use of the variogram analysis to model the variance with distance between points in a data set. Cross-validation uses this model to determine the difference between the actual data and the modelled data for a particular point. Kriging uses the variogram model to develop a weighted average set of grid data which can subsequently be contoured.

Several important terms should be defined. These are:

1. <u>Sill</u> The highest level of model variance in the variogram. In some instances, the distance where the sill is reached may be beyond the effective range of the model.

2. <u>Range</u> The distance of influence such that one sample may be statistically related to another. Beyond the range the sample values are independent of each other.

3. Nugget Effect — The level of variance which is inherent to geological conditions and which is independent of distance. The nugget can be considered an internal error which is a uniform contributor to the variance of all samples in a data set.

4. Indicator Kriging — This is used to predict the possibility of a particular point being greater than a selected action level. This method is quite useful for determining where additional samples may be necessary to determine if a is indeed above an action level. Kriged contours are based upon a percent level that indicates whether a point is above or below that level.

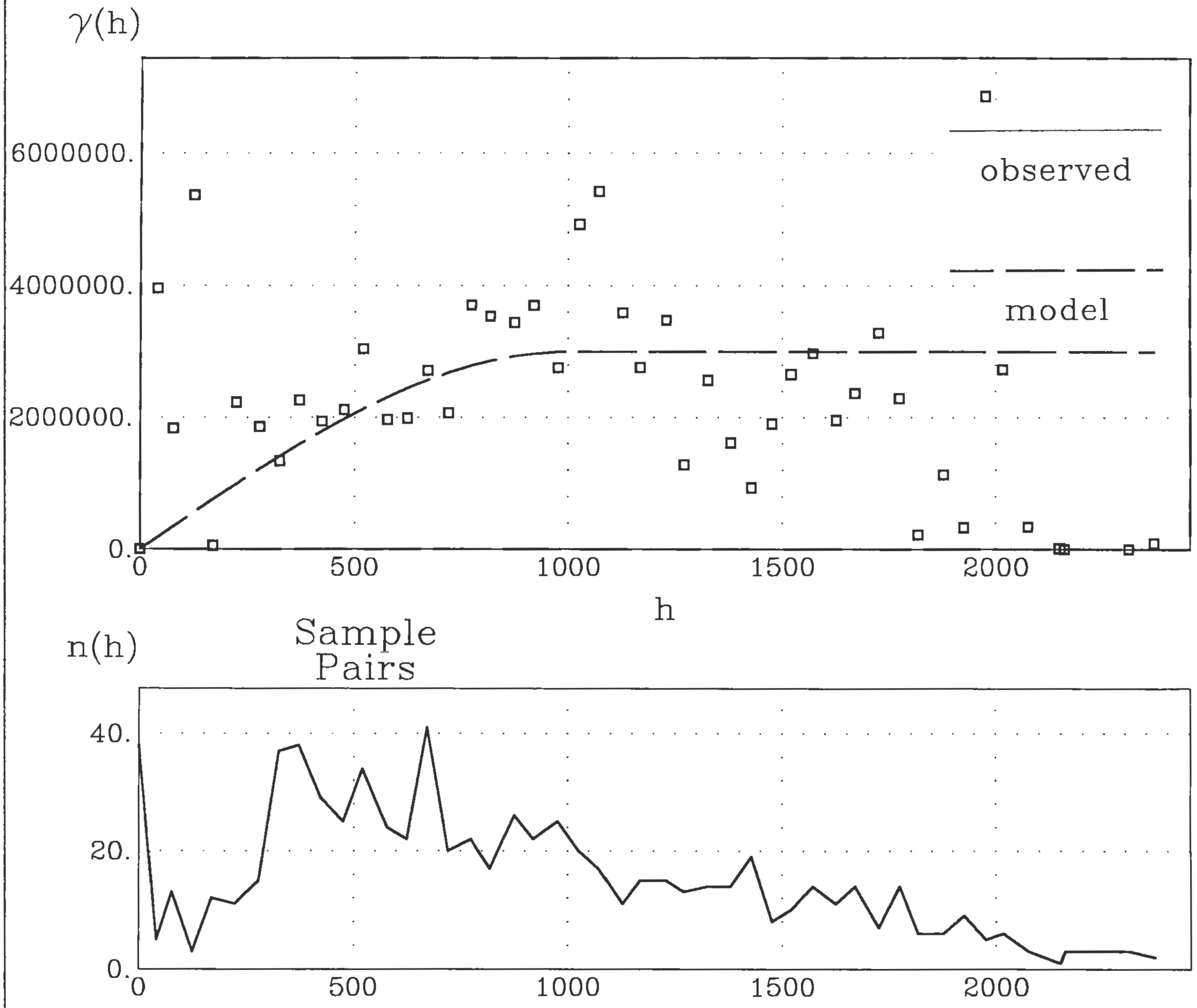
4.2.2 Grid Borings.

Based on the variogram evaluation presented in the original workplan it was recommended that sample spacings be approximately 200 feet for the grid borings. This was based on a variogram model with a range of approximately 400 feet. While this 200 foot spacing is larger than the preferred 1/4 range limit for variogram analysis, it was felt that a 200 foot grid boring spacing would be sufficient to characterize the site.

The chemical analysis data from the soil samples has been used in the geostatistical evaluation. A variogram analysis has been performed on the data using the lead and copper concentrations from the shallowest sample in each grid boring. It was not possible to model 2,4,6-trinitrotoluene due to the limited number of grid boring samples where explosive compounds were detected.

The variogram for lead is shown in Figure 4-3. This variogram shows a spherical model for lead. This variogram model has a range of 1,000 feet, however, the best fit of the data might limit the range to no more than 800 feet. These results suggest a sample interval of approximately 200 to 250 feet which is in good agreement with the 200-foot grid boring spacing used in this investigation.

The variogram model for copper is shown in Figure 4-4. As with lead, the model has a range of approximately 1,000 feet. This range also suggests a sample distance of 200 to 250 feet as being valid for these data. Thus, it appears that a 200-foot spacing was sufficient.



ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

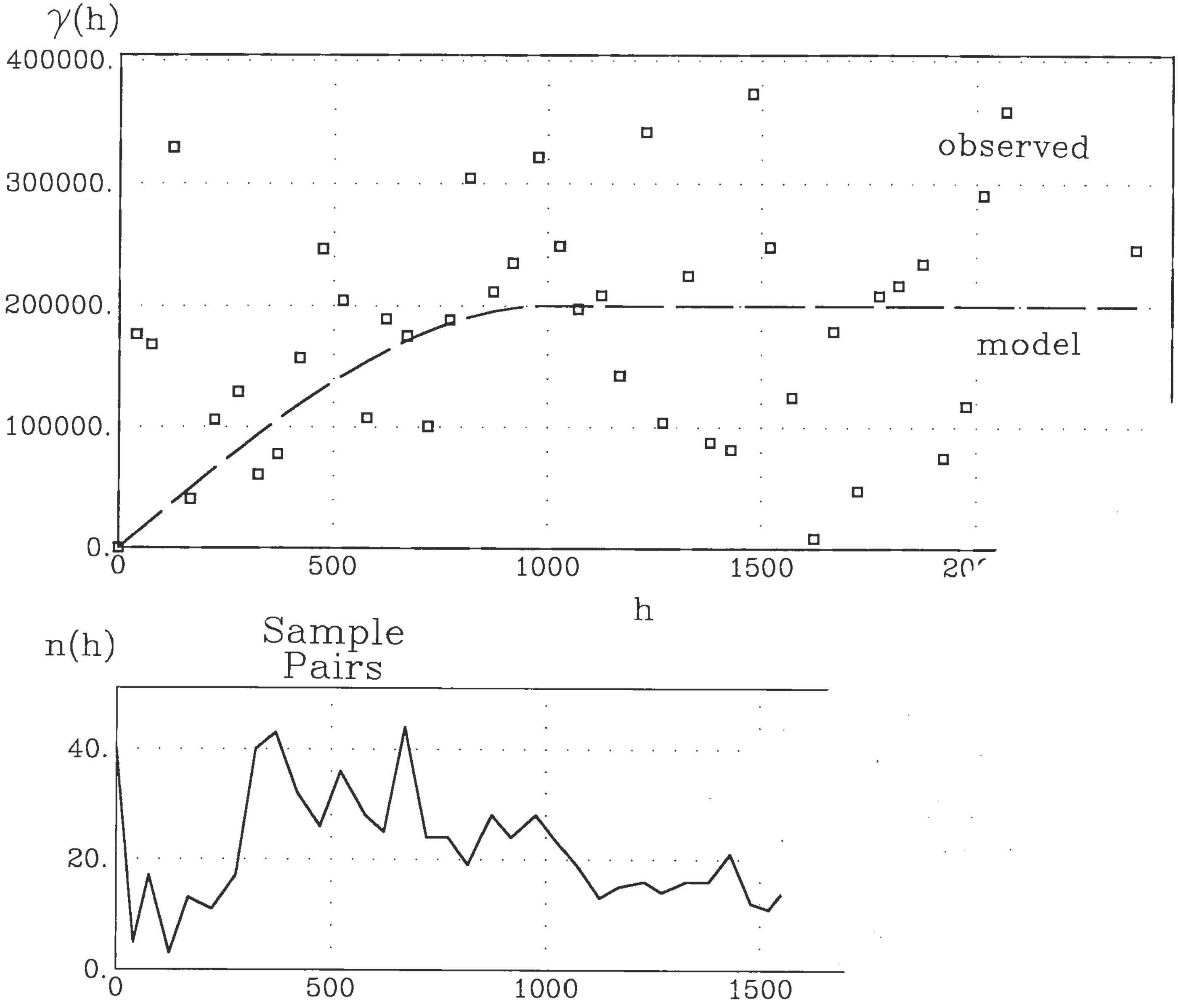
DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-3

VARIOGRAM FOR LEAD

IN SURFACE SOILS

SCALE



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REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING	NO 720446-01000

FIGURE 4-4

VARIOGRAM FOR COPPER

IN SURFACE SOILS

SCALE

4.3 BURNING PADS

The following sections present the results of the sampling performed on each of the nine burning pads. To assist in the presentation of the data, summary tables of validated data have been developed on a pad by pad basis that present the complete results of the analytical program. These tables also list the following information:

1) the frequency of detection for each compound,
2) the maximum concentration detected
3) the New York State TAGM recommend cleanup objective, and (NYSDEC TAGM HWR-92-4046, November 16, 1992)
4) the number of samples above the TAGM.

Additionally, figures have been prepared on a pad-by-pad basis that present the results of the explosives and metals analyses. For each pad the explosives that were detected are presented along with the four metals barium, copper, lead, and zinc.

4.3.1 Open Burning Pad A

During Phase I, soil boring PB-A-1 was installed, and berm excavations BE-A-1 and BE-A-2 were sampled. In Phase II, berm excavations BE-A-3 and BE-A-4 were sampled. Four soil samples were collected from the boring PB-A-1 and four samples (one each) were collected from the berm excavations. The surface soil sample collected at location PB-A-1 went directly for Level IV analyses. All of the four berm samples, and three of the four pad boring samples underwent Level II screening for lead, TNT, and VOCs. From these eight samples three went for subsequent Level IV analyses, these being two of the berm samples (BE-A-1 and BE-A-2) and one additional subsurface samples (PB-A-2) from pad boring PB-A-1.

A summary of the analytical results for the Level IV analyses is presented in Table 4-4. The following sections review the compounds detected within the soil samples collected on Burning Pad A.

4.3.1.1 Volatile Organic Compounds

The volatile organic compounds toluene and chlorobenzene were detected in the duplicate sample PB-A-1A at estimated concentrations of 2 and 4 ug/kg respectively. Both of the values

TABLE 4−4

PAD A
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS AND PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD A 3.5' 12/03/91 BE−A−1−91	PAD A 2.0 feet 12/04/92 BE−A−3	PAD A 0−6" 12/16/91 PB−A−1	PAD−A 0−6" 12/16/91 PB−A−1A	PAD−A 0−2" 12/16/91 PB−A−2	PAD−A 0−2" 12/16/91 PB−A−2A	PAD−A 0−2" 12/16/91 PB−A−2ARE
VOCs (ug/kg)											
Methylene Chloride	0.0%	0	100	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
Acetone	0.0%	0	200	0	11 U	12 U	11 U	11 U	13 U	13 U J	13 U J
1,2−Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
Chloroform	0.0%	0	300	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
2−Butanone	0.0%	0	300	0	11 U	12 U	11 U	11 U	13 U	13 U J	13 U J
1,1,1−Trichloroethane	0.0%	0	800	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
Carbon Tetrachloride	0.0%	0	600	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
Trichloroethene	0.0%	0	700	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
Benzene	0.0%	0	60	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
Tetrachloroethene	0.0%	0	1400	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
Toluene	14.3%	2	1500	0	6 U	12 U	5 U	2 J	6 U	7 U J	7 U J
Chlorobenzene	14.3%	2	1700	0	6 U	12 U	5 U	4 J	6 U	7 U J	7 U J
Xylene (total)	0.0%	0	1200	0	6 U	12 U	5 U	6 U	6 U	7 U J	7 U J
Semivolatiles (ug/kg)											
Phenol	0.0%	0	30 or MDL	0	740 U	410 U	730 U	710 U	720 U	750 U	N
2−Methylphenol	0.0%	0	100 or MDL	0	740 U	410 U	730 U	710 U	720 U	750 U	N
4−Methylphenol	0.0%	0	900	0	740 U	410 U	730 U	710 U	720 U	750 U	N
2,4−Dimethylphenol	0.0%	0	50,000*	0	740 U	410 U	730 U	710 U	720 U	750 U	N
Benzoic acid	0.0%	0	2700	0	3600 U	N	3500 U	3400 U	3500 U	3600 U	N
Naphthalene	0.0%	0	13,000	0	740 U	410 U	730 U	710 U	720 U	750 U	N
2−Methylnaphthalene	66.7%	100	36,400	0	740 U	410 U	88 J	87 J	67 J	100 J	N
2−Chloronaphthalene	0.0%	0	50,000*	0	740 U	410 U	730 U	710 U	720 U	750 U	N
2−Nitroaniline	0.0%	0	430 or MDL	0	3600 U	990 U	3500 U	3400 U	3500 U	3600 U	N
Acenaphthylene	0.0%	0	41,000	0	740 U	410 U	730 U	710 U	720 U	750 U	N
2,6−Dinitrotoluene	0.0%	0	1000	0	740 U	410 U	730 U	710 U	720 U	750 U	N
3−Nitroaniline	0.0%	0	500 or MDL	0	3600 U	990 U	3500 U	3400 U	3500 U	3600 U	N
Acenaphthene	0.0%	0	50,000*	0	740 U	410 U	730 U	710 U	720 U	750 U	N
Dibenzofuran	0.0%	0	6200	0	740 U	410 U	730 U	710 U	720 U	750 U	N
2,4−Dinitrotoluene	66.7%	1500	50,000*	0	740 U	410 U	470 J	310 J	860 J	1500 J	N
Diethylphthalate	16.7%	250	7100	0	740 U	410 U	730 U	250 J	720 U	750 U	N
Fluorene	0.0%	0	50,000*	0	740 U	410 U	730 U	710 U	720 U	750 U	N
N−Nitrosodiphenylamine	0.0%	0	50,000*	0	740 U	410 U	730 U	710 U	720 U	750 U	N
Hexachlorobenzene	0.0%	0	410	0	740 U	410 U	730 U	710 U	720 U	750 U	N
Pentachlorophenol	0.0%	0	1000 or MDL	0	3600 U	990 U	3500 U	3400 U	3500 U	3600 U	N
Phenanthrene	66.7%	80	50,000*	0	740 U	410 U	79 J	73 J	78 J	80 J	N
Anthracene	0.0%	0	50,000*	0	740 U	410 U	730 U	710 U	720 U	750 U	N
Carbazole	0.0%	0	50,000*	0	N	410 U	N	N	N	N	N
Di−n−butylphthalate	16.7%	160	8100	0	740 U	410 U	730 U	160 J	720 U	750 U	N
Fluoranthene	16.7%	100	50,000*	0	740 U	410 U	730 U	100 J	720 U	750 U	N
Pyrene	16.7%	86	50,000*	0	740 U	410 U	730 U	86 J	720 U	750 U	N
Butylbenzylphthalate	16.7%	140	50,000*	0	740 U	410 U	730 U	140 J	720 U	750 U	N
Benzo(a)anthracene	16.7%	120	220 or MDL	0	740 U	410 U	730 U	120 J	720 U	750 U	N
Chrysene	16.7%	120	400	0	740 U	410 U	730 U	120 J	720 U	750 U	N
bis(2−Ethylhexyl)phthalate	16.7%	190	50,000*	0	740 U	410 U	730 U	190 J	720 U	750 U	N
Di−n−octylphthalate	16.7%	140	50,000*	0	740 U	410 U	730 U	140 J	720 U	750 U	N
Benzo(b)fluoranthene	16.7%	130	1100	0	740 U	410 U	730 U	130 J	720 U	750 U	N
benzo(k)fluoranthene	16.7%	120	1100	0	740 U	410 U	730 U	120 J	720 U	750 U	N
Benzo(a)pyrene	16.7%	120	61 or MDL	1	740 U	410 U	730 U	120 J	720 U	750 U	N
Indeno(1,2,3−cd)pyrene	16.7%	87	3200	0	740 U	410 U	730 U	87 J	720 U	750 U	N
Dibenz(a,h)anthracene	16.7%	74	14 or MDL	1	740 U	410 U	730 U	74 J	720 U	750 U	N
Benzo(g,h,i)perylene	16.7%	86	50,000*	0	740 U	410 U	730 U	86 J	720 U	750 U	N

TABLE 4-4

PAD A
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS AND PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD A 3.5' 12/03/91 BE-A-1-91	PAD A 2.0 feet 12/04/92 BE-A-3	PAD A 0-6" 12/16/91 PB-A-1	PAD-A 0-6" 12/16/91 PB-A-1A	PAD-A 0-2' 12/16/91 PB-A-2	PAD-A 0-2' 12/16/91 PB-A-2A	PAD-A 0-2' 12/16/91 PB-A-2ARE
Pesticides/PCBs (ug/kg)											
beta-BHC	0.0%	0	200	0	18 U	2.1 U	88 U	52 U	17 U	18 U	N
delta-BHC	0.0%	0	300	0	18 U	2.1 U	88 U	52 U	17 U	18 U	N
gamma-BHC (Lindane)	0.0%	0	60	0	18 U	2.1 U	88 U	52 U	17 U	18 U	N
Heptachlor	0.0%	0	100	0	18 U	2.1 U	88 U	52 U	17 U	18 U	N
Aldrin	0.0%	0	41	0	18 U	2.1 U	88 U	52 U	17 U	18 U	N
Heptachlor epoxide	0.0%	0	20	0	18 U	2.1 U	88 U	52 U	17 U	18 U	N
Endosulfan I	0.0%	0	900	0	18 U	2.1 U	88 U	52 U	17 U	18 U	N
Dieldrin	0.0%	0	44	0	36 U	4 U	180 U	100 U	35 U	36 U	N
4,4'-DDE	83.3%	140	2100	0	36 U	14	140 J	100 J	21 J	28 J	N
Endrin	0.0%	0	100	0	36 U	4 U	180 U	100 U	35 U	36 U	N
Endosulfan II	0.0%	0	900	0	36 U	4 U	180 U	100 U	35 U	36 U	N
4,4'-DDD	0.0%	0	2900	0	36 U	4 U	180 U	100 U	35 U	36 U	N
Endosulfan sulfate	0.0%	0	1000	0	36 U	4 U	180 U	100 U	35 U	36 U	N
4,4'-DDT	16.7%	9	2100	0	36 U	9	180 U	100 U	35 U	36 U	N
Endrin aldehyde	0.0%	0		NA	N	4 U	N	N	N	N	N
alpha-Chlordane	0.0%	0	540	0	180 U	2.1 U	880 U	520 U	170 U	180 U	N
Aroclor-1254	0.0%	0	1000	0	360 U	40 U	1800 U	1000 U	350 U	360 U	N
Aroclor-1260	0.0%	0	1000	0	360 U	40 U	1800 U	1000 U	350 U	360 U	N
Explosives (ug/kg)											
HMX	0.0%	0		NA	1000 U	120 U	1000 U	1000 U	1000 U	1000 U	N
RDX	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	N
1,3,5-Trinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	N
1,3-Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	N
Tetryl	0.0%	0		NA	400 U	120 U	400 U	400 U	400 U	400 U	N
2,4,6-Trinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	N
4-amino-2,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	N
2-amino-4,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	N
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	120 U	120 U	120 U	120 U	N
2,4-Dinitrotoluene	100.0%	1600		NA	140	120 J	1400	1500	1600	600	N
Metals (mg/kg)											
Aluminum	100.0%	19000	17503.0	2	18300	19000	14800	15000	15800	13300	N
Antimony	66.7%	18.7	5	4	14.5 R	11.2 R	15.3	5.7 J	18.7	13.5	N
Arsenic	83.3%	10.3	7.5	1	5 R	4.5 J	4	4.4	10.3	7.1	N
Barium	100.0%	1910	300	6	1040	607	1290	1910	1540	1820	N
Beryllium	16.7%	0.77	1	1	0.85 R	0.77	0.72 R	0.74 R	0.6 R	0.54 R	N
Cadmium	100.0%	9.6	1.8	5	3.9 J	0.74	3.3	2.6	9.6	5.9	N
Calcium	100.0%	37200	46825.0	0	8210	10900	37200	30500	36200	17700	N
Chromium	83.3%	46.4	26.6	3	24.5 R	27	26.1	25.9	46.4	35.9	N
Cobalt	100.0%	17.6	30	0	17.6	10.6	15.3	13.5	15.5	11.2	N
Copper	100.0%	3160	25	6	767	504	962	1660	3160	2090	N
Iron	100.0%	49700	32698.0	3	28200	29400	41300	28300	49700	43900	N
Lead	100.0%	7880	30	6	7880 J	1380	1980	1560	2530	1220	N
Magnesium	100.0%	9370	9071.1	1	7030	5740	8450	8480	9370	8760	N
Manganese	100.0%	1620	1065.8	2	1260	381	447	417	1620 J	502 J	N
Mercury	66.7%	0.13	0.1	1	0.04 UJ	0.09 J	0.13 J	0.04 J	0.04 U	0.05 J	N
Nickel	100.0%	57.7	41.3	4	31.5	32.9	57.7	46.4	53.2	42.3	N
Potassium	100.0%	3160	1529.6	4	1740 J	1950	1280	1450	3160	1810	N
Selenium	50.0%	0.79	2	0	0.21 UJ	0.79 J	0.52 U	0.53 U	0.19 J	0.21 J	N
Silver	0.0%	0	0.6	0	0.38 R	0.37 U	0.99 U	0.87 U	0.86 U	0.94 U	N
Sodium	83.3%	331	76	3	66.6 J	94 R	64.4 J	63.4 J	331 J	141 J	N
Thallium	0.0%	0	0.3	0	0.67 U	0.45 U	0.33 U	0.34 U	0.34 U	0.36 U	N
Vanadium	100.0%	29.1	150	0	28.8	29.1	16.2	18.6	21.9	16.7	N
Zinc	100.0%	2150	89.1	6	210	426	222	350	2150	926	N
Cyanide	0.0%	0	NA	NA	0.65 U	0.62 U	0.49 U	0.64 U	0.58 U	0.62 U	N

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

are below the sample quantitation limit and are also significantly below the TAGM limit of 1,500 and 1,700 ug/kg, respectively.

4.3.1.2 Semivolatile Organic Compounds

A variety of semivolatile compounds were detected in the soil samples collected at Pad A. The compound 2-methylnaphthalene, along with a variety of phthalates were all detected at estimated concentrations below the sample quantitation limit. The duplicate sample PB-A-1A possessed the largest number of semivolatiles, again, all at estimated concentrations below the sample quantitation limit. This sample also had concentrations of benzo(a)pyrene and dibenz(a,h)anthracene above the TAGM. The compound 2,4-dinitrotoluene (also an explosive) was detected in samples PB-A-1 and PB-A-2 at estimated concentrations of 470 and 1,500 ug/kg, respectively. The distribution of explosive compounds detected in Pad A soil samples is further discussed in Section 4.3.1.4.

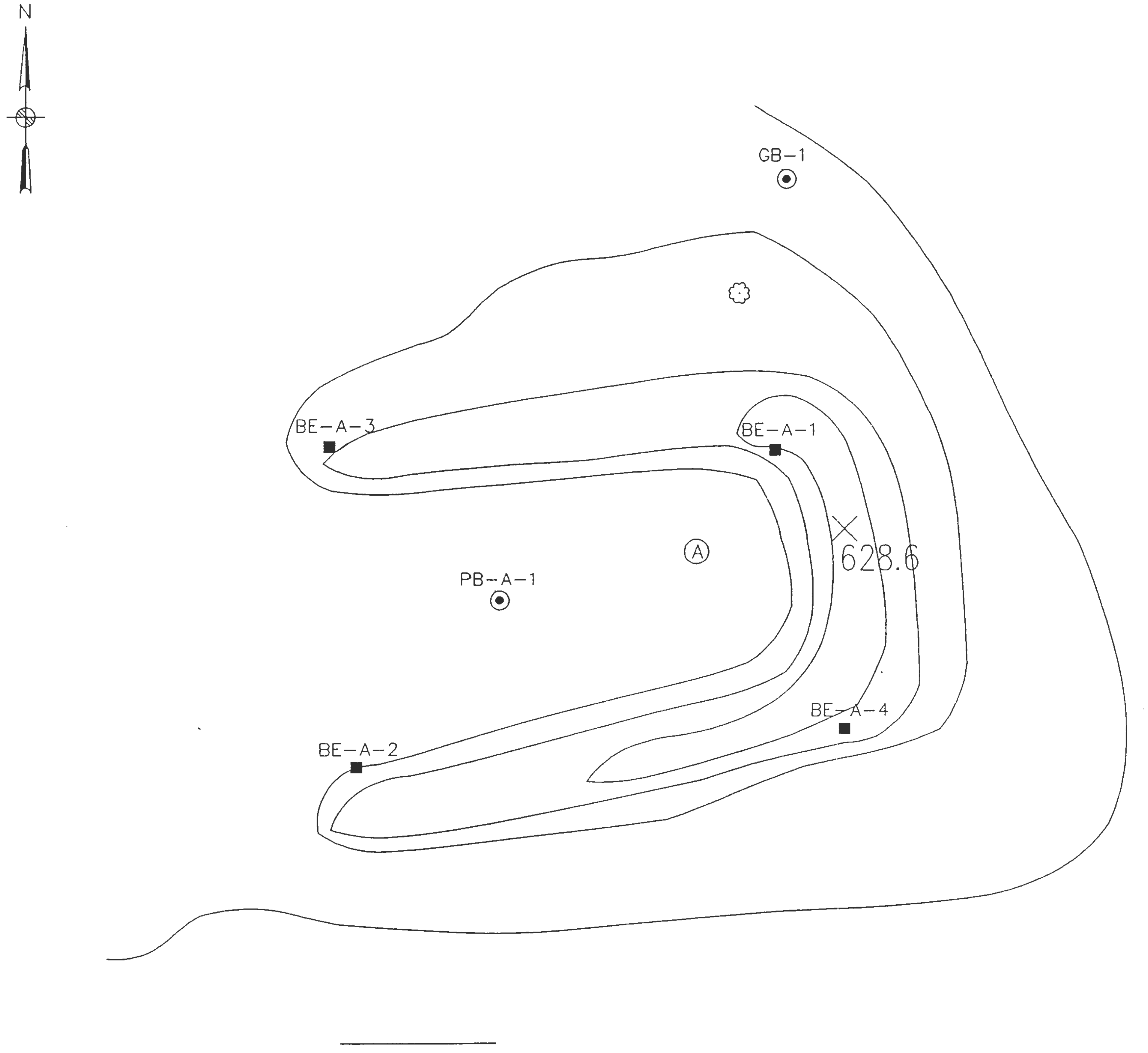
4.3.1.3 Pesticides/PCBs

Two pesticides, 4,4'-DDE and 4,4'-DDT were detected in soil samples collected at Pad A. The compound 4,4'-DDE was detected in five of the six samples analyzed with a maximum concentration of 140 ug/kg (estimated) found in sample PB-A-1. The compound 4,4'-DDT was detected in one of the Pad A soil samples (BE-A-3) at an estimated concentration of 9 ug/kg. Both of these values are significantly below the TAGM value of 2,100 ug/kg for both 4,4'-DDE and 4,4'-DDT.

4.3.1.4 Explosives

Figure 4-5 shows the locations were berm excavation and pad boring soil samples were collected. Also presented on this figure is a tabular summary of the Level II screening results along with the Level IV analytical results for explosives in soils.

The compound 2,4-dinitrotoluene was detected within all of the Pad A soil samples that were analyzed. No other explosive compounds were found in Pad A soils. The maximum concentration of 2,4-dinitrotoluene was detected in sample PB-A-2 at a depth of 0 to 2 feet (1,500 ug/kg). This Level IV result corresponds well with the Level II screening result of 1460 ug/kg for this soil sample. This compound was also detected in the soil sample PB-A-1, collected from a depth of 0 to 6 inches, at a concentration of 1500 ug/kg. Level II screening



BERM EXCAVATIONS			
LOCATION	DEPTH	LEVEL II	LEVEL IV
		TNT	2,4-D
BE-A-1	3.5'	<1000	140
BE-A-3	2.0'	<1000	120 J
BE-A-2	3.5'	<1000	NA
BE-A-4	2.0'	<1000	NA

All concentrations in ug/Kg.

PAD BORINGS			
LOCATION	DEPTH	LEVEL II	LEVEL IV
		TNT	2,4-D
PB-A-1	0-6"	NA	1500
	0-2'	1460	1600
	2-4'	<1000	NA
	4-6'	<1000	NA

All concentrations in ug/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION
BE-G-1 ■	BERM EXCAVATION & DESIGNATION
PB-G-1 GB-2 ⦿	BORING & DESIGNATION
650	GROUND CONTOUR AND ELEVATION
W-1	WETLAND & DESIGNATION
MW-17 ◒	MONITORING WELL & DESIGNATION
⚋	DIRT ROAD
◇	UTILITY POLE
○	TREE
⬭	BRUSH
SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
J	ESTIMATED VALUE
U	UNDETECTED VALUE
N/A	NOT AVAILABLE

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING NO. 720446-01000

FIGURE 4-5
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD A

SCALE 1" = 20'

indicates that concentrations were below the detection limit of 1,000 ug/kg for the deeper soil samples PB-A-3 (2 to 4 feet) and PB-A-4 (4 to 6 feet) of explosives.

The compound 2,4-dinitrotoluene was also detected in the berm excavation samples BE-A-1 and BE-A-3 at very low concentrations of 120 ug/kg and 140 ug/kg, respectively. Level II screening indicates that concentrations of explosives were below the detection limit of 1,000 ug/kg for the remaining berm excavation samples BE-A-2 and BE-A-4.

4.3.1.5 Metals

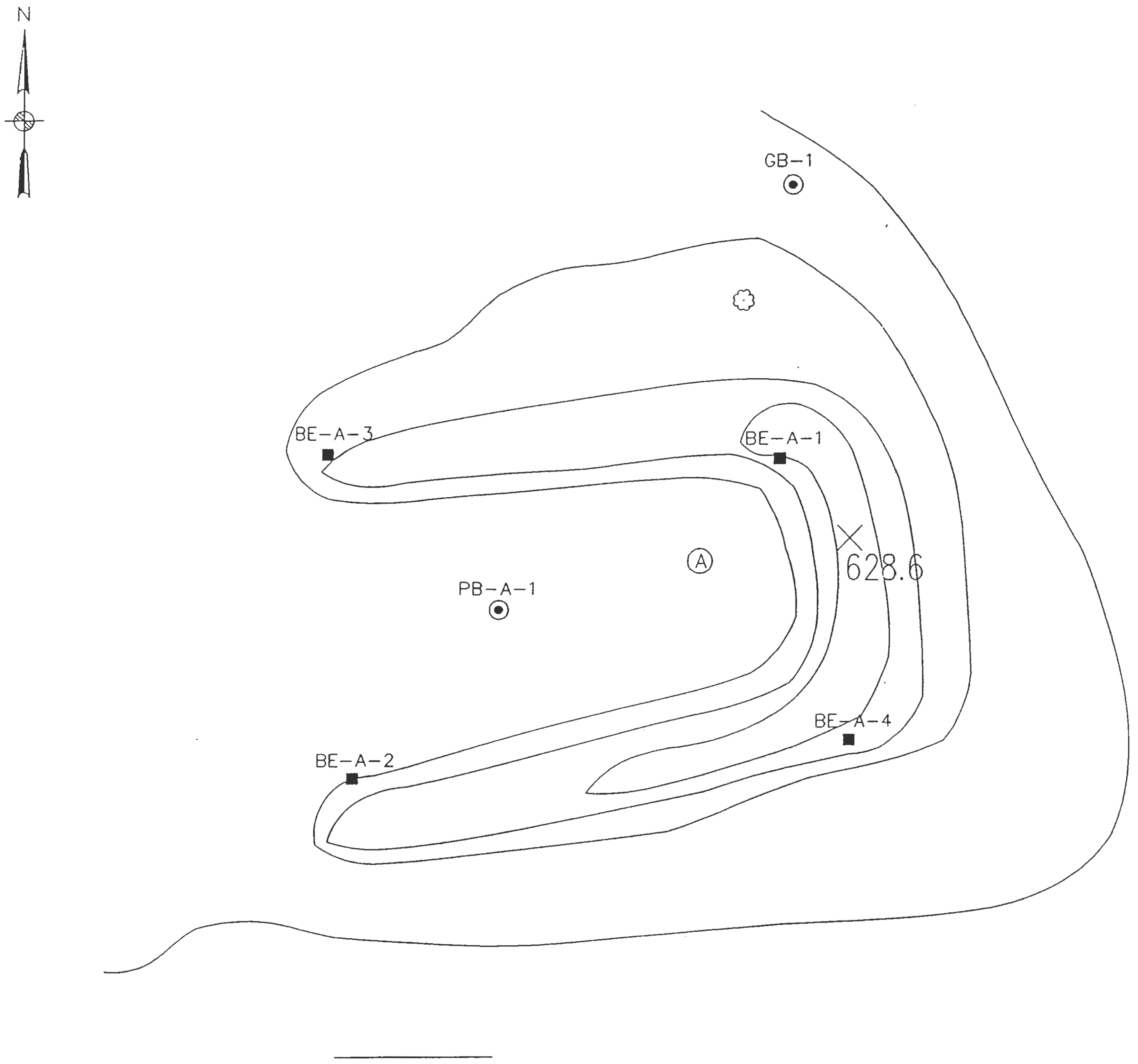
Figure 4-6 shows the locations where berm excavation and pad boring soil samples were collected. Also presented on this figure is a tabular summary of the Level II screening results along with the Level IV analytical results for the analysis of metals in soils.

The highest concentrations of barium (1910 mg/kg), copper (3160 mg/kg), and zinc (2150 mg/kg) were found in the two shallow (less than 2 feet) soil samples PB-A-1 and PB-A-2, collected from boring PB-A-1. The highest Pad A lead concentration (7880 mg/kg) was identified in the berm sample BE-A-1 which was collected on the northwest side of the berm. The TAGM values were exceeded by all of the Level IV soil samples analyzed on Pad A for the four metals of concern.

While lead concentrations in the two shallow (less than 2 feet) soil samples collected in boring PB-A-1 are generally high, the Level II data for the samples collected below 2 feet indicate that the concentration in lead in these deeper soils drops significantly. The Level II lead concentrations determined for the berm samples BE-A-2 and BE-A-4, both collected on the southern side of the berm, were 800 and 540 mg/kg, respectively, which are lower than the lead values determined for the two berm samples BE-A-1 and BE-A-3 collected on the northern side of the berm.

4.3.2 Burning Pad B

Four Level IV analyses were performed on samples collected from surface and subsurface soils at Pad B. During Phase I, the soil boring PB-B-1 was installed, and the berm excavations BE-B-1 and BE-B-2 were sampled. In Phase II, the berm excavations BE-B-3 and BE-B-4 were sampled. Five soil samples were collected from the boring PB-B-1 and one sample each was collected from the berm excavations BE-B-1 through BE-B-4. The surface sample



BERM EXCAVATIONS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
BE-A-1	3.5'	6600	1040	767	7880 J	210
BE-A-3	2.0'	1170	607	504	1380	426
BE-A-2	3.5'	800	NA	NA	NA	NA
BE-A-4	2.0'	540	NA	NA	NA	NA

All concentrations in mg/Kg.

PAD BORINGS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
PB-A-1	0-6"	NA	1910	1660	1560	350
	0-2'	2100	1820	2090	1220	926
	2-4'	101	NA	NA	NA	NA
	4-6'	68	NA	NA	NA	NA

All concentrations in mg/Kg.

LEGEND:

(G)	BURNING PAD DESIGNATION
BE-G-1 ■	BERM EXCAVATION & DESIGNATION
PB-G-1 GB-2 ◉	BORING & DESIGNATION
600	GROUND CONTOUR AND ELEVATION
W-1	WETLAND & DESIGNATION
MW-17	MONITORING WELL & DESIGNATION
	DIRT ROAD
	UTILITY POLE
	TREE
	BRUSH
SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
J	ESTIMATED VALUE
U	UNDETECTED VALUE
N/A	NOT AVAILABLE

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-6
DISTRIBUTION OF METALS
OPEN BURNING PAD A

SCALE 1" = 20'

collected at location PB-B-1, all four berm samples, and four of the five pad boring samples underwent Level II screening for lead, TNT, and VOCs. From these nine samples four were submitted for subsequent Level IV analyses, including two of the berm samples (BE-B-2 and BE-B-4) and two samples (PB-B-1-1 and PB-B-1-5) collected from pad boring PB-B-1.

A summary of the analytical results for the Level IV analyses is presented in Table 4-5. The following sections review the compounds detected within the soil samples collected on Pad B.

4.3.2.1 Volatile Organic Compounds

The volatile organic compound toluene was detected in the re-analysis of sample PB-B-1-5 at an estimated concentration of 3 ug/kg. This value is below the sample quantitation limit and is also significantly below the TAGM limit of 1500 ug/kg.

4.3.2.2 Semivolatile Organic Compounds

A variety of semivolatile compounds were detected in the soil samples collected at Pad B. The compounds 2,4-dinitrotoluene, di-n-butylphthalate, and bis-(2-ethylhexyl)phthalate were the most frequently detected, being found in half of the samples analyzed. Several naphthalene and phthalate related compounds were detected in low concentrations in the berm samples BE-B-2 and BE-B-3. Total SVOCs were 680 ug/kg (BE-B-2), 7460 ug/kg (BE-B-3), and 290 ug/kg (PB-B-1-1). No semivolatiles were detected in sample PB-B-1-5. The highest semivolatile concentrations, di-n-butylphthalate (790 ug/kg), and bis(2-ethylhexyl)phthalate (300 ug/kg) were detected in sample BE-B-3. None of the semivolatile compounds identified exceeded the TAGM limits.

The compounds 2,4-dinitrotoluene and 2,6-dinitrotoluene (also considered explosives) were detected in sample BE-B-3 at concentrations of 5600 ug/kg and 470 ug/kg, respectively, while berm sample BE-B-2 had the compound 2,4-dinitrotoluene detected at an estimated concentration of 130 ug/kg. The distribution of explosive compounds detected in Pad B soil samples is further discussed in Section 4.3.2.4.

TABLE 4-5

PAD B
SUMMARY OF COMPOUNDS DETECTED IN PAD B BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD B 2.5' 12/10/91 BE-B-2-91	OB 2.0 feet 12/03/92 BE-B-3	OB 2.0 feet 12/03/92 BE-B-4	PAD-B 0-6" 12/11/91 PB-B-1-1	PAD-B 0-6" 12/11/91 PB-B-1-1RI	PAD-B 6-8' 12/11/91 PBB-1-5	PAD-B 6-8' 12/11/91 PBB-1-5RE
VOCs (ug/kg)											
Methylene Chloride	0.0%	0	100	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Acetone	0.0%	0	200	0	12 U	12 U	N	11 U J	10 U J	11 U J	11 U J
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Chloroform	0.0%	0	300	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
2-Butanone	0.0%	0	300	0	12 U	12 U	N	11 U J	10 U J	11 U J	11 U J
1,1,1-Trichloroethane	0.0%	0	800	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Carbon Tetrachloride	0.0%	0	600	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Trichloroethene	0.0%	0	700	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Benzene	0.0%	0	60	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Tetrachloroethene	0.0%	0	1400	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Toluene	16.7%	3	1500	0	6 U	12 U	N	6 U J	5 U J	6 U J	3 J
Chlorobenzene	0.0%	0	1700	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Xylene (total)	0.0%	0	1200	0	6 U	12 U	N	6 U J	5 U J	6 U J	6 U J
Semivolatiles (ug/kg)											
Phenol	0.0%	0	30 or MDL	0	770 U	420 U	N	960 U	N	740 U	N
2-Methylphenol	0.0%	0	100 or MDL	0	770 U	420 U	N	960 U	N	740 U	N
4-Methylphenol	0.0%	0	900	0	770 U	420 U	N	960 U	N	740 U	N
2,4-Dimethylphenol	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N
Benzoic acid	0.0%	0	2700	0	3800 U	N	N	4700 U	N	3600 U	N
Naphthalene	25.0%	160	13,000	0	770 U	420 U	N	160 J	N	740 U	N
2-Methylnaphthalene	25.0%	15	36,400	0	770 U	15 J	N	960 U	N	740 U	N
2-Chloronaphthalene	25.0%	130	50,000*	0	770 U	420 U	N	130 J	N	740 U	N
2-Nitroaniline	0.0%	0	430 or MDL	0	3800 U	1000 U	N	4700 U	N	3600 U	N
Acenaphthylene	0.0%	0	41,000	0	770 U	420 U	N	960 U	N	740 U	N
2,6-Dinitrotoluene	25.0%	470	1000	0	770 U	470	N	960 U	N	740 U	N
3-Nitroaniline	0.0%	0	500 or MDL	0	3800 U	1000 U	N	4700 U	N	3600 U	N
Acenaphthene	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N
Dibenzofuran	0.0%	0	6200	0	770 U	420 U	N	960 U	N	740 U	N
2,4-Dinitrotoluene	50.0%	5600	50,000*	0	130 J	5600 J	N	960 U	N	740 U	N
Diethylphthalate	0.0%	0	7100	0	770 U	420 U	N	960 U	N	740 U	N
Fluorene	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N
N-Nitrosodiphenylamine	25.0%	240	50,000*	0	770 U	240 J	N	960 U	N	740 U	N
Hexachlorobenzene	25.0%	20	410	0	770 U	20 J	N	960 U	N	740 U	N
Pentachlorophenol	0.0%	0	1000 or MDL	0	3800 U	1000 U	N	4700 U	N	3600 U	N
Phenanthrene	25.0%	25	50,000*	0	770 U	25 J	N	960 U	N	740 U	N
Anthracene	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N
Carbazole	0.0%	0	50,000*	0	N	420 U	N	N	N	N	N
Di-n-butylphthalate	50.0%	790	8100	0	380 J	790	N	960 U	N	740 U	N
Fluoranthene	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N
Pyrene	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N
Butylbenzylphthalate	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N
Benzo(a)anthracene	0.0%	0	220 or MDL	0	770 U	420 U	N	960 U	N	740 U	N
Chrysene	0.0%	0	400	0	770 U	420 U	N	960 U	N	740 U	N
bis(2-Ethylhexyl)phthalate	50.0%	300	50,000*	0	170 J	300 J	N	960 U	N	740 U	N
Di-n-octylphthalate	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N
Benzo(b)fluoranthene	0.0%	0	1100	0	770 U	420 U	N	960 U	N	740 U	N
benzo(k)fluoranthene	0.0%	0	1100	0	770 U	420 U	N	960 U	N	740 U	N
Benzo(a)pyrene	0.0%	0	61 or MDL	0	770 U	420 U	N	960 U	N	740 U	N
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	770 U	420 U	N	960 U	N	740 U	N
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	770 U	420 U	N	960 U	N	740 U	N
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	770 U	420 U	N	960 U	N	740 U	N

TABLE 4–5

PAD B
SUMMARY OF COMPOUNDS DETECTED IN PAD B
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD B 2.5' 12/10/91 BE–B–2–91	OB 2.0 feet 12/03/92 BE–B–3	OB 2.0 feet 12/03/92 BE–B–4	PAD–B 0–6" 12/11/91 PB–B–1–1	PAD–B 0–6" 12/11/91 PB–B–1–1RE	PAD–B 6–8' 12/11/91 PBB–1–5	PAD–B 6–8' 12/11/91 PBB–1–5RE
Pesticides/PCBs (ug/kg)											
beta–BHC	0.0%	0	200	0	190 U	2.2 U	N	180 U	N	18 U	N
delta–BHC	0.0%	0	300	0	190 U	2.2 U	N	180 U	N	18 U	N
gamma–BHC (Lindane)	0.0%	0	60	0	190 U	2.2 U	N	180 U	N	18 U	N
Heptachlor	0.0%	0	100	0	190 U	2.2 U	N	180 U	N	18 U	N
Aldrin	0.0%	0	41	0	190 U	2.2 U	N	180 U	N	18 U	N
Heptachlor epoxide	0.0%	0	20	0	190 U	2.2 U	N	180 U	N	18 U	N
Endosulfan I	0.0%	0	900	0	190 U	2.2 U	N	180 U	N	18 U	N
Dieldrin	0.0%	0	44	0	380 U	4.2 U	N	350 U	N	36 U	N
4,4'–DDE	25.0%	6.2	2100	0	380 U	6.2	N	350 U	N	36 U	N
Endrin	0.0%	0	100	0	380 U	4.2 U	N	350 U	N	36 U	N
Endosulfan II	0.0%	0	900	0	380 U	4.2 U	N	350 U	N	36 U	N
4,4'–DDD	0.0%	0	2900	0	380 U	4.2 U	N	350 U	N	36 U	N
Endosulfan sulfate	0.0%	0	1000	0	380 U	4.2 U	N	350 U	N	36 U	N
4,4'–DDT	50.0%	2800	2100	1	2800	11	N	350 U	N	36 U	N
Endrin aldehyde	0.0%	0		NA	N	4.2 U	N	N	N	N	N
alpha–Chlordane	0.0%	0	540	0	1900 U	2.2 U	N	1800 U	N	180 U	N
Aroclor–1254	0.0%	0	1000	0	3800 U	42 U	N	3500 U	N	360 U	N
Aroclor–1260	0.0%	0	1000	0	3800 U	42 U	N	3500 U	N	360 U	N
Explosives (ug/kg)											
HMX	0.0%	0		NA	1000 U	120 U	N	1000 U	N	1000 U	N
RDX	0.0%	0		NA	120 U	120 U	N	120 U	N	120 U	N
1,3,5–Trinitrobenzene	50.0%	250		NA	250	120 J	N	120 U	N	120 U	N
1,3–Dinitrobenzene	0.0%	0		NA	120 U	120 U	N	120 U	N	120 U	N
Tetryl	0.0%	0		NA	400 U	120 U	N	400 U	N	400 U	N
2,4,6–Trinitrotoluene	50.0%	430		NA	300	430	N	120 U	N	120 U	N
4–amino–2,6–Dinitrotoluene	25.0%	200		NA	120 U	200 J	N	120 U	N	120 U	N
2–amino–4,6–Dinitrotoluene	50.0%	360		NA	360	170	N	120 U	N	120 U	N
2,6–Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	N	120 U	N	120 U	N
2,4–Dinitrotoluene	50.0%	590		NA	590	530	N	120 U	N	120 U	N
Metals (mg/kg)											
Aluminum	100.0%	23900	17503.0	2	19400	N	23900	15700	N	16600	N
Antimony	0.0%	0	5	0	68.8 R	N	17.7 R	9.9 UR	N	17.8 R	N
Arsenic	75.0%	8	7.5	2	10.1 R	N	7.7 J	8 J	N	5.6 J	N
Barium	100.0%	19600	300	4	19600	N	2510	14700 J	N	6040 J	N
Beryllium	25.0%	0.96	1	0	0.77 R	N	0.96	0.74 R	N	0.67 R	N
Cadmium	100.0%	15	1.8	4	15 J	N	5.5	9.5	N	5	N
Calcium	100.0%	33400	46825.0	0	11700	N	7030	24300 J	N	33400 J	N
Chromium	75.0%	47.7	26.6	3	48.1 R	N	41.6	47.7	N	27	N
Cobalt	100.0%	19.5	30	0	19.5	N	14.6	15.5	N	11.6	N
Copper	100.0%	38100	25	4	38100	N	3050	1150 J	N	6890 J	N
Iron	100.0%	48100	32698.0	4	43200	N	37200	48100 J	N	39100 J	N
Lead	100.0%	41200	30	4	41200 J	N	7210	231 J	N	3180 J	N
Magnesium	100.0%	13400	9071.1	2	9210	N	8390	7010	N	13400	N
Manganese	100.0%	693	1065.8	0	646	N	518	693	N	420	N
Mercury	100.0%	0.2	0.1	2	0.2 J	N	0.15	0.07 J	N	0.08	N
Nickel	100.0%	64.8	41.3	4	44.8	N	46.3	64.8	N	42.8	N
Potassium	100.0%	3570	1529.6	4	3570 J	N	3060	3150	N	1850	N
Selenium	100.0%	3.2	2	2	3.2 J	N	3 J	0.32 J	N	0.2 J	N
Silver	50.0%	2.3	0.6	2	3.1 R	N	0.74 J	2.3	N	0.95 U	N
Sodium	75.0%	347	76	3	347 J	N	158 R	337 J	N	149 J	N
Thallium	0.0%	0	0.3	0	0.34 U	N	0.51 U	0.4 U	N	0.31 U	N
Vanadium	100.0%	36.2	150	0	29.2	N	36	36.2	N	21.6	N
Zinc	100.0%	5380	89.1	4	5380	N	2070	2610 J	N	712 J	N
Cyanide	25.0%	0.52	NA	NA	0.67 U	N	0.59 U	0.61 U	N	0.52	N

NOTES:

a) * = As per proposed TAGM, Total VOCs <10ppm, Total Semi–VOCs <500 ppm, Individual Semi–VOCs <50ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2–Dichloroethene (trans) was used for 1,2–Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

4.3.2.3 Pesticides/PCBs

The two pesticides 4,4'-DDE and 4,4'-DDT were detected in soil samples collected within the berm at Pad B. The compound 4,4'-DDE was detected in the berm sample BE-B-3 at a concentration of 6 ug/kg which is well below the TAGM value of 2,100 ug/kg. The compound 4,4'-DDT was detected in samples BE-B-2 and BE-B-3 at concentrations of 2,800 ug/kg and 11 ug/kg, respectively. The measured concentration of 2,800 ug/kg in sample BE-B-2 exceeds the TAGM value of 2,100 ug/kg for 4,4'-DDT.

4.3.2.4 Explosives

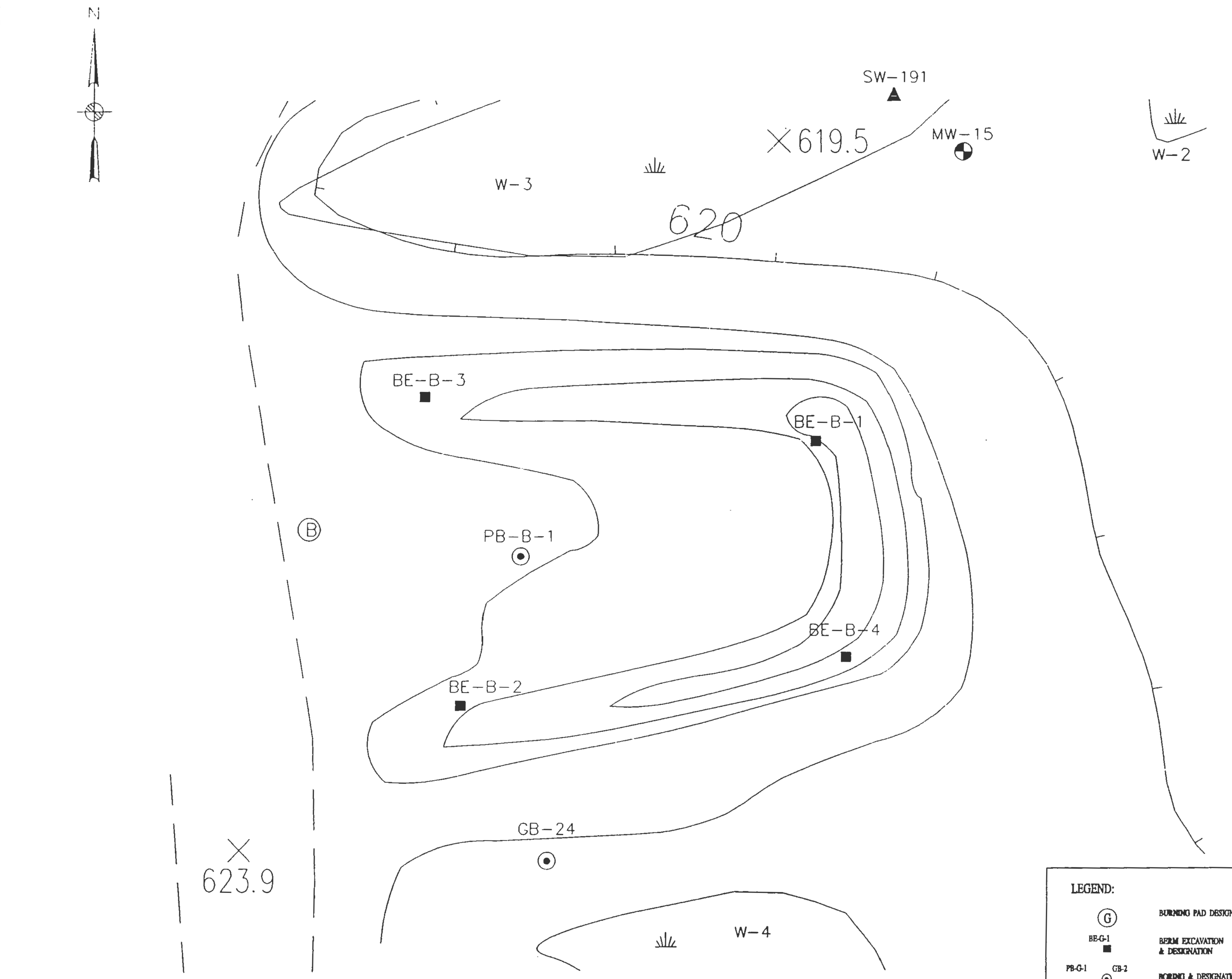
Figure 4-7 summarizes the explosives results for Pad B. Several explosive compounds were detected within the berm samples BE-B-2 and BE-B-3. No explosive compounds were detected within the two soil samples collected from pad boring PB-B-1. The compounds 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 2-amino 4,6 dinitrotoluene and 2,4-dinitrotoluene were identified in two of the four samples analyzed. The maximum concentration was found in sample BE-B-2 (590 ug/kg). The total explosives found in sample BE-B-2 was 1,500 ug/kg while sample BE-B-3 had total explosives of 1,450 ug/kg.

No explosive compounds were identified within the soil samples collected from pad boring PB-B-1. The near surface (0 to 6 inches) sample, and a sample collected from the 6 to 8 feet depth were submitted for Level IV analysis. While the deeper sample showed explosive compounds present based upon the Level II screening, the subsequent Level IV analysis did not confirm the presence of any explosive compounds. It should be noted that the Level II screening result of 1,010 ug/kg (1.01 ug/kg) for the deep soil sample collected at PB-B-1 is just above the Level II detection limit of 1.0 ug/kg.

4.3.2.5 Metals

Figure 4-8 summarize the metals data for Pad B.

The highest concentrations of barium (19600 mg/kg), copper (38,100 mg/kg), lead (41,200 mg/kg), and zinc (5,380 mg/kg) were found in the berm sample BE-B-2. The TAGM limits were exceeded by all of the Level IV soil samples analyzed on Pad B for the four metals of concern.



BERM EXCAVATIONS								
LOCATION	DEPTH	LEVEL II	LEVEL IV					
		TNT	1,3,5-T	2,4,6-T	4-amino	2-amino	2,4-D
BE-B-1	2.0'	<1000	NA	NA	NA	NA	NA
BE-B-2	2.5'	1270	250	300	120 U	360	590
BE-B-3	2.0'	1000	120 J	430	200 J	170	530
BE-B-4	2.0'	<1000	NA	NA	NA	NA	NA

All concentrations in ug/Kg.

PAD BORINGS							
LOCATION	DEPTH	LEVEL II	LEVEL IV				
		TNT	1,3,5-T	2,4,6-T	4-amino	2-amino	2,4-D
PBB-1	0-6"	<1000	120 U	120 U	120 U	120 U	120 U
	0-2'	<1000	NA	NA	NA	NA	NA
	2-4'	<1000	NA	NA	NA	NA	NA
	4-6'	<1000	NA	NA	NA	NA	NA
	6-8'	1010	120 U	120 U	120 U	120 U	120 U

All concentrations in ug/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION	⁼⁼	DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	◊	UTILITY POLE
PB-G-1 GB-2 ◉	BORING & DESIGNATION	⊙	TREE
650 ⌒	GROUND CONTOUR AND ELEVATION	○	BRUSH
W-1	WETLAND & DESIGNATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
		J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17 ⊕	MONITORING WELL & DESIGNATION	N/A	NOT AVAILABLE

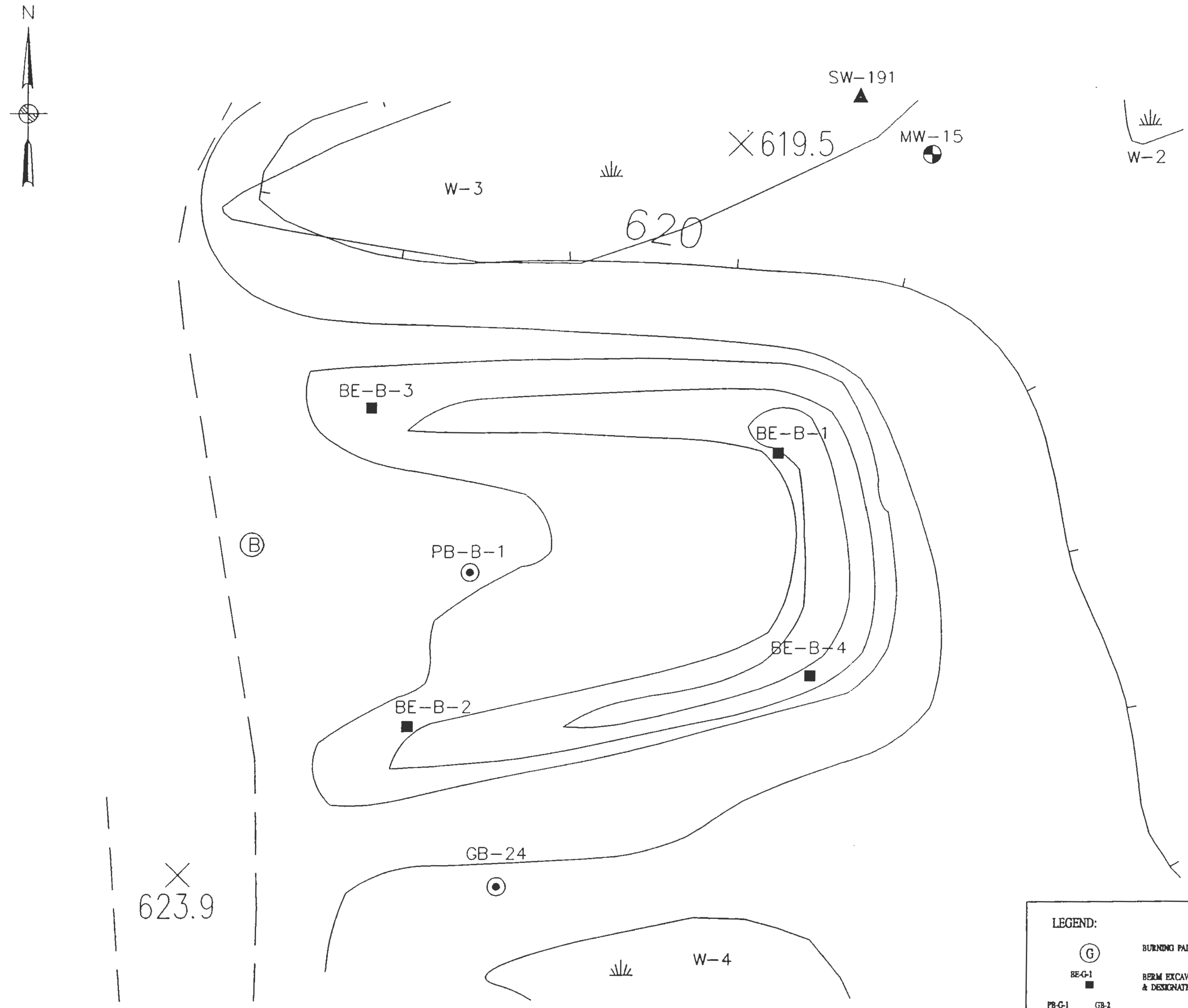
ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-7
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD B

SCALE 1" = 20'



BERM EXCAVATIONS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
BE-B-1	2.0'	4000	NA	NA	NA	NA
BE-B-2	2.5'	34000	19600	38100	41200 J	5380
BE-B-3	2.0'	3900	NA	NA	NA	NA
BE-B-4	2.0'	6000	2510	3050	7210	2070

All concentrations in mg/Kg.

PAD BORINGS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
PBB-1	0-6"	NA	14700 J	1150 J	231 J	2610 J
	0-2'	77	NA	NA	NA	NA
	2-4'	2600	NA	NA	NA	NA
	4-6'	2100	NA	NA	NA	NA
	6-8'	960	6040 J	6890 J	3180 J	712 J

All concentrations in mg/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION	- - -	DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	◇	UTILITY POLE
		○	TREE
PB-G-1 GB-2 ⊙	BORING & DESIGNATION		BRUSH
650	GROUND CONTOUR AND ELEVATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
W-1	WETLAND & DESIGNATION	J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17 ◍	MONITORING WELL & DESIGNATION	N/A	NOT AVAILABLE

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OPEN BURNING GROUNDS

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FIGURE 4-8
DISTRIBUTION OF METALS
OPEN BURNING PAD B

SCALE 1" = 20'

Metals concentrations in the two soil samples collected in boring PB-B-1 are also high, with the sample PB-B-1-1, collected from a depth of 0 to 6 inches, having concentrations of 14,700 mg/kg (barium), 1,150 mg/kg (copper), 231 mg/kg (lead), and 2,610 mg/kg (zinc). The deeper soil sample PB-B-1-5 also exhibited elevated concentrations of these metals. The second berm sample that underwent Level IV analysis, BE-B-4, had concentrations of 2,510 mg/kg (barium), 3,050 mg/kg copper, 7,210 mg/kg lead, and 2,070 mg/kg zinc. The Level II lead concentrations determined for the berm samples BE-B-1 and BE-B-3 were 4,000 and 3,900 mg/kg, respectively.

4.3.3 Burning Pad C

Ten Level IV analyses were performed on samples collected from surface and subsurface soils at Pad C. During Phase I, the pad boring PB-C-1 was installed, and the berm excavations BE-C-1 through BE-C-4 were sampled. In Phase II, pad borings PB-C-2 through PB-C-5 were installed. Berm excavations BE-C-5 and BE-C-6 were also sampled in Phase II. In total, five pad borings, and six berm excavations were completed at Pad C during the RI.

The four soil samples collected from borings PB-C-2 through PB-C-5, and the surface sample collected at pad boring PB-C-1 underwent only Level IV analyses. Four of the five soil samples collected from boring PB-C-1, and all of the six berm excavation samples collected at Pad C underwent Level II screening for lead, TNT, and VOCs. From these ten samples, four were submitted for subsequent Level IV analyses, these being three of the berm samples (BE-C-2, BE-C-3, and BE-B-6) and one pad boring sample (PB-C-1-3).

A summary of the analytical results for the Level IV analyses is presented in Table 4-6. The following sections review the compounds detected within the soil samples collected on Pad C.

4.3.3.1 Volatile Organic Compounds

Low levels of volatile organic compounds were detected in a few of the soil samples collected at Pad C. With the exception of methylene chloride, all the detected volatiles were reported at concentrations (ranging from 2 to 7 ug/kg), which are all below the sample quantitation limits. Methylene chloride was reported in sample PBC-2-1 at a concentration of 21 ug/kg. Tetrachloroethene was reported in sample BE-C-2 at a concentration of 6 ug/kg. None of the

TABLE 4–6

PAD C
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD C 4.0' 12/03/91 BE–C–2–91	PAD C 4.0' 12/03/91 BE–C–3–91	OB 2.0 feet 12/03/92 BE–C–5	OB 2.0 feet 12/03/92 BE–C–5RE	OB 2.0 feet 12/03/92 BE–C–6	PAD C 0–6" 01/07/92 PBC–1–1	PAD C 0–6" 01/07/92 PBC–1–1A	PAD C 0–6" 01/07/92 PBC–1–1ARE	PAD C 2–4' 01/07/92 PBC–1–3	PAD C 2–4' 01/07/92 PBC–1–3DL
VOCs(ug/kg)														
Methylene Chloride	6.3%	21	100	0	6 U	6 U	12 U	N	N	8 U J	6 U J	5 U J	6 U R	28 U
Acetone	0.0%	0	200	0	11 U	12 U	12 U	N	N	11 U J	11 U J	11 U J	11 U R	56 U
1,2–Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	6 U	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Chloroform	6.3%	7	300	0	6 U	6 U	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
2–Butanone	0.0%	0	300	0	11 U	12 U	12 U	N	N	11 U J	11 U J	11 U J	11 U R	56 U
1,1,1–Trichloroethane	0.0%	0	800	0	6 U	6 U	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Carbon Tetrachloride	0.0%	0	600	0	6 U	6 U	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Trichloroethene	6.3%	4	700	0	6 U	6 U	4 J	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Benzene	6.3%	2	60	0	6 U	6 U	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Tetrachloroethene	12.5%	6	1400	0	6	1 J	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Toluene	6.3%	2	1500	0	6 U	6 U	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Chlorobenzene	0.0%	0	1700	0	6 U	6 U	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Xylene (total)	0.0%	0	1200	0	6 U	6 U	12 U	N	N	5 U J	6 U J	5 U J	6 U R	28 U
Semivolatiles (ug/kg)														
Phenol	16.7%	360	30 or MDL	2	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
2–Methylphenol	16.7%	760	100 or MDL	2	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
4–Methylphenol	16.7%	1300	900	2	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
2,4–Dimethylphenol	16.7%	630	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Benzoic acid	0.0%	0	2700	0	3700 U	3900 U	N	N	N	3400 U	3400 U	N	N	N
Naphthalene	41.7%	84	13,000	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
2–Methylnaphthalene	58.3%	360	36,400	0	750 U	800 U	15 J	N	N	710 U	710 U	N	N	N
2–Chloronaphthalene	8.3%	18	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
2–Nitroaniline	0.0%	0	430 or MDL	0	3700 U	3900 U	980 U	N	N	3400 U	3400 U	N	N	N
Acenaphthylene	0.0%	0	41,000	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
2,6–Dinitrotoluene	8.3%	250	1000	0	750 U	800 U	250 J	N	N	710 U	710 U	N	N	N
3–Nitroaniline	0.0%	0	500 or MDL	0	3700 U	3900 U	980 U	N	N	3400 U	3400 U	N	N	N
Acenaphthene	0.0%	0	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Dibenzofuran	0.0%	0	6200	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
2,4–Dinitrotoluene	25.0%	2900	50,000*	0	750 U	730 J	2900 J	N	N	710 U	710 U	N	N	N
Diethylphthalate	0.0%	0	7100	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Fluorene	0.0%	0	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
N–Nitrosodiphenylamine	33.3%	1100	50,000*	0	750 U	190 J	360 J	N	N	710 U	710 U	N	N	N
Hexachlorobenzene	0.0%	0	410	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Pentachlorophenol	0.0%	0	1000 or MDL	0	3700 U	3900 U	980 U	N	N	3400 U	3400 U	N	N	N
Phenanthrene	50.0%	540	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Anthracene	0.0%	0	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Carbazole	0.0%	0	50,000*	0	N	N	400 U	N	N	N	N	N	N	N
Di–n–butylphthalate	25.0%	740	8100	0	740 J	200 J	720	N	N	710 U	710 U	N	N	N
Fluoranthene	16.7%	20	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Pyrene	25.0%	120	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Butylbenzylphthalate	0.0%	0	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Benzo(a)anthracene	16.7%	77	220 or MDL	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Chrysene	16.7%	180	400	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
bis(2–Ethylhexyl)phthalate	50.0%	750	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Di–n–octylphthalate	0.0%	0	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Benzo(b)fluoranthene	16.7%	79	1100	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
benzo(k)fluoranthene	0.0%	0	1100	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Benzo(a)pyrene	16.7%	160	61 or MDL	2	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Indeno(1,2,3–cd)pyrene	16.7%	63	3200	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N
Benzo(g,h,i)perylene	16.7%	320	50,000*	0	750 U	800 U	400 U	N	N	710 U	710 U	N	N	N

TABLE 4-6

PAD C
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD C 4.0' 12/03/91 BE-C-2-91	PAD C 4.0' 12/03/91 BE-C-3-91	OB 2.0 feet 12/03/92 BE-C-5	OB 2.0 feet 12/03/92 BE-C-5RE	OB 2.0 feet 12/03/92 BE-C-6	PAD C 0-6" 01/07/92 PBC-1-1	PAD C 0-6" 01/07/92 PBC-1-1A	PAD C 0-6" 01/07/92 PBC-1-1ARE	PAD C 2-4' 01/07/92 PBC-1-3	PAD C 2-4' 01/07/92 PBC-1-3DL
Pesticides/PCBs (ug/kg)														
beta-BHC	0.0%	0	200	0	18 U	19 U	2.1 U	2.1 U	N	17 U	17 U	N	N	N
delta-BHC	0.0%	0	300	0	18 U	19 U	2.1 U	2.1 U	N	17 U	17 U	N	N	N
gamma-BHC (Lindane)	7.7%	9.6	60	0	18 U	19 U	2.1 U	2.1 U	N	17 U	17 U	N	N	N
Heptachlor	7.7%	32	100	0	18 U	19 U	2.1 U	2.1 U	N	17 U	17 U	N	N	N
Aldrin	23.1%	4	41	0	18 U	19 U	2.1 U	2.1 U	N	17 U	17 U	N	N	N
Heptachlor epoxide	0.0%	0	20	0	18 U	19 U	2.1 U	2.1 U	N	17 U	17 U	N	N	N
Endosulfan I	15.4%	2.6	900	0	18 U	19 U	2.1 U	2.1 U	N	17 U	17 U	N	N	N
Dieldrin	0.0%	0	44	0	37 U	39 U	4.1 U	4.1 U	N	34 U	34 U	N	N	N
4,4'-DDE	15.4%	1.3	2100	0	37 U	39 U	1.3 J	1.2 J	N	34 U	34 U	N	N	N
Endrin	0.0%	0	100	0	37 U	39 U	4.1 U	4.1 U	N	34 U	34 U	N	N	N
Endosulfan II	15.4%	110	900	0	37 U	39 U	4.1 U	4.1 U	N	34 U	34 U	N	N	N
4,4'-DDD	15.4%	3.7	2900	0	37 U	39 U	4.1 U	4.1 U	N	34 U	34 U	N	N	N
Endosulfan sulfate	15.4%	4.3	1000	0	37 U	39 U	4.1 U	4.1 U	N	34 U	34 U	N	N	N
4,4'-DDT	23.1%	2.6	2100	0	37 U	39 U	2.2 J	2.6 J	N	34 U	34 U	N	N	N
Endrin aldehyde	14.3%	4.5		NA	N	N	4.1 U	4.1 U	N	N	N	N	N	N
alpha-Chlordane	23.1%	270	540	0	180 U	190 U	2.1 U	2.1 U	N	170 U	170 U	N	N	N
Aroclor-1254	0.0%	0	1000	0	370 U	390 U	41 U	41 U	N	340 U	340 U	N	N	N
Aroclor-1260	0.0%	0	1000	0	370 U	390 U	41 U	41 U	N	340 U	340 U	N	N	N
Explosives (ug/kg)														
HMX	0.0%	0		NA	1000 U	1000 U	120 U	N	N	1000 U	1000 U	N	N	N
RDX	8.3%	88		NA	120 U	120 U	120 U	N	N	120 U	120 U	N	N	N
1,3,5-Trinitrobenzene	33.3%	610		NA	610	180	140	N	N	120 U	120 U	N	N	N
1,3-Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	N	N	120 U	120 U	N	N	N
Tetryl	0.0%	0		NA	400 U	400 U	120 U	N	N	400 U	400 U	N	N	N
2,4,6-Trinitrotoluene	16.7%	240		NA	120 U	240	160 J	N	N	120 U	120 U	N	N	N
4-amino-2,6-Dinitrotoluene	16.7%	240		NA	120 U	240	240 J	N	N	120 U	120 U	N	N	N
2-amino-4,6-Dinitrotoluene	8.3%	240		NA	120 U	120 U	240 J	N	N	120 U	120 U	N	N	N
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	120 U	N	N	120 U	120 U	N	N	N
2,4-Dinitrotoluene	58.3%	1000		NA	440	460	1000 J	N	N	120 U	120 U	N	N	N
Metals (mg/kg)														
Aluminum	100.0%	30500	17503.0	2	20700	30500	N	N	16800	13100	15100	N	N	N
Antimony	33.3%	143	5	3	6.1 R	67.7 R	N	N	17.7 R	4.9 U J	5.2 U J	N	N	N
Arsenic	91.7%	20	7.5	1	6.2 R	20	N	N	6.4 J	6.1 J	5.3 J	N	N	N
Barium	100.0%	3900	300	7	2240	3900	N	N	1360	102	166	N	N	N
Beryllium	50.0%	0.83	1	0	0.79 R	0.86 R	N	N	0.83	0.68 R	0.77 R	N	N	N
Cadmium	100.0%	28.2	1.8	10	28.2	16.3 J	N	N	1.7	4.5	3.6	N	N	N
Calcium	100.0%	31100	46825.0	0	15200	12300	N	N	11300	22400	27800	N	N	N
Chromium	83.3%	32.1	26.6	7	53.6 R	46 R	N	N	27.4	26 J	28.2 J	N	N	N
Cobalt	100.0%	14.4	30	0	13.8	11.4	N	N	11.9	12.7	13.8	N	N	N
Copper	100.0%	13000	25	12	3800	3620	N	N	4860	93.7 J	1330 J	N	N	N
Iron	100.0%	42600	32698.0	5	36200	33800	N	N	27700	30400	36500	N	N	N
Lead	100.0%	56700	30	12	56700 J	29000 J	N	N	5730	373	146	N	N	N
Magnesium	100.0%	8770	9071.1	0	8060	8770	N	N	6650	6330	7700	N	N	N
Manganese	100.0%	676	1065.8	0	610	676	N	N	529	342	374	N	N	N
Mercury	41.7%	0.23	0.1	3	0.21 J	0.23 J	N	N	0.09	0.1 R	0.25 R	N	N	N
Nickel	100.0%	66.1	41.3	9	49.9	51.6	N	N	37.9	53 J	51.8 J	N	N	N
Potassium	100.0%	3060	1529.6	9	2880 J	3060 J	N	N	2240	1580 J	1930 J	N	N	N
Selenium	58.3%	0.79	2	0	1 UJ	0.86 UJ	N	N	0.74 J	0.45 J	0.4 J	N	N	N
Silver	66.7%	6.5	0.6	6	4.7	6.5	N	N	0.86 J	1.2	0.54 J	N	N	N
Sodium	83.3%	482	76	10	353 J	482 J	N	N	82.6 R	105 J	110 J	N	N	N
Thallium	16.7%	0.76	0.3	2	0.64 U	0.55 U	N	N	0.6 U	0.76 J	0.51 J	N	N	N
Vanadium	91.7%	31.8	150	0	22.9	31.8	N	N	27.5	19 R	20.6	N	N	N
Zinc	100.0%	127000	89.1	12	7640	3380	N	N	966	613	1540	N	N	N
Cyanide	0.0%	0	NA	NA	0.6 U	0.69 U	N	N	0.61 U	0.6 U	0.55 U	N	N	N

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TABLE 4-6

PAD C
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	NUMBER OF SAMPLES ABOVE SITE BACKGROUND	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD C 2-4' 01/07/92 PBC-1-3A	PAD C 2-4' 01/07/92 PBC-1-3ADI	PAD C 2-4' 01/07/92 PBC-1-4	PAD C 2-4' 01/07/92 PBC-1-4A	OB 0-2 03/11/93 PBC-2-1	OB 0-2 03/11/93 PBC-2-2	OB 0-2 03/11/93 PBC2-2RE	OB 0-2 03/11/93 PBC-3-1	OB 0-2 03/11/93 PBC-4-1	OB 0-2 03/11/93 PBC-5-1
VOCs(ug/kg)														
Methylene Chloride	6.3%	1	100	0	6 U J	950 U R	N	N	21	11 U	11 U	11 U	28 U	11 U
Acetone	0.0%	0	200	0	15 U J	1500 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U J	740 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Chloroform	6.3%	0	300	0	6 U J	740 U R	N	N	11 U	11 U	11 U	11 U	7 J	11 U
2-Butanone	0.0%	0	300	0	12 U J	1500 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
1,1,1-Trichloroethane	0.0%	0	800	0	6 U J	740 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Carbon Tetrachloride	0.0%	0	600	0	6 U J	740 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Trichloroethene	6.3%	0	700	0	6 U J	740 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Benzene	6.3%	0	60	0	2 J	180 R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Tetrachloroethene	12.5%	0	1400	0	6 U J	740 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Toluene	6.3%	0	1500	0	2 J	740 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Chlorobenzene	0.0%	0	1700	0	6 U J	740 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Xylene (total)	0.0%	0	1200	0	6 U J	740 U R	N	N	11 U	11 U	11 U	11 U	28 U	11 U
Semivolatiles (ug/kg)														
Phenol	16.7%	0	30 or MDL	2	N	N	360 J	360 J	360 U	360 U	N	350 U	1800 U	3600 U
2-Methylphenol	16.7%	2	100 or MDL	2	N	N	650 J	760	360 U	360 U	N	350 U	1800 U	3600 U
4-Methylphenol	16.7%	2	900	2	N	N	1100	1300	360 U	360 U	N	350 U	1800 U	3600 U
2,4-Dimethylphenol	16.7%	2	50,000*	0	N	N	120 J	630 J	360 U	360 U	N	350 U	1800 U	3600 U
Benzoic acid	0.0%	0	2700	0	N	N	3800 U	3600 U	N	N	N	N	N	N
Naphthalene	41.7%	0	13,000	0	N	N	84 J	80 J	55 J	59 J	N	20 J	1800 U	3600 U
2-Methylnaphthalene	58.3%	0	36,400	0	N	N	360 J	330 J	240 J	180 J	N	35 J	270 J	3600 U
2-Chloronaphthalene	8.3%	0	50,000*	0	N	N	780 U	750 U	360 U	360 U	N	18 J	1800 U	3600 U
2-Nitroaniline	0.0%	0	430 or MDL	0	N	N	3800 U	3600 U	870 U	880 U	N	850 U	4300 U	8700 U
Acenaphthylene	0.0%	0	41,000	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
2,6-Dinitrotoluene	8.3%	0	1000	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
3-Nitroaniline	0.0%	0	500 or MDL	0	N	N	3800 U	3600 U	870 U	880 U	N	850 U	4300 U	8700 U
Acenaphthene	0.0%	0	50,000*	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Dibenzofuran	0.0%	0	6200	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
2,4-Dinitrotoluene	25.0%	2	50,000*	0	N	N	670 J	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Diethylphthalate	0.0%	0	7100	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Fluorene	0.0%	0	50,000*	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
N-Nitrosodiphenylamine	33.3%	2	50,000*	0	N	N	1100 J	510 J	360 U	360 U	N	350 U	1800 U	3600 U
Hexachlorobenzene	0.0%	0	410	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	N	N	3800 U	3600 U	870 U	880 U	N	850 U	4300 U	8700 U
Phenanthrene	50.0%	1	50,000*	0	N	N	220 J	200 J	100 J	88 J	N	22 J	540 J	3600 U
Anthracene	0.0%	0	50,000*	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Carbazole	0.0%	0	50,000*	0	N	N	N	N	360 U	360 U	N	350 U	1800 U	3600 U
Di-n-butylphthalate	25.0%	2	8100	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Fluoranthene	16.7%	0	50,000*	0	N	N	780 U	750 U	20 J	19 J	N	350 U	1800 U	3600 U
Pyrene	25.0%	0	50,000*	0	N	N	780 U	750 U	120 J	97 J	N	350 U	120 J	3600 U
Butylbenzylphthalate	0.0%	0	50,000*	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Benzo(a)anthracene	16.7%	0	220 or MDL	0	N	N	780 U	750 U	77 J	56 J	N	350 U	1800 U	3600 U
Chrysene	16.7%	0	400	0	N	N	780 U	750 U	180 J	130 J	N	350 U	1800 U	3600 U
bis(2-Ethylhexyl)phthalate	50.0%	1	50,000*	0	N	N	290 J	240 J	260 J	290 J	N	350 U	750 J	410 J
Di-n-octylphthalate	0.0%	0	50,000*	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Benzo(b)fluoranthene	16.7%	0	1100	0	N	N	780 U	750 U	79 J	55 J	N	350 U	1800 U	3600 U
benzo(k)fluoranthene	0.0%	0	1100	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Benzo(a)pyrene	16.7%	0	61 or MDL	2	N	N	780 U	750 U	160 J	120 J	N	350 U	1800 U	3600 U
Indeno(1,2,3-cd)pyrene	16.7%	0	3200	0	N	N	780 U	750 U	63 J	46 J	N	350 U	1800 U	3600 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	N	N	780 U	750 U	360 U	360 U	N	350 U	1800 U	3600 U
Benzo(g,h,i)perylene	16.7%	0	50,000*	0	N	N	780 U	750 U	350 J	320 J	N	350 U	1800 U	3600 U

TABLE 4-6

PAD C
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	NUMBER OF SAMPLES ABOVE SITE BACKGROUND	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD C 2-4' 01/07/92 PBC-1-3A	PAD C 2-4' 01/07/92 PBC-1-3ADI	PAD C 2-4' 01/07/92 PBC-1-4	PAD C 2-4' 01/07/92 PBC-1-4A	OB 0-2 03/11/93 PBC-2-1	OB 0-2 03/11/93 PBC-2-2	OB 0-2 03/11/93 PBC2-2RE	OB 0-2 03/11/93 PBC-3-1	OB 0-2 03/11/93 PBC-4-1	OB 0-2 03/11/93 PBC-5-1
Pesticides/PCBs (ug/kg)														
beta-BHC	0.0%	0	200	0	N	N	19 U	18 U	1.8 U	1.9 U	N	9.1 U	3.7 U	19 U
delta-BHC	0.0%	0	300	0	N	N	19 U	18 U	1.8 U	1.9 U	N	9.1 U	3.7 U	19 U
gamma-BHC (Lindane)	7.7%	0	60	0	N	N	19 U	18 U	1.8 U	1.9 U	N	9.1 U	3.7 U	9.6 J
Heptachlor	7.7%	1	100	0	N	N	19 U	18 U	1.8 U	1.9 U	N	32 J	3.7 U	19 U
Aldrin	23.1%	0	41	0	N	N	19 U	18 U	3.7	3.8	N	9.1 U	4 J	19 U
Heptachlor epoxide	0.0%	0	20	0	N	N	19 U	18 U	1.8 U	1.9 U	N	9.1 U	3.7 U	19 U
Endosulfan I	15.4%	0	900	0	N	N	19 U	18 U	1.8 U	2.6 J	N	9.1 U	1.9 J	19 U
Dieldrin	0.0%	0	44	0	N	N	38 U	36 U	3.6 U	3.6 U	N	18 U	7.2 U	36 U
4,4'-DDE	15.4%	0	2100	0	N	N	38 U	36 U	3.6 U	3.6 U	N	18 U	7.2 U	36 U
Endrin	0.0%	0	100	0	N	N	38 U	36 U	3.6 U	3.6 U	N	18 U	7.2 U	36 U
Endosulfan II	15.4%	1	900	0	N	N	38 U	36 U	3.6 U	2.8 J	N	18 U	7.2 U	110
4,4'-DDD	15.4%	0	2900	0	N	N	38 U	36 U	3.7	3.6 J	N	18 U	7.2 U	36 U
Endosulfan sulfate	15.4%	0	1000	0	N	N	38 U	36 U	3.9	3.6 U	N	18 U	4.3 J	36 U
4,4'-DDT	23.1%	0	2100	0	N	N	38 U	36 U	3.6 U	3.6 J	N	18 U	7.2 U	36 U
Endrin aldehyde	14.3%	0		NA	N	N	N	N	3.6 U	4.5 J	N	18 U	7.2 U	36 U
alpha-Chlordane	23.1%	1	540	0	N	N	190 U	180 U	1.8 U	1.9 U	N	69 J	6.1 J	270 J
Aroclor-1254	0.0%	0	1000	0	N	N	380 U	360 U	36 U	36 U	N	180 U	72 U	360 U
Aroclor-1260	0.0%	0	1000	0	N	N	380 U	360 U	36 U	36 U	N	180 U	72 U	360 U
Explosives (ug/kg)														
HMX	0.0%	0		NA	N	N	1000 U	1000 U	120 U	120 U	N	120 U	120 U	120 U
RDX	8.3%	1		NA	N	N	120 U	120 U	120 U	120 U	N	120 U	88 J	120 U
1,3,5-Trinitrobenzene	33.3%	4		NA	N	N	120 U	120 U	120 U	120 U	N	120 U	120 U	130 J
1,3-Dinitrobenzene	0.0%	0		NA	N	N	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U
Tetryl	0.0%	0		NA	N	N	400 U	400 U	120 U	120 U	N	120 U	120 U	120 U
2,4,6-Trinitrotoluene	16.7%	2		NA	N	N	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	16.7%	2		NA	N	N	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U
2-amino-4,6-Dinitrotoluene	8.3%	1		NA	N	N	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	N	N	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U
2,4-Dinitrotoluene	58.3%	7		NA	N	N	120 U	120 U	180	620	N	120 U	360	980
Metals (mg/kg)														
Aluminum	100.0%	1	17503.0	2	N	N	16900	15700	13900	12600	N	10800	13300	14700
Antimony	33.3%	2	5	3	N	N	6.4 U J	6 U J	4.6 J	3.5 UJ	N	6.4 J	143 J	34.1 J
Arsenic	91.7%	1	7.5	1	N	N	3.8 J	5 J	4.6	3.6	N	3.9	4.1	5.6
Barium	100.0%	9	300	7	N	N	911	566	124	102	N	727	209	1190
Beryllium	50.0%	0	1	0	N	N	0.9 R	0.9 R	0.67 J	0.55 J	N	0.48 J	0.4 J	0.6 J
Cadmium	100.0%	8	1.8	10	N	N	3.9	3.3	1	5	N	2.8	7.2	3.1
Calcium	100.0%	0	46825.0	0	N	N	23600	20600	22200	25200	N	31100	24500	27800
Chromium	83.3%	0	26.6	7	N	N	32.1 J	27.3 J	28.3	31.6	N	21.4	17.6	27.4
Cobalt	100.0%	0	30	0	N	N	12.3	11.9	12.7	13.7	N	12	8.4 J	14.4
Copper	100.0%	12	25	12	N	N	522	281	2600	204	N	1430	563	13000
Iron	100.0%	0	32698.0	5	N	N	37000	31800	29300	42600	N	23000	18700	29700
Lead	100.0%	12	30	12	N	N	256	475	256	108	N	837	603	4280
Magnesium	100.0%	0	9071.1	0	N	N	7280	6210	7050	6580	N	5690	4460	7270
Manganese	100.0%	0	1065.8	0	N	N	475	562	322	377	N	369	250	447
Mercury	41.7%	3	0.1	3	N	N	0.16 R	0.13 R	0.04 U	0.04 U	N	0.04 U	0.03 J	0.11
Nickel	100.0%	1	41.3	9	N	N	46.9 J	42.1 J	50.6 J	66.1 J	N	39.9 J	33.3 J	49.9 J
Potassium	100.0%	5	1529.6	9	N	N	2470 J	2030 J	1570	1420	N	1110	678 J	1920
Selenium	58.3%	5	2	0	N	N	0.21 J	0.34 J	0.22 UJ	0.29 J	N	0.15 UJ	0.37 J	0.21 UJ
Silver	66.7%	4	0.6	6	N	N	0.46 J	0.38 U	0.69 U	0.56 U	N	0.72 J	0.78 U	1.4
Sodium	83.3%	6	76	10	N	N	217 J	195 J	100 J	99.5 J	N	175 J	93.4 U	200 J
Thallium	16.7%	2	0.3	2	N	N	0.5 U	0.33 U	0.51 U	0.45 U	N	0.34 U	0.61 U	0.48 U
Vanadium	91.7%	0	150	0	N	N	23.9	23.1	20.1	18.7	N	18	12.8	21
Zinc	100.0%	12	89.1	12	N	N	578	440	579	2030	N	799	127000	3180
Cyanide	0.0%	0	NA	NA	N	N	0.71 U	0.6 U	0.65 U	0.65 U	N	0.63 U	0.65 U	0.66 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

soil samples found to contain volatile organic compounds had concentrations that exceeded the TAGM limits.

4.3.3.2 Semivolatile Organic Compounds

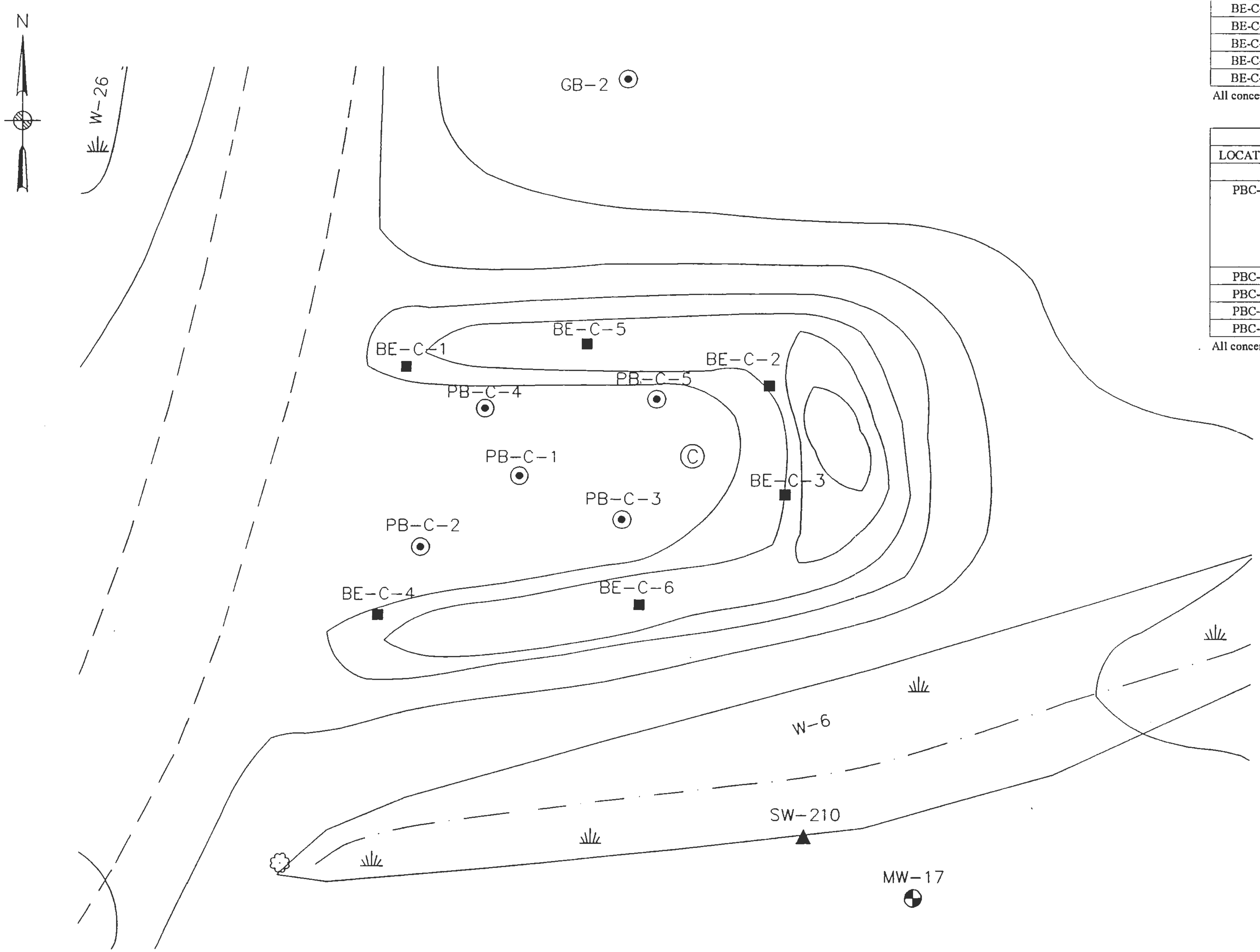
A total of 21 semivolatile compounds were detected in the soil samples collected at Burning Pad C. Of the 21 semivolatiles detected, four compounds (phenol, 2-methylphenol, 4-methylphenol and benzo(a)pyrene) were detected at concentrations that exceed the TAGM values. The pad boring sample PBC-1-4 (4,954 ug/kg) contained the highest total semivolatile concentrations. The highest concentrations of phenol (360 ug/kg), 2-methylphenol (760 ug/kg), and 4-methylphenol (1,300 ug/kg) were identified within sample PBC-1-4A collected from a depth of 2 to 4 feet in boring PB-C-1. The highest concentration of benzo(a)pyrene (160 ug/kg) on Pad C was detected in the soil sample PBC-2-1.

4.3.3.3 Pesticides/PCBs

A total of 11 pesticide compounds were detected in the low ug/kg concentration range in the soil samples collected at Pad C. None of these compounds were detected at concentrations that exceeded the TAGM values. The highest concentration detected on Pad C was from soil sample PBC-5-1 where 270 ug/kg of alpha-chlordane was detected. The second highest concentration of pesticides were also detected in the soil sample PBC-5-1 where 110 ug/kg of endosulfan sulfate was detected. This concentration is significantly below the TAGM concentration limit of 900 ug/kg for endosulfan sulfate. The remaining pesticide compounds were all found at concentrations below 10 ug/kg.

4.3.3.4 Explosives

Figure 4-9 summarizes the explosives data for Pad C. A total of six explosive compounds were detected in the Pad C soil samples. Of these compounds 2,4-dinitrotoluene was found in 58 percent of the samples while RDX, the second most prevalent explosive on Pad C, was detected in 33 percent of the samples. The majority of explosives were found in the berm excavation samples BE-C-3 and BE-C-5. No explosive compounds were detected within the two soil samples collected from pad borings PB-C-1 and PB-C-3, while only three compounds (RDX, 1,3,5-trinitrobenzene, and 2,4-dinitrotoluene) were detected within the remaining three pad boring soil samples. The highest total explosives were found in samples BE-C-5 (1780 ug/kg), BE-C-3 (1120 ug/kg) and PBC-5-1 (1110 ug/kg). The highest individual concentration



BERM EXCAVATIONS

LOCATION	DEPTH	LEVEL II	LEVEL IV					
		TNT	RDX	1,3,5-T	2,4,6-T	4-amino	2-amino	2,4-D
BE-C-1	1.5'	<1000	NA	NA	NA	NA	NA	NA
BE-C-2	4.0'	1110	120 U	610	120 U	120 U	120 U	440
BE-C-3	4.0'	<1000	120 U	180	240	240	120 U	460
BE-C-4	1.5'	<1000	NA	NA	NA	NA	NA	NA
BE-C-5	2.0'	1400	120 U	140	160 J	240 J	240 J	1000 J
BE-C-6	2.0'	<1000	NA	NA	NA	NA	NA	NA

All concentrations in ug/Kg.

PAD BORINGS

LOCATION	DEPTH	LEVEL II	LEVEL IV					
		TNT	RDX	1,3,5-T	2,4,6-T	4-amino	2-amino	2,4-D
PBC-1	0-6"	<1000	120 U	120 U	120 U	120 U	120 U	120 U
	0-2'	<1000	NA	NA	NA	NA	NA	NA
	2-4'	<1000	120 U	120 U	120 U	120 U	120 U	120 U
	4-6'	<1000	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA
PBC-2	0-2'	NA	120 U	120 U	120 U	120 U	120 U	620
PBC-3	0-2'	NA	120 U	120 U	120 U	120 U	120 U	120 U
PBC-4	0-2'	NA	88 J	120 U	120 U	120 U	120 U	360
PBC-5	0-2'	NA	120 U	130 J	120 U	120 U	120 U	980

All concentrations in ug/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION
BE-G-1 ■	BERM EXCAVATION & DESIGNATION
PB-G-1 ⊙ GB-2	BORING & DESIGNATION
650	GROUND CONTOUR AND ELEVATION
W-1	WETLAND & DESIGNATION
MW-17	MONITORING WELL & DESIGNATION
	DIRT ROAD
◦	UTILITY POLE
○	TREE
	BRUSH
SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
J	ESTIMATED VALUE
U	UNDETECTED VALUE
N/A	NOT AVAILABLE

ES

ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-9
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD C

SCALE 1" = 20'

mg/kg. Other samples with significantly elevated concentrations of lead included BE-C-3 (29,000 mg/kg), BE-C-6 (5,730 mg/kg), and PBC-5-1 (4,280 mg/kg). Soil samples collected at PBC-1-1 and PBC-1-2 also had lead concentrations above the TAGM limit, but these samples had the lowest concentrations measured on Pad C and are coincident with the areas of low copper and barium.

The highest concentration of zinc (127,000 mg/kg) was detected in the soil sample collected from pad boring PB-C-4. Of the 12 soil samples collected at Pad C and analyzed by Level IV methods, all of these had zinc concentrations that exceeded the TAGM of 89.1 mg/kg. Other samples with elevated concentrations of zinc included BE-C-2 (7,640 mg/kg), BE-C-3 (3,380 mg/kg), PBC-1-1A (1,540 mg/kg), PBC-2-2 (2,030 mg/kg), and PBC-5-1 (3,180 mg/kg).

4.3.4 Burning Pad D

During Phase I, soil boring PB-D-1, and berm excavations BE-D-1 and BE-D-2 were sampled. In Phase II, berm excavations BE-D-3 and BE-D-4 were sampled. The surface soil sample collected at PB-D-1 was submitted for Level IV analysis. Four of the five soil samples collected from boring PB-D-1, and all of the four berm excavation samples collected at Pad D underwent Level II screening for lead, TNT, and VOCs. From these eight samples, four were submitted for Level IV metals analysis, these being two of the berm samples (BE-D-2, and BE-D-3) and two samples (PBD-1-1 and PBD-1-3) collected from pad boring PB-D-1. Samples PBD-1-1 and PBD-1-3 were also analyzed in duplicate (sample IDs PBD-1-1A and PBD-1-3A).

A summary of the analytical results for the Level IV analyses is presented in Table 4-7. The following sections review the compounds detected within the soil samples collected on Pad D.

4.3.4.1 Volatile Organic Compounds

Three volatiles, benzene, tetrachloroethene, and toluene were detected in the soil samples collected at Pad D, all at estimated concentrations below the sample quantitation limits. Benzene was detected in the sample PBD-1-3 at a concentration of 3 ug/kg. Tetrachloroethene was detected in BE-D-2 and BE-D-3 at concentrations of 1 ug/kg and 2 ug/kg, respectively. The surface soil sample PBD-1-1 had no volatiles detected. Toluene was detected in the sample PDB-1-3 at an estimated concentration of 2 ug/kg. None of the soil

TABLE 4-7

PAD D
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD-D 3.0' 12/04/91 BE-D-1-91	PAD D 2.5' 12/04/91 BE-D-2-91	OB 2.0 feet 12/04/92 BE-D-3	PAD D 0-6" 01/07/92 PBD-1-1	PAD D 0-6" 01/07/92 PBD-1-1RE	PAD D 0-6" 01/07/92 PBD-1-1A	PAD D 0-6" 01/07/92 PBD-1-1ARE	PAD D 2-4' 01/07/92 PBD-1-3	PAD D 2-4' 01/07/92 PBD-1-3A
VOCs (ug/kg)													
Methylene Chloride	0.0%	0	100	0	N	6 U	12 U	5 U J	7 U J	9 U J	5 U J	6 U J	7 U J
Acetone	0.0%	0	200	0	N	11 U	12 U	10 U J	11 U J	11 U J	11 U J	11 U J	11 U J
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	5 U J	6 U J
Chloroform	0.0%	0	300	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	5 U J	6 U J
2-Butanone	0.0%	0	300	0	N	11 U	12 U	10 U J	11 U J	11 U J	11 U J	11 U J	11 U J
1,1,1-Trichloroethane	0.0%	0	800	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	5 U J	6 U J
Carbon Tetrachloride	0.0%	0	600	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	5 U J	6 U J
Trichloroethene	0.0%	0	700	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	5 U J	6 U J
Benzene	25.0%	3	60	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	3 J	3 J
Tetrachloroethene	25.0%	2	1400	0	N	1 J	2 J	5 U J	5 U J	5 U J	5 U J	5 U J	6 U J
Toluene	12.5%	2	1500	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	2 J	6 U J
Chlorobenzene	0.0%	0	1700	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	5 U J	6 U J
Xylene (total)	0.0%	0	1200	0	N	6 U	12 U	5 U J	5 U J	5 U J	5 U J	5 U J	6 U J
Semivolatiles (ug/kg)													
Phenol	0.0%	0	30 or MDL	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
2-Methylphenol	0.0%	0	100 or MDL	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
4-Methylphenol	0.0%	0	900	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
Benzoic acid	0.0%	0	2700	0	N	3600 U	N	3400 U	N	3500 U	N	3500 U	3500 U
Naphthalene	33.3%	210	13,000	0	N	750 U	400 U	700 U	N	710 U	N	210 J	190 J
2-Methylnaphthalene	50.0%	220	36,400	0	N	750 U	27 J	700 U	N	710 U	N	220 J	160 J
2-Chloronaphthalene	0.0%	0	50,000*	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
2-Nitroaniline	0.0%	0	430 or MDL	0	N	3600 U	970 U	3400 U	N	3500 U	N	3500 U	3500 U
Acenaphthylene	0.0%	0	41,000	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
2,6-Dinitrotoluene	16.7%	120	1000	0	N	750 U	120 J	700 U	N	710 U	N	720 U	720 U
3-Nitroaniline	0.0%	0	500 or MDL	0	N	3600 U	970 U	3400 U	N	3500 U	N	3500 U	3500 U
Acenaphthene	0.0%	0	50,000*	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
Dibenzofuran	0.0%	0	6200	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
2,4-Dinitrotoluene	16.7%	1400	50,000*	0	N	750 U	1400	700 U	N	710 U	N	720 U	720 U
Diethylphthalate	0.0%	0	7100	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
Fluorene	0.0%	0	50,000*	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
N-Nitrosodiphenylamine	16.7%	82	50,000*	0	N	750 U	82 J	700 U	N	710 U	N	720 U	720 U
Hexachlorobenzene	0.0%	0	410	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	N	3600 U	970 U	3400 U	N	3500 U	N	3500 U	3500 U
Phenanthrene	50.0%	180	50,000*	0	N	750 U	78 J	700 U	N	710 U	N	160 J	180 J
Anthracene	16.7%	25	50,000*	0	N	750 U	25 J	700 U	N	710 U	N	720 U	720 U
Carbazole	0.0%	0	50,000*	0	N	N	400 U	N	N	N	N	N	N
Di-n-butylphthalate	33.3%	690	8100	0	N	400 J	690	700 U	N	710 U	N	720 U	720 U
Fluoranthene	16.7%	180	50,000*	0	N	750 U	180 J	700 U	N	710 U	N	720 U	720 U
Pyrene	16.7%	180	50,000*	0	N	750 U	180 J	700 U	N	710 U	N	720 U	720 U
Butylbenzylphthalate	0.0%	0	50,000*	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
Benzo(a)anthracene	16.7%	130	220 or MDL	0	N	750 U	130 J	700 U	N	710 U	N	720 U	720 U
Chrysene	16.7%	160	400	0	N	750 U	160 J	700 U	N	710 U	N	720 U	720 U
bis(2-Ethylhexyl)phthalate	33.3%	120	50,000*	0	N	750 U	400 U	700 U	N	710 U	N	420 J	290 J
Di-n-octylphthalate	0.0%	0	50,000*	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
Benzo(b)fluoranthene	16.7%	180	1100	0	N	750 U	180 J	700 U	N	710 U	N	720 U	720 U
benzo(k)fluoranthene	16.7%	180	1100	0	N	750 U	180 J	700 U	N	710 U	N	720 U	720 U
Benzo(a)pyrene	16.7%	120	61 or MDL	1	N	750 U	120 J	700 U	N	710 U	N	720 U	720 U
Indeno(1,2,3-cd)pyrene	16.7%	130	3200	0	N	750 U	130 J	700 U	N	710 U	N	720 U	720 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	N	750 U	400 U	700 U	N	710 U	N	720 U	720 U
Benzo(g,h,i)perylene	16.7%	93	50,000*	0	N	750 U	93 J	700 U	N	710 U	N	720 U	720 U

TABLE 4-7

PAD D
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD-D 3.0' 12/04/91 BE-D-1-91	PAD D 2.5' 12/04/91 BE-D-2-91	OB 2.0 feet 12/04/92 BE-D-3	PAD D 0-6" 01/07/92 PBD-1-1	PAD D 0-6" 01/07/92 PBD-1-1RE	PAD D 0-6" 01/07/92 PBD-1-1A	PAD D 0-6" 01/07/92 PBD-1-1ARE	PAD D 2-4' 01/07/92 PBD-1-3	PAD D 2-4' 01/07/92 PBD-1-3A
Pesticides/PCBs (ug/kg)													
beta-BHC	0.0%	0	200	0	N	18 U	2.1 U	17 U	N	17 U	N	18 U	17 U
delta-BHC	16.7%	15	300	0	N	18 U	15 J	17 U	N	17 U	N	18 U	17 U
gamma-BHC (Lindane)	0.0%	0	60	0	N	18 U	2.1 U	17 U	N	17 U	N	18 U	17 U
Heptachlor	0.0%	0	100	0	N	18 U	2.1 U	17 U	N	17 U	N	18 U	17 U
Aldrin	0.0%	0	41	0	N	18 U	2.1 U	17 U	N	17 U	N	18 U	17 U
Heptachlor epoxide	16.7%	1.2	20	0	N	18 U	1.2 J	17 U	N	17 U	N	18 U	17 U
Endosulfan I	16.7%	1.8	900	0	N	18 U	1.8 J	17 U	N	17 U	N	18 U	17 U
Dieldrin	0.0%	0	44	0	N	36 U	4 U	34 U	N	35 U	N	35 U	35 U
4,4'-DDE	16.7%	7.8	2100	0	N	36 U	7.8 J	34 U	N	35 U	N	35 U	35 U
Endrin	0.0%	0	100	0	N	36 U	4 U	34 U	N	35 U	N	35 U	35 U
Endosulfan II	0.0%	0	900	0	N	36 U	4 U	34 U	N	35 U	N	35 U	35 U
4,4'-DDD	16.7%	2.4	2900	0	N	36 U	2.4 J	34 U	N	35 U	N	35 U	35 U
Endosulfan sulfate	0.0%	0	1000	0	N	36 U	4 U	34 U	N	35 U	N	35 U	35 U
4,4'-DDT	0.0%	0	2100	0	N	36 U	4 U	34 U	N	35 U	N	35 U	35 U
Endrin aldehyde	0.0%	0		NA	N	N	4 U		N	N	N	N	N
alpha-Chlordane	0.0%	0	540	0	N	180 U	2.1 U	170 U	N	170 U	N	180 U	170 U
Aroclor-1254	0.0%	0	1000	0	N	360 U	40 U	340 U	N	350 U	N	350 U	350 U
Aroclor-1260	0.0%	0	1000	0	N	360 U	40 U	340 U	N	350 U	N	350 U	350 U
Explosives (ug/kg)													
HMX	0.0%	0		NA	N	1000 U	120 U	1000 U	N	1000 U	N	1000 U	1000 U
RDX	16.7%	190		NA	N	120 U	120 U	120 U	N	120 U	N	120 U	190 J
1,3,5-Trinitrobenzene	33.3%	170		NA	N	170	91 J	120 U	N	120 U	N	120 U	120 U
1,3-Dinitrobenzene	0.0%	0		NA	N	120 U	120 U	120 U	N	120 U	N	120 U	120 U
Tetryl	0.0%	0		NA	N	400 U	120 U	400 U	N	400 U	N	400 U	400 U
2,4,6-Trinitrotoluene	16.7%	95		NA	N	120 U	95 J	120 U	N	120 U	N	120 U	120 U
4-amino-2,6-Dinitrotoluene	16.7%	66		NA	N	120 U	66 J	120 U	N	120 U	N	120 U	120 U
2-amino-4,6-Dinitrotoluene	33.3%	69		NA	N	110 J	69 J	120 U	N	120 U	N	120 U	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	N	120 U	120 U	120 U	N	120 U	N	120 U	120 U
2,4-Dinitrotoluene	33.3%	910		NA	N	360	910	120 U	N	120 U	N	130 U	120 U
Metals (mg/kg)													
Aluminum	100.0%	21100	17503.0	1	16800	N	21100	6860	N	14600	N	10600	10700
Antimony	33.3%	75.6	5	2	54.2 R	N	19.6 R	5.4 U J	N	4.9 U J	N	75.6 J	21.8 J
Arsenic	83.3%	8.6	7.5	3	6.9 R	N	8.1 J	4.7 J	N	4 J	N	8.6 J	8.2 J
Barium	83.3%	1970	300	3	740 R	N	753	48.5 J	N	195 J	N	1970 J	359 J
Beryllium	16.7%	0.83	1	0	0.78 R	N	0.83	0.47 R	N	0.76 R	N	0.5 R	0.62 R
Cadmium	100.0%	24.4	1.8	6	10.9 J	N	24.4	2.4	N	4.7	N	17.6	15.2
Calcium	100.0%	124000	46825.0	1	10600	N	13300	10400	N	19600	N	124000 J	39800 J
Chromium	83.3%	43.2	26.6	3	31.1 R	N	43.2	14.3 J	N	31.2 J	N	40 J	22 J
Cobalt	100.0%	14.4	30	0	11.2	N	12.5	6.7	N	14.4	N	7.7	9.9
Copper	100.0%	12900	25	6	704	N	12900	56.2	N	141	N	1640 J	254 J
Iron	100.0%	36600	32698.0	3	33400	N	33400	19400	N	36600	N	24300	25000
Lead	100.0%	16000	30	6	14400 J	N	9380	123	N	233	N	16000 J	3930 J
Magnesium	100.0%	7540	9071.1	0	5690	N	6000	3230	N	6750	N	7540	6010
Manganese	100.0%	751	1065.8	0	751	N	672	186	N	471	N	480	322
Mercury	33.3%	0.42	0.1	2	0.23 J	N	0.42	0.08 R	N	0.07 R	N	0.06 R	0.1 R
Nickel	100.0%	58.2	41.3	2	36.7	N	48.8	30.2 J	N	58.2 J	N	28.9 J	39.8 J
Potassium	100.0%	2850	1529.6	4	1930 J	N	2850	799 J	N	2280 J	N	2380 J	1410 J
Selenium	100.0%	1	2	0	0.19 J	N	1 J	0.34 J	N	0.34 J	N	0.46 J	0.59 J
Silver	83.3%	42.6	0.6	3	1.7 R	N	42.6	0.38 J	N	1.2 J	N	0.97 J	0.42 J
Sodium	66.7%	324	76	3	295 R	N	318 R	50.3 J	N	162 J	N	324 J	130 J
Thallium	66.7%	0.54	0.3	4	0.62 U	N	0.62 U	0.54 J	N	0.44 J	N	0.44	0.47
Vanadium	66.7%	29.9	150	0	25.3	N	29.9	10.9 R	N	21.6	N	17.9	14.4 R
Zinc	100.0%	13000	89.1	6	13000	N	6530	427	N	959	N	1060	457
Cyanide	0.0%	0	NA	NA	0.67 U	N	0.59 U	0.63 U	N	0.6 U	N	0.58 U	0.63 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

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samples analyzed were found to contain volatile organic compounds at concentrations that exceeded the TAGM limits.

4.3.4.2 Semivolatile Organic Compounds

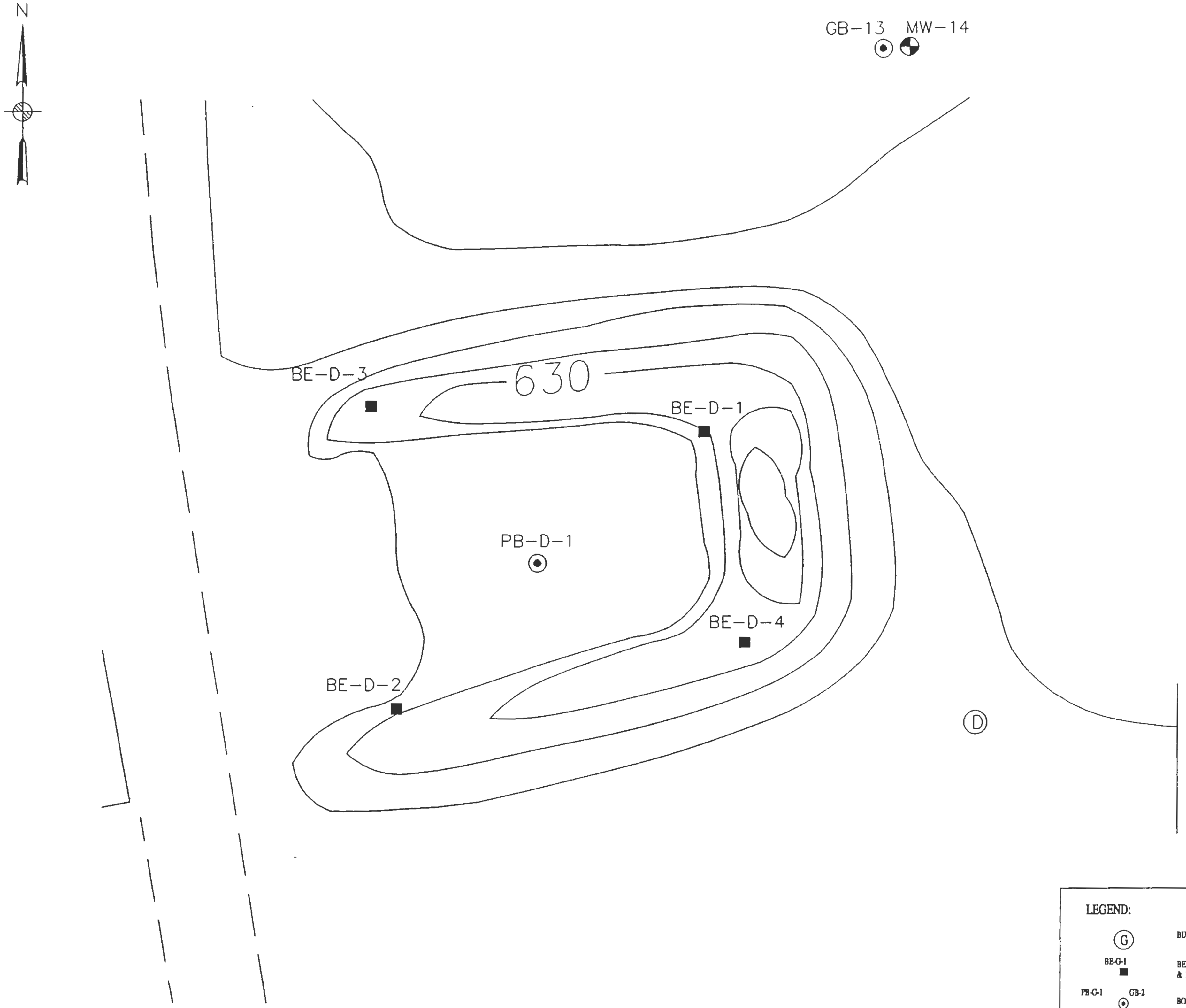
A total of 18 semivolatile organic compounds were detected in the soil samples collected at Pad D. Of these 18, only benzo(a)pyrene (120 ug/kg in BE-D-3) was detected at a concentration that exceeded the TAGM limit of 61 ug/kg. While some semivolatile compounds were found in three of the four soil samples analyzed at Pad D, sample BE-D-2 had only 1 SVOC detected, and sample PBD-1-3 had only 4 SVOCs detected. The surface soil sample PB-D-1 had no SVOCs detected. By comparison, the berm excavation sample BE-D-3 was found to contain sixteen of the eighteen SVOCs detected. The highest concentrations of 2,4-dinitrotoluene (1400 ug/kg) and di-n-butylphthalate (690 ug/kg) were found within this berm excavation soil sample.

4.3.4.3 Pesticides/PCBs

A total of 5 pesticide compounds were detected in the low parts per billion concentration range in the soil samples collected at Pad D. None of these compounds were detected at concentrations that exceed the TAGM. Each of these compounds were reported in the sample BE-D-3 at concentrations below the sample quantitation limits. The highest concentration detected was in sample BE-D-3 where 15 ug/kg of delta-BHC was detected. The second highest concentration of pesticides was also detected in the soil sample BE-D-3 where 7.8 ug/kg of 4,4'-DDE was detected. Both of these concentrations are significantly below the TAGM concentration limits of 300 ug/kg and 2100 ug/kg, respectively.

4.3.4.4 Explosives

Figure 4-11 summarizes the explosives data for Pad D. Six explosive compounds were detected within the soil samples collected at Pad D. The majority of explosives were found in the berm excavation samples BE-D-2 and BE-D-3. Only one explosive compound, RDX, was detected in sample PBD-1-3A at an estimated concentration of 190 ug/kg. This was the only instance of RDX identified on Pad D. No explosive compounds were identified in the surface soil sample PBD-1-1. The Level II screening results indicated no explosive compounds within any of the remaining soil samples collected from pad boring PB-D-1.



BERM EXCAVATIONS								
LOCATION	DEPTH	LEVEL II	LEVEL IV					
		TNT	RDX	1,3,5-T	2,4,6-T	4-amino	2-amino	2,4-D
BE-D-1	3.0'	<1000	NA	NA	NA	NA	NA	NA
BE-D-2	2.5'	12500	120 U	170	120 U	120 U	110 J	360
BE-D-3	2.0'	<1000	120 U	91 J	95 J	66 J	69 J	910
BE-D-4	2.0'	<1000	NA	NA	NA	NA	NA	NA

All concentrations in ug/Kg.

PAD BORINGS								
LOCATION	DEPTH	LEVEL II	LEVEL IV					
		TNT	RDX	1,3,5-T	2,4,6-T	4-amino	2-amino	2,4-D
PBD-1	0-6"	NA	120 U	120 U	120 U	120 U	120 U	120 U
	0-2'	<1000	NA	NA	NA	NA	NA	NA
	2-4'	<1000	120 U	190 J	120 U	120 U	120 U	120 U
	4-6'	<1000	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA
	8-9.2'	<1000	NA	NA	NA	NA	NA	NA

All concentrations in ug/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION	- - -	DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	◊	UTILITY POLE
		○	TREE
PB-G-1 GB-2 ⊙	BORING & DESIGNATION	◯	BRUSH
630	GROUND CONTOUR AND ELEVATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
W-1	WETLAND & DESIGNATION	J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17 ◒	MONITORING WELL & DESIGNATION	N/A	NOT AVAILABLE

ES
ENGINEERING-SCIENCE, INC.

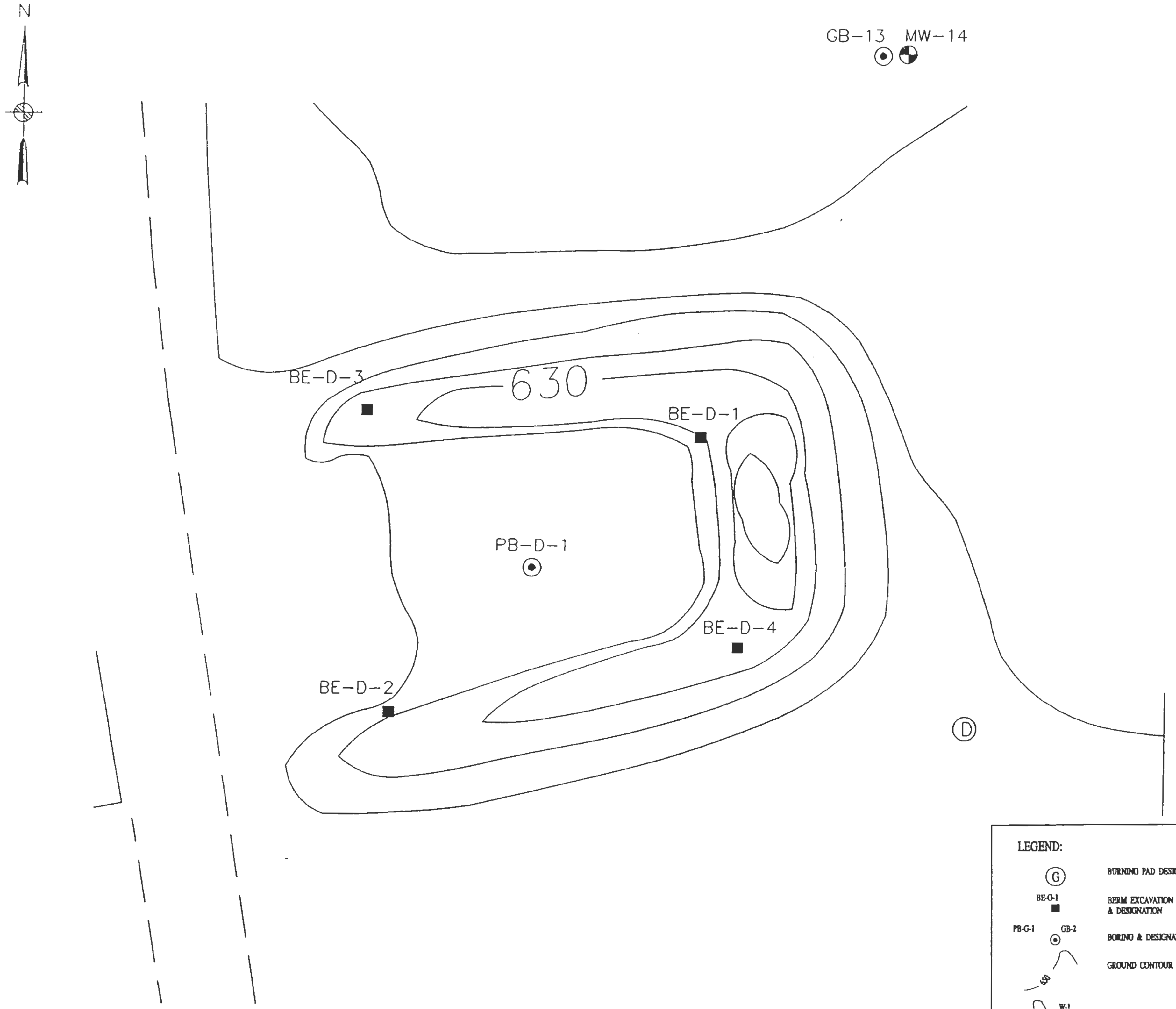
CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-11
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD D

SCALE 1" = 20'



BERM EXCAVATIONS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
BE-D-1	3.0'	12000	740	704	14400	13000
BE-D-2	2.5'	1870	NA	NA	NA	NA
BE-D-3	2.0'	8100	753	12900	9380	6530
BE-D-4	2.0'	910	NA	NA	NA	NA

All concentrations in mg/Kg.

PAD BORINGS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
PBD-1	0-6"	NA	195 J	141	233	959
	0-2'	1270	NA	NA	NA	NA
	2-4'	12400	1970 J	1640 J	16000 J	1060
	4-6'	1100	NA	NA	NA	NA
	6-8'	1090	NA	NA	NA	NA
	8-9.2'	1850	NA	NA	NA	NA

All concentrations in mg/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION	- - -	DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	◊	UTILITY POLE
		○	TREE
PB-G-1 GB-2 ⊙	BORING & DESIGNATION	○	BRUSH
650	GROUND CONTOUR AND ELEVATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
W-1	WETLAND & DESIGNATION	J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17 ◕	MONITORING WELL & DESIGNATION	N/A	NOT AVAILABLE

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-12
DISTRIBUTION OF METALS
OPEN BURNING PAD D

SCALE 1" = 20'

elevated lead concentrations were also identified within the sample BE-D-3 where 9,380 mg/kg of lead were detected.

All six soil samples collected at Pad D and analyzed by Level IV methods had zinc concentrations that exceeded both the TAGM concentration limit of 89.1 mg/kg. The highest concentration of zinc (13,000 mg/kg) was detected in the soil sample collected from berm excavation BE-D-1. Other samples with significantly elevated concentrations of zinc included BE-D-3 where 6,530 mg/kg of zinc was detected, and PBD-1-3 where 1,060 mg/kg were detected.

In summary, berm samples BE-D-2 and BE-D-3, and pad boring sample PBD-1-3 consistently show elevated concentrations of the four metals of interest.

4.3.5 Burning Pad E

During Phase I, soil boring PB-E-1 was installed, and berm excavations BE-E-1 and BE-E-2 were sampled. In Phase II, four additional soil samples were collected at pad borings PB-E-3 through PB-E-6 from the 0- to 2-foot depth. The berm excavations BE-E-3 and BE-E-4 were also sampled in Phase II. The four soil samples collected from borings PB-C-2 through PB-C-5, and the surface sample collected at pad boring PB-E-1 underwent only Level IV analyses. Six of the seven soil samples collected from boring PB-E-1, and all of the four berm excavation samples collected at Pad E underwent Level II screening for lead, TNT, and VOCs. From these ten samples, three went for subsequent Level IV analyses, these being two of the berm samples (BE-E-1, and BE-E-3) and one additional sample (PBE-1-3) collected from pad boring PB-E-1.

A summary of the analytical results for the Level IV analyses is presented in Table 4-8. The following sections review the compounds detected within the soil samples collected on Pad E.

4.3.5.1 Volatile Organic Compounds

Two volatile organic compounds, tetrachloroethene, and toluene were detected in the soil samples collected at Pad E at concentrations below the sample quantitation limits. Tetrachloroethene was detected in the sample BE-E-3 at an estimated concentration of 8 ug/kg. Toluene was detected in the sample PBE-1-3 at an estimated concentration of 4 ug/kg.

TABLE 4-8

PAD E
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD E 3.0' 12/03/91 BE-E-1-91	OB 2.0 feet 12/03/92 BE-E-3	OB 2.0 feet 12/03/92 BE-E-3RE	PAD E 0-6" 01/08/92 PBE-1-1	PAD E 0-6" 01/08/92 PBE-1-1RE	PAD E 2-4' 01/08/92 PBE-1-3	OB 0-2 03/11/93 PBE-2-1	OB 0-2 03/11/93 PBE-3-1	OB 0-2 03/11/93 PBE3-1RE	OB 0-2 03/11/93 PBE-4-1	OB 0-2 03/11/93 PBE4-1RE	OB 0-2 03/11/93 PBE-5-1
VOCs (ug/kg)																
Methylene Chloride	0.0%	0	100	0	6 U	13 U	N	8 U J	6 U J	7 U	11 U	11 U	11 U	14 U	14 U	11 U
Acetone	0.0%	0	200	0	12 U	13 U	N	10 U J	11 U J	24 U	11 U	11 U	11 U	14 U	14 U	11 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	13 U	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Chloroform	0.0%	0	300	0	6 U	13 U	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
2-Butanone	0.0%	0	300	0	12 U	13 U	N	10 U J	11 U J	12 U	11 U	11 U	11 U	14 U	14 U	11 U
1,1,1-Trichloroethane	0.0%	0	800	0	6 U	13 U	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Carbon Tetrachloride	0.0%	0	600	0	6 U	13 U	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Trichloroethene	0.0%	0	700	0	6 U	13 U	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Benzene	0.0%	0	60	0	6 U	13 U	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Tetrachloroethene	9.1%	8	1400	0	6 U	8 J	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Toluene	18.2%	4	1500	0	6 U	13 U	N	4 J	3 J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Chlorobenzene	0.0%	0	1700	0	6 U	13 U	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Xylene (total)	0.0%	0	1200	0	6 U	13 U	N	5 U J	5 U J	6 U	11 U	11 U	11 U	14 U	14 U	11 U
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
2-Methylphenol	0.0%	0	100 or MDL	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
4-Methylphenol	0.0%	0	900	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Benzoic acid	0.0%	0	2700	0	3700 U	N	N	3300 U	N	3800 U	N	N	N	N	N	N
Naphthalene	22.2%	34	13,000	0	750 U	420 U	420 U	680 U	N	780 U	34 J	20 J	N	390 U	N	360 U
2-Methylnaphthalene	33.3%	120	36,400	0	750 U	420 U	420 U	680 U	N	780 U	120 J	30 J	N	390 U	N	31 J
2-Chloronaphthalene	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
2-Nitroaniline	0.0%	0	430 or MDL	0	3700 U	1000 U	1000 U	3300 U	N	3800 U	870 U	900 U	N	940 U	N	870 U
Acenaphthylene	0.0%	0	41,000	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
2,6-Dinitrotoluene	22.2%	350	1000	0	750 U	350 J	130 J	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
3-Nitroaniline	0.0%	0	500 or MDL	0	3700 U	1000 U	1000 U	3300 U	N	3800 U	870 U	900 U	N	940 U	N	870 U
Acenaphthene	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Dibenzofuran	0.0%	0	6200	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
2,4-Dinitrotoluene	33.3%	4400	50,000*	0	750 U	4400 J	1900 J	680 U	N	160 J	360 U	370 U	N	390 U	N	360 U
Diethylphthalate	0.0%	0	7100	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Fluorene	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
N-Nitrosodiphenylamine	33.3%	340	50,000*	0	750 U	120 J	340 J	680 U	N	290 J	360 U	370 U	N	390 U	N	360 U
Hexachlorobenzene	0.0%	0	410	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	3700 U	1000 U	1000 U	3300 U	N	3800 U	870 U	900 U	N	940 U	N	870 U
Phenanthrene	22.2%	65	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	65 J	20 J	N	390 U	N	360 U
Anthracene	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Carbazole	0.0%	0	50,000*	0	N	420 U	420 U	N	N	N	360 U	370 U	N	390 U	N	360 U
Di-n-butylphthalate	33.3%	1100	8100	0	750 U	1100	1000	680 U	N	660 J	360 U	370 U	N	390 U	N	360 U
Fluoranthene	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Pyrene	11.1%	18	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	18 J	370 U	N	390 U	N	360 U
Butylbenzylphthalate	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Benzo(a)anthracene	0.0%	0	220 or MDL	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Chrysene	0.0%	0	400	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
bis(2-Ethylhexyl)phthalate	11.1%	190	50,000*	0	750 U	190 J	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Di-n-octylphthalate	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Benzo(b)fluoranthene	0.0%	0	1100	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
benzo(k)fluoranthene	0.0%	0	1100	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Benzo(a)pyrene	11.1%	18	61 or MDL	0	750 U	420 U	420 U	680 U	N	780 U	360 U	18 J	N	390 U	N	360 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	750 U	420 U	420 U	680 U	N	780 U	360 U	370 U	N	390 U	N	360 U

TABLE 4-8

PAD E
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD E	OB	OB	PAD E	PAD E	PAD E	OB	OB	OB	OB	OB	OB
					3.0'	2.0 feet	2.0 feet	0-6"	0-6"	2-4'	0-2	0-2	0-2	0-2	0-2	0-2
					12/03/91	12/03/92	12/03/92	01/08/92	01/08/92	01/08/92	03/11/93	03/11/93	03/11/93	03/11/93	03/11/93	03/11/93
					BE-E-1-91	BE-E-3	BE-E-3RE	PBE-1-1	PBE-1-1RE	PBE-1-3	PBE-2-1	PBE-3-1	PBE3-1RE	PBE-4-1	PBE4-1RE	PBE-5-1
Pesticides/PCBs (ug/kg)																
beta-BHC	0.0%	0	200	0	18 U	2.2 U	N	17 U	N	19 U	3.7 U	19 U	N	2 U	N	1.8 U
delta-BHC	0.0%	0	300	0	18 U	2.2 U	N	17 U	N	19 U	3.7 U	19 U	N	2 U	N	1.8 U
gamma-BHC (Lindane)	0.0%	0	60	0	18 U	2.2 U	N	17 U	N	19 U	3.7 U	19 U	N	2 U	N	1.8 U
Heptachlor	0.0%	0	100	0	18 U	2.2 U	N	17 U	N	19 U	3.7 U	19 U	N	2 U	N	1.8 U
Aldrin	25.0%	3.2	41	0	18 U	3.2 J	N	17 U	N	19 U	3.7 U	19 U	N	2 U	N	0.96 J
Heptachlor epoxide	0.0%	0	20	0	18 U	2.2 U	N	17 U	N	19 U	3.7 U	19 U	N	2 U	N	1.8 U
Endosulfan I	0.0%	0	900	0	18 U	2.2 U	N	17 U	N	19 U	3.7 U	19 U	N	2 U	N	1.8 U
Dieldrin	0.0%	0	44	0	37 U	4.2 U	N	33 U	N	38 U	7.3 U	37 U	N	3.9 U	N	3.6 U
4,4'-DDE	0.0%	0	2100	0	37 U	4.2 U	N	33 U	N	38 U	7.3 U	37 U	N	3.9 U	N	3.6 U
Endrin	0.0%	0	100	0	37 U	4.2 U	N	33 U	N	38 U	7.3 U	37 U	N	3.9 U	N	3.6 U
Endosulfan II	12.5%	4.6	900	0	37 U	4.2 U	N	33 U	N	38 U	4.6 J	37 U	N	3.9 U	N	3.6 U
4,4'-DDD	0.0%	0	2900	0	37 U	4.2 U	N	33 U	N	38 U	7.3 U	37 U	N	3.9 U	N	3.6 U
Endosulfan sulfate	12.5%	3.9	1000	0	37 U	4.2 U	N	33 U	N	38 U	3.9 J	37 U	N	3.9 U	N	3.6 U
4,4'-DDT	12.5%	2.5	2100	0	37 U	2.5 J	N	33 U	N	38 U	7.3 U	37 U	N	3.9 U	N	3.6 U
Endrin aldehyde	0.0%	0		NA	N	4.2 U	N	N	N	N	7.3 U	37 U	N	3.9 U	N	3.6 U
alpha-Chlordane	25.0%	5.4	540	0	180 U	2.2 U	N	170 U	N	190 U	5.4	19 U	N	2 U	N	1.4 J
Aroclor-1254	0.0%	0	1000	0	370 U	42 U	N	330 U	N	380 U	73 U	370 U	N	39 U	N	36 U
Aroclor-1260	0.0%	0	1000	0	370 U	42 U	N	330 U	N	380 U	73 U	370 U	N	39 U	N	36 U
Explosives (ug/kg)																
HMX	0.0%	0		NA	1000 U	120 U	N	1000 U	N	1000 U	120 U	120 U	N	120 U	N	120 U
RDX	0.0%	0		NA	120 U	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	N	120 U
1,3,5-Trinitrobenzene	12.5%	120		NA	120 J	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	N	120 U
1,3-Dinitrobenzene	0.0%	0		NA	120 U	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	N	120 U
Tetryl	0.0%	0		NA	400 U	120 U	N	400 U	N	400 U	120 U	120 U	N	120 U	N	120 U
2,4,6-Trinitrotoluene	0.0%	0		NA	120 U	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	N	120 U
4-amino-2,6-Dinitrotoluene	12.5%	78		NA	120 U	78 J	N	120 U	N	120 U	120 U	120 U	N	120 U	N	120 U
2-amino-4,6-Dinitrotoluene	25.0%	86		NA	86 J	70 J	N	120 U	N	120 U	120 U	120 U	N	120 U	N	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	N	120 U
2,4-Dinitrotoluene	62.5%	1900		NA	1900	430	N	120 U	N	510	240	120	N	120 U	N	120 U
Metals (mg/kg)																
Aluminum	100.0%	20200	17503.0	1	17500	19500	N	15500	N	20200	15700	14200	N	12600	N	12900
Antimony	12.5%	13.3	5	1	5.4 R	12.6 R	N	5.1 U J	N	5.8 U J	5.4 UJ	13.3 J	N	5 UJ	N	5.1 UJ
Arsenic	87.5%	6.1	7.5	0	6.2 R	6.1 J	N	4.5 J	N	5.8 J	5.2	4.8	N	5.6	N	4.1
Barium	87.5%	699	300	2	680 R	699	N	38	N	211	143	309	N	96.8	N	61.4
Beryllium	62.5%	1.1	1	1	0.85 R	1.1	N	0.78 R	N	0.79 R	0.69 J	0.57	N	0.58 J	N	0.61 J
Cadmium	75.0%	7.9	1.8	5	7.9 J	5.1	N	2.9	N	3.2	1.4	2.8	N	0.36 U	N	0.37 U
Calcium	100.0%	25100	46825.0	0	8930	6080	N	25100	N	8720	22500	24500	N	19400	N	19200
Chromium	87.5%	32.7	26.6	5	32.2 R	32.6	N	27.4 J	N	28.5 J	29.5	32.7	N	24.2	N	24.2
Cobalt	100.0%	14.9	30	0	14.2	13.2	N	14.3	N	10.5	14.8	12.6	N	14.9	N	13.5
Copper	100.0%	847	25	8	444	847	N	37.9	N	133	125	235	N	39.9	N	36.2
Iron	100.0%	52000	32698.0	4	52000	32500	N	35700	N	33200	33400	26800	N	27100	N	29000
Lead	87.5%	1260	30	6	1260 J	1090	N	30.4 R	N	205	140	224	N	26.2	N	180
Magnesium	100.0%	7700	9071.1	0	5930	6280	N	7700	N	5810	7670	6570	N	6410	N	6340
Manganese	100.0%	656	1065.8	0	656	604	N	313	N	549	404	374	N	317	N	290
Mercury	62.5%	0.24	0.1	2	0.18 J	0.24	N	0.07 R	N	0.09 R	0.06 J	0.05 J	N	0.05 U	N	0.03 J
Nickel	100.0%	58.5	41.3	7	47.2	43.9	N	58.5 J	N	34.6 J	55.2 J	56.5 J	N	50.5 J	N	51.9 J
Potassium	100.0%	2250	1529.6	6	2030 J	2250	N	1490 J	N	2170 J	2160	1550	N	1490	N	1620
Selenium	100.0%	2.1	2	1	0.28 J	2.1 J	N	0.39 J	N	0.19 J	0.26 J	0.4 J	N	0.46 J	N	0.41 J
Silver	37.5%	0.91	0.6	2	0.54 R	0.91 J	N	0.51 J	N	0.37 U	0.85 U	0.84 J	N	0.78 U	N	0.8 U
Sodium	75.0%	322	76	6	123 R	109 R	N	93.7 J	N	322 J	141 J	197 J	N	98.3 J	N	102 J
Thallium	0.0%	0	0.3	0	0.61 U	0.64 U	N	0.47 U	N	0.35 U	0.46 U	0.55 U	N	0.51 U	N	0.45 U
Vanadium	100.0%	28.8	150	0	28	28.8	N	19.9	N	28.8	21.8	18.6	N	18.7	N	18.1
Zinc	100.0%	1060	89.1	8	775	958	N	195	N	158	374 J	1060	N	187 J	N	143 J
Cyanide	0.0%	0	NA	NA	N	0.6 U	N	0.6 U	N	0.61 U	0.66 U	0.67 U	N	0.56 U	N	0.53 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above tbe TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

None of the soil samples were found to contain volatile organic compound concentrations that exceeded the TAGM limits.

4.3.5.2 Semivolatile Organic Compounds

Ten semivolatile organic compounds were detected in the soil samples collected at burning Pad E. Semivolatile organic compounds were found at low concentrations within the pad boring samples PBE-1-3, PBE-2-1, PBE-3-1, and PBE-5-1. The highest concentrations of SVOCs within pad boring soils was identified in sample PBE-1-3 where an estimated 660 ug/kg of di-n-butylphthalate was detected. This pad boring sample also had the highest total SVOCs at 1110 ug/kg. None of these compounds were detected at concentrations that exceeded the TAGM limits. While some semivolatile compounds were found in four of the six pad boring soil samples analyzed, samples PBE-1-1 and PBE-4-1 had no SVOCs detected, PBE-1-3 had only 3 SVOCs detected, samples PBE-2-1 and PBE-3-1 had only 4 SVOCs detected, and finally sample PBE-5-1 had only 1 SVOC detected.

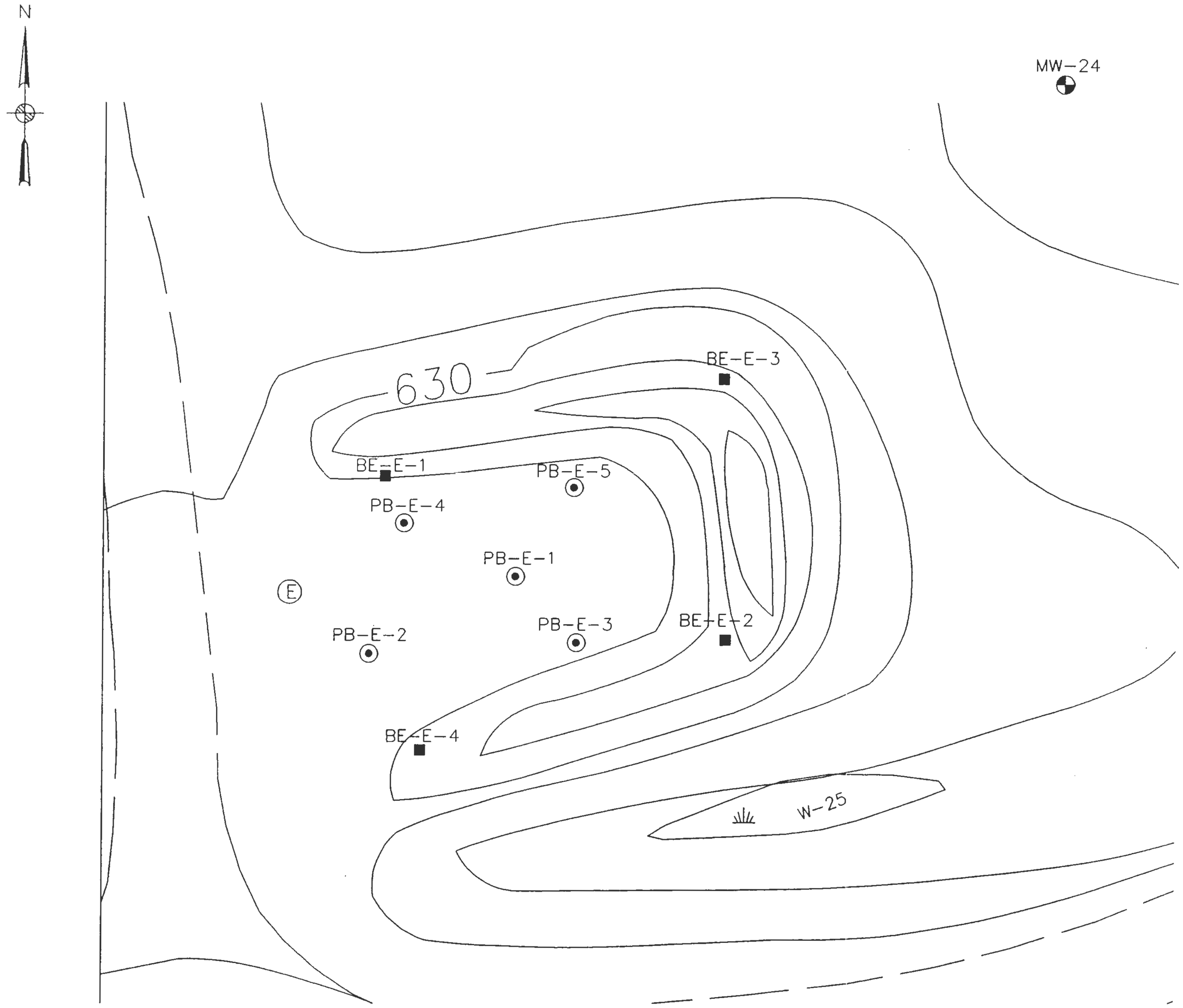
The berm excavation sample BE-E-1 had no SVOCs detected. The other berm sample, BE-E-3, had the highest SVOC concentrations found on pad E where estimated concentrations of 4400 ug/kg of 2,4-dinitrotoluene and 1100 ug/kg of di-n-butylphthalate were detected.

4.3.5.3 Pesticides/PCBs

Five pesticide compounds were detected in the low parts per billion concentration range in the soil samples collected at Pad E. None of these compounds were detected at concentrations that exceed the TAGM limits. All of these compounds were reported in the samples BE-E-3, PBE-2-1, and PBE-5-1 at concentrations below the sample quantitation limits with the exception of alpha-chlordane (5.4 ug/kg) reported in sample PBE-2-1. This was the highest concentration reported for all of the soil samples collected at Pad E. Samples BE-E-1, PBE-1-1, PBE-1-3, and PBE-4-1 had no pesticides/PCBs detected.

4.3.5.4 Explosives

Figure 4-13 summarizes the explosives date for Pad E. Four explosive compounds were detected within the soil samples collected at Pad E. The most frequently detected compound was 2,4-dinitrotoluene, found in 62 percent of the samples. The majority of explosives were found in the berm excavation samples BE-D-1 and BE-D-3. Only one explosive compound



BERM EXCAVATIONS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		TNT	1,3,5-T	4-amino	2-amino	2,4-D
BE-E-1	3.0'	<1000	120 J	120 U	86 J	1900
BE-E-2	3.0'	<1000	NA	NA	NA	NA
BE-E-3	2.0'	<1000	120 U	78 J	70 J	430
BE-E-4	1.5'	<1000	NA	NA	NA	NA

All concentrations in ug/Kg.

PAD BORINGS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		TNT	1,3,5-T	4-amino	2-amino	2,4-D
PBE-1	0-6"	NA	120 U	120 U	120 U	120 U
	0-2'	<1000	NA	NA	NA	NA
	2-4'	<1000	120 U	120 U	120 U	510
	4-6'	<1000	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA
	8-10'	<1000	NA	NA	NA	NA
	10-11.4'	<1000	NA	NA	NA	NA
PBE-2	0-2'	NA	120 U	120 U	120 U	240
PBE-3	0-2'	NA	120 U	120 U	120 U	120
PBE-4	0-2'	NA	120 U	120 U	120 U	120 U
PBE-5	0-2'	NA	120 U	120 U	120 U	120 U

All concentrations in ug/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION	⁄⁄	DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	◊	UTILITY POLE
		○	TREE
PB-G-1 GB-2 ⊙	BORING & DESIGNATION	◯	BRUSH
630	GROUND CONTOUR AND ELEVATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
W-1	WETLAND & DESIGNATION	J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17 ⊕	MONITORING WELL & DESIGNATION	N/A	NOT AVAILABLE

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-13
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD E

SCALE 1" = 20'

(2,4-dinitrotoluene) was detected in the soil samples collected on the pad surface. This compound was detected in samples PBE-1-3 (510 ug/kg), PBE-2-1 (240 ug/kg), and PBE-3-1 (120 ug/kg). The pad boring samples PBE-1-1, PBE-4-1 and PBE-5-1 had no explosive compounds detected. Also, Level II screening results, identified no explosive compounds within any of the soil samples collected from the deeper intervals of pad boring PB-E-1.

By comparison, the berm excavation samples BE-E-1 and BE-E-3 had the explosive compounds 1,3,5-trinitrobenzene, 4-amino-2,6-dinitrotoluene, 2-amino-4,6-dinitrotoluene, and 2,4-dinitrotoluene detected. The compound 2,4-dinitrotoluene was reported at a concentration of 1900 ug/kg in the soil sample BE-E-1. This sample was collected on the northeast side of the berm. This sample also has the highest total explosives measured on Pad E (2106 ug/kg). The soil sample BE-E-3 also had 2,4-dinitrotoluene detected at a concentration of 430 ug/kg and had the second highest total explosives concentration of 578 ug/kg.

4.3.5.5 Metals

Figure 4-14 summarizes the metals data for Pad E. The highest concentration of barium (699 mg/kg) was detected in the soil sample collected from the berm excavation BE-E-3. Of the eight soil samples collected at Pad E and analyzed by Level IV methods, only 2 (BE-E-3 and PBE-3-1) had barium concentrations that exceeded the TAGM limit of 300 mg/kg. The second elevated barium concentration was found in the surface sample collected from pad boring PB-E-3 where 309 mg/kg of barium was detected.

The highest concentration of copper (847 mg/kg) was also detected in the soil sample collected from the berm excavation BE-E-3. All eight soil samples collected at Pad E and analyzed by Level IV methods had copper concentrations that exceeded the TAGM concentration limit of 25 mg/kg. The second highest copper concentration was identified in the berm excavation sample BE-E-1 where 444 mg/kg of copper were detected. The highest concentration of copper in soils samples collected from the pad surface was identified in the pad boring PB-E-3 (235 mg/kg). While the soil samples collected from this pad surface had concentrations above the TAGM limit, in general, these samples do not appear to have significantly elevated copper concentrations.

The highest concentration of lead (1,260 mg/kg) was detected in the soil sample collected from berm excavation BE-E-1. Of the eight soil samples collected at Pad E and analyzed by Level IV methods, six of these had lead concentrations that exceeded the TAGM

BERM EXCAVATIONS

LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
BE-E-1	3.0'	1030	680	444	1260	775
BE-E-2	3.0'	310	NA	NA	NA	NA
BE-E-3	2.0'	820	699	847	1090	958
BE-E-4	1.5'	168	NA	NA	NA	NA

All concentrations in mg/Kg.

PAD BORINGS

LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
PBE-1	0-6"	NA	38	37.9	30.4 R	195
	0-2'	36	NA	NA	NA	NA
	2-4'	970	211	133	205	158
	4-6'	32	NA	NA	NA	NA
	6-8'	33	NA	NA	NA	NA
	8-10'	280	NA	NA	NA	NA
	10-11.4'	17.4	NA	NA	NA	NA
PBE-2	0-2'	NA	143	125	140	374 J
PBE-3	0-2'	NA	309	235	224	1060
PBE-4	0-2'	NA	96.8	39.9	26.2	187 J
PBE-5	0-2'	NA	61.4	36.2	180	143 J

All concentrations in mg/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION	- - -	DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	◊	UTILITY POLE
		⊙	TREE
PB-G-1 GB-2 ⊙	BORING & DESIGNATION	◯	BRUSH
650	GROUND CONTOUR AND ELEVATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
W-1	WETLAND & DESIGNATION	J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17 ◍	MONITORING WELL & DESIGNATION	N/A	NOT AVAILABLE

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CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO 720446-01000

FIGURE 4-14
DISTRIBUTION OF METALS
OPEN BURNING PAD E

SCALE 1" = 20'

concentration limit of 30 mg/kg. The second highest lead concentration was identified in the berm excavation sample BE-E-3 where 1,090 mg/kg of lead was detected. The highest concentration of lead in soils samples collected from the pad surface was identified in the pad boring PB-E-3 (224 mg/kg).

The highest concentration of zinc (1,060 mg/kg) was detected in the soil sample collected from the pad boring PB-E-3. All eight soil samples collected at Pad E and analyzed by Level IV methods had zinc concentrations that exceeded the TAGM concentration limit of 89.1 mg/kg. The second highest zinc concentration was identified in the berm excavation sample BE-E-3 where 958 mg/kg of zinc was detected. Elevated levels of zinc were also reported in the berm excavation sample BE-E-1 where 775 mg/kg of zinc was detected.

4.3.6 Burning Pad F

Six pad borings and six berm excavations were completed at Pad F. During Phase I, the soil boring PB-F-1 and berm excavations BE-F-1 through BE-F-3 were sampled. In Phase II, four additional soil samples were collected at pad borings PB-F-2 through PB-F-6 from the 0- to 2-foot depth. The berm excavations BE-F-4 through BE-F-6 were also sampled in Phase II.

The four soil samples collected from borings PB-F-3 through PB-F-6, and the surface samples collected at pad borings PB-F-1 and PB-F-2 underwent only Level IV analyses. Ten soil samples collected from the two pad borings PB-F-1 and PB-F-2, and all of the seven berm excavation samples collected at Pad F underwent Level II screening for lead, TNT, and VOCs. From these 17 samples, six went for subsequent Level IV analyses, these being four of the berm samples (BE-F-1, BE-F-2, BE-F-5, and BE-F-6) along with one sample from PB-F-1 (PB-F-1-4) and two samples from PB-F-2 (PB-F-2-3 and PB-F-2-4). Duplicate samples of PBF-2-1 (PBF-2-6), PBF-3-1 (PBF-3-2) and BE-F-2 (BE-F-2A) were also analyzed.

A summary of the analytical results for the Level IV analyses is presented in Table 4-9. The following sections review the compounds detected within the soil samples collected on Pad F.

4.3.6.1 Volatile Organic Compounds

Seven volatile organic compounds were detected in the soil samples collected at Pad F. All of the volatile organic compounds reported were at estimated concentrations below the

TABLE 4-9

PAD F
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD F 2.0' 12/12/91 BE-F-1-91	PAD F 2.0' 12/10/91 BE-F-2-91	PAD-F 2.0' 12/10/91 BE-F-2-91DL	PAD F 2.0' 12/10/91 BE-F-2A-91	PAD-F 2.0' 12/10/91 BE-F-2A-91DL	OB 2.0 feet 12/03/92 BE-F-5	OB 2.0 feet 12/03/92 BE-F-6	OB 2.0 feet 12/03/92 BE-F-6RE	PAD-F 0-6" 12/11/91 PB-F-1-1	PAD-F 4-6' 12/12/91 PB-F-1-4
VOCs (ug/kg)														
Methylene Chloride	0.0%	0	100	0	6 U	5 U	N	6 U	N	12 U	12 U	N	6 U	6 U
Acetone	6.7%	52	200	0	11 U	11 U	N	11 U	N	12 U	12 U	N	11 U	36 U
1,2-Dichloroethene (total)	6.7%	1	300 (b)	0	6 U	5 U	N	6 U	N	12 U	12 U	N	6 U	6 U
Chloroform	0.0%	0	300	0	6 U	5 U	N	6 U	N	12 U	12 U	N	6 U	6 U
2-Butanone	6.7%	9	300	0	11 U	11 U	N	11 U	N	12 U	12 U	N	11 U	11 U
1,1,1-Trichloroethane	0.0%	0	800	0	6 U	5 U	N	6 U	N	12 U	12 U	N	6 U	6 U
Carbon Tetrachloride	0.0%	0	600	0	6 U	5 U	N	6 U	N	12 U	12 U	N	6 U	6 U
Trichloroethene	6.7%	2	700	0	6 U	5 U	N	6 U	N	12 U	12 U	N	6 U	6 U
Benzene	6.7%	1	60	0	6 U	1 J	N	6 U	N	12 U	12 U	N	6 U	6 U
Tetrachloroethene	33.3%	6	1400	0	6 U	2 J	N	1 J	N	3 J	6 J	N	6 U	6 U
Toluene	20.0%	5	1500	0	6 U	5 J	N	2 J	N	12 U	12 U	N	6 U	2 J
Chlorobenzene	0.0%	0	1700	0	6 U	5 U	N	6 U	N	12 U	12 U	N	6 U	6 U
Xylene (total)	6.7%	8	1200	0	6 U	5 U	N	6 U	N	12 U	12 U	N	6 U	6 U
Semivolatiles (ug/kg)														
Phenol	0.0%	0	30 or MDL	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
2-Methylphenol	0.0%	0	100 or MDL	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
4-Methylphenol	0.0%	0	900	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Benzoic acid	0.0%	0	2700	0	3500 U	3500 U	N	3500 U	N	N	N	N	3500 U	3600 U
Naphthalene	25.0%	94	13,000	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
2-Methylnaphthalene	62.5%	1300	36,400	0	720 U	730 U	N	720 U	N	22 J	390 U	390 U	100 J	730 U
2-Chloronaphthalene	0.0%	0	50,000*	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
2-Nitroaniline	0.0%	0	430 or MDL	0	3500 U	3500 U	N	3500 U	N	980 U	950 U	950 U	3500 U	3600 U
Acenaphthylene	0.0%	0	41,000	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
2,6-Dinitrotoluene	37.5%	570	1000	0	720 U	100 J	N	250 J	N	400 U	390 U	390 U	730 U	730 U
3-Nitroaniline	0.0%	0	500 or MDL	0	3500 U	3500 U	N	3500 U	N	980 U	950 U	950 U	3500 U	3600 U
Acenaphthene	12.5%	210	50,000*	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Dibenzofuran	6.3%	93	6200	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
2,4-Dinitrotoluene	68.8%	8000	50,000*	0	720 U	1400	N	4200	N	180 J	46 J	18 J	730 U	730 U
Diethylphthalate	0.0%	0	7100	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Fluorene	6.3%	250	50,000*	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
N-Nitrosodiphenylamine	37.5%	1500	50,000*	0	720 U	1000 J	N	580 J	N	400 U	390 U	390 U	730 U	730 U
Hexachlorobenzene	6.3%	28	410	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	3500 U	3500 U	N	3500 U	N	980 U	950 U	950 U	3500 U	3600 U
Phenanthrene	56.3%	1000	50,000*	0	720 U	730 U	N	75 J	N	400 U	390 U	390 U	730 U	730 U
Anthracene	6.3%	39	50,000*	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	400 U	390 U	390 U	N	N
Di-n-butylphthalate	56.3%	3100	8100	0	720 U	200 J	N	3100 J	N	140 J	390 U	390 U	730 U	730 U
Fluoranthene	25.0%	66	50,000*	0	720 U	730 U	N	66 J	N	400 U	390 U	390 U	730 U	730 U
Pyrene	0.0%	0	50,000*	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Butylbenzylphthalate	0.0%	0	50,000*	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Benzo(a)anthracene	0.0%	0	220 or MDL	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Chrysene	0.0%	0	400	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
bis(2-Ethylhexyl)phthalate	37.5%	800	50,000*	0	720 U	730 U	N	89 J	N	320 J	210 J	390 U	730 U	730 U
Di-n-octylphthalate	6.3%	220	50,000*	0	720 U	220 J	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Benzo(b)fluoranthene	0.0%	0	1100	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
benzo(k)fluoranthene	0.0%	0	1100	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Benzo(a)pyrene	0.0%	0	61 or MDL	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	720 U	730 U	N	720 U	N	400 U	390 U	390 U	730 U	730 U

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TABLE 4-9

PAD F
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD F 2.0' 12/12/91 BE-F-1-91	PAD F 2.0' 12/10/91 BE-F-2-91	PAD-F 2.0' 12/10/91 BE-F-2-91DL	PAD F 2.0' 12/10/91 BE-F-2A-91	PAD-F 2.0' 12/10/91 BE-F-2A-91DL	OB 2.0 feet 12/03/92 BE-F-5	OB 2.0 feet 12/03/92 BE-F-6	OB 2.0 feet 12/03/92 BE-F-6RE	PAD-F 0-6" 12/11/91 PB-F-1-1	PAD-F 4-6' 12/12/91 PB-F-1-4
Pesticides/PCBs (ug/kg)														
beta-BHC	0.0%	0	200	0	17 U	18 U	N	17 U	N	2.1 U	2 U	2 U	18 U	18 U
delta-BHC	6.3%	2.4	300	0	17 U	18 U	N	17 U	N	2.4 J	2 U	2 U	18 U	18 U
gamma-BHC (Lindane)	0.0%	0	60	0	17 U	18 U	N	17 U	N	2.1 U	2 U	2 U	18 U	18 U
Heptachlor	0.0%	0	100	0	17 U	18 U	N	17 U	N	2.1 U	2 U	2 U	18 U	18 U
Aldrin	18.8%	3.3	41	0	17 U	18 U	N	17 U	N	2.1 U	2 U	2 U	18 U	18 U
Heptachlor epoxide	0.0%	0	20	0	17 U	18 U	N	17 U	N	2.1 U	2 U	2 U	18 U	18 U
Endosulfan I	12.5%	3.7	900	0	17 U	18 U	N	17 U	N	2.1 U	2 U	2 U	18 U	18 U
Dieldrin	0.0%	0	44	0	35 U	35 U	N	35 U	N	4 U	3.9 U	3.9 U	35 U	36 U
4,4'-DDE	12.5%	1.6	2100	0	35 U	35 U	N	35 U	N	4 U	3.9 U	3.9 U	35 U	36 U
Endrin	12.5%	2.4	100	0	35 U	35 U	N	35 U	N	4 U	3.9 U	3.9 U	35 U	36 U
Endosulfan II	0.0%	0	900	0	35 U	35 U	N	35 U	N	4 U	3.9 U	3.9 U	35 U	36 U
4,4'-DDD	37.5%	3.6	2900	0	35 U	35 U	N	35 U	N	4 U	3.9 U	3.9 U	35 U	36 U
Endosulfan sulfate	6.3%	2.5	1000	0	35 U	35 U	N	35 U	N	4 U	3.9 U	3.9 U	35 U	36 U
4,4'-DDT	18.8%	5.3	2100	0	35 U	35 U	N	35 U	N	5.3 J	3.9 U	2.6 J	35 U	36 U
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	4 U	3.9 U	3.9 U	N	N
alpha-Chlordane	0.0%	0	540	0	170 U	180 U	N	170 U	N	2.1 U	2 U	2 U	180 U	180 U
Aroclor-1254	0.0%	0	1000	0	350 U	350 U	N	350 U	N	40 U	39 U	39 U	350 U	360 U
Aroclor-1260	6.3%	180	1000	0	350 U	350 U	N	180 J	N	40 U	39 U	39 U	350 U	360 U
Explosives (ug/kg)														
HMX	11.8%	580		NA	1000 U	1000 U	10000 R	1000 U	25000 R	580	150	N	1000 U	1000 U
RDX	58.8%	1300		NA	180	1000	1200 R	1100	3100 R	1300	170	N	280	120 U
1,3,5-Trinitrobenzene	52.9%	7800		NA	110 J	7700 R	7800 J	5800 R	6800 J	170	120 U	N	160	120 U
1,3-Dinitrobenzene	11.8%	200		NA	120 U	180	1200 R	200	3100 R	120 U	120 U	N	120 U	120 U
Tetryl	29.4%	1000		NA	400 U	400 U	4000 R	400 U	10000 R	120 U	120 U	N	400 U	400 U
2,4,6-Trinitrotoluene	64.7%	80000		NA	150	26000 R	25000 J	80000 R	80000 J	280	85 J	N	590	120 U
4-amino-2,6-Dinitrotoluene	64.7%	8900		NA	870	1300 J	1900 R	150 J	3100 R	650	270	N	2500	120 U
2-amino-4,6-Dinitrotoluene	64.7%	11000		NA	1000	2500	2500 R	1800	2000 R	720	320	N	2700	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	1200 R	120 U	3100 R	120 U	120 U	N	120 U	120 U
2,4-Dinitrotoluene	76.5%	5100		NA	200	1600 J	1500 R	1600 J	1800 R	300	110 J	N	570	120 U
Metals (mg/kg)														
Aluminum	100.0%	21300	17503.0	4	14600	19900	N	21300	N	18400	18300	N	16100	16100
Antimony	46.7%	18.4	5	6	5.5 R	21.3 R	N	19.9 R	N	17 R	11.8 R	N	9.7 R	5.7 R
Arsenic	80.0%	6.7	7.5	0	8 R	9.5 R	N	15.4 R	N	5.4 J	5.1 J	N	4.1 J	3.5 J
Barium	93.3%	4570	300	12	674 R	3300	N	4570	N	975	563	N	1560 J	178 J
Beryllium	66.7%	0.95	1	0	0.85 R	0.71 R	N	0.78 R	N	0.86	0.95	N	0.64 R	0.69 R
Cadmium	93.3%	11.4	1.8	8	3.5 J	10.1 J	N	11.4 J	N	2.2	0.41 J	N	8.8	3.3
Calcium	100.0%	105000	46825.0	2	6070	17200	N	N	N	11200	6640	N	105000 J	42300 J
Chromium	80.0%	31.5	26.6	4	21.1 R	34.1 R	N	37 R	N	31.1	25.3	N	24.2	24.4
Cobalt	100.0%	14.4	30	0	10.9	11.7	N	12.1	N	13.3	13.3	N	9.1	11.2
Copper	93.3%	1770	25	14	100	787	N	1770	N	263	118	N	90.9 J	52 J
Iron	100.0%	47600	32698.0	5	23600	47600	N	42200	N	36200	27000	N	22900 J	28300 J
Lead	100.0%	13100	30	15	2350 J	5310 J	N	9340 J	N	2290	2320	N	2320 J	59.6
Magnesium	100.0%	10600	9071.1	1	4700	6780	N	7570	N	6140	5410	N	10600	7830
Manganese	100.0%	836	1065.8	0	836	697	N	758	N	682	577	N	365	389
Mercury	93.3%	1	0.1	10	0.25 J	0.09 J	N	0.3 J	N	1	0.17	N	0.17	0.03 U
Nickel	100.0%	53.1	41.3	5	26	41.7	N	53.1	N	38.9	31.5	N	37	39.8
Potassium	100.0%	3030	1529.6	11	1380 J	2160 J	N	2500 J	N	2370	1750	N	3030	1780
Selenium	66.7%	1.2	2	0	0.17 J	1 UJ	N	1.1 R	N	1.2 J	1 J	N	0.2 J	0.11 U J
Silver	40.0%	1	0.6	3	0.36 R	1.1 R	N	2.1 R	N	0.81 J	0.39 U	N	1.6 U	0.92 U
Sodium	86.7%	414	76	12	72.9 J	335 J	N	414 J	N	134 R	62.3 R	N	191 J	97.3 J
Thallium	0.0%	0	0.3	0	0.35 U	0.32 U	N	0.35 U	N	0.41 U	0.5 U	N	0.65 U	0.35 U
Vanadium	100.0%	29.2	150	0	25.3	25.7	N	29.1	N	26.2	29.2	N	20.2	22.3
Zinc	100.0%	2730	89.1	14	138	2730	N	2160	N	389	134	N	494 J	114 J
Cyanide	20.0%	2.2	NA	NA	0.65 U	2	N	2.2	N	0.73 U	0.72 U	N	1.1	0.66 U

TABLE 4-9

PAD F
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-2 01/13/93 PBF-2-1	OB 4-6 01/13/93 PBF-2-3	OB 6-8 01/13/93 PBF-2-4	OB 0-2 01/13/93 PBF-2-6	OB 0-2 03/12/93 PBF-3-1	OB 0-2 03/12/93 PBF-3-2	OB 0-2 03/12/93 PBF-4-1	OB 0-2 03/12/93 PBF-5-1	OB 0-2 03/12/93 PBF-6-1
VOCs (ug/kg)													
Methylene Chloride	0.0%	0	100	0	12 U	N	60 U	12 U	11 U	11 U	11 U	11 U	14 U
Acetone	6.7%	52	200	0	22 U	N	52 J	43 U	11 U	11 U	11 U	11 U	14 U
1,2-Dichloroethene (total)	6.7%	1	300 (b)	0	12 U	N	60 U	12 U	11 U	11 U	11 U	1 J	14 U
Chloroform	0.0%	0	300	0	12 U	N	60 U	12 U	11 U	11 U	11 U	11 U	14 U
2-Butanone	6.7%	9	300	0	12 U	N	60 U	9 J	11 U	11 U	11 U	11 U	14 U
1,1,1-Trichloroethane	0.0%	0	800	0	12 U	N	60 U	12 U	11 U	11 U	11 U	11 U	14 U
Carbon Tetrachloride	0.0%	0	600	0	12 U	N	60 U	12 U	11 U	11 U	11 U	11 U	14 U
Trichloroethene	6.7%	2	700	0	12 U	N	60 U	12 U	11 U	11 U	11 U	2 J	14 U
Benzene	6.7%	1	60	0	12 U	N	60 U	12 U	11 U	11 U	11 U	11 U	14 U
Tetrachloroethene	33.3%	6	1400	0	12 U	N	60 U	12 U	11 U	11 U	11 U	4 J	14 U
Toluene	20.0%	5	1500	0	12 U	N	60 U	12 U	11 U	11 U	11 U	11 U	14 U
Chlorobenzene	0.0%	0	1700	0	12 U	N	60 U	12 U	11 U	11 U	11 U	11 U	14 U
Xylene (total)	6.7%	8	1200	0	12 U	N	60 U	12 U	11 U	11 U	8 J	11 U	14 U
Semivolatiles (ug/kg)													
Phenol	0.0%	0	30 or MDL	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
2-Methylphenol	0.0%	0	100 or MDL	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
4-Methylphenol	0.0%	0	900	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Benzoic acid	0.0%	0	2700	0	N	N	N	N	N	N	N	N	N
Naphthalene	25.0%	94	13,000	0	21 J	94 J	N	510 U	23 J	20 J	3400 U	360 U	1200 U
2-Methylnaphthalene	62.5%	1300	36,400	0	82 J	660	N	110 J	66 J	63 J	1300 J	42 J	55 J
2-Chloronaphthalene	0.0%	0	50,000*	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
2-Nitroaniline	0.0%	0	430 or MDL	0	870 U	970 U	N	1200 U	990 U	890 U	8400 U	880 U	2800 U
Acenaphthylene	0.0%	0	41,000	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
2,6-Dinitrotoluene	37.5%	570	1000	0	360 U	400 U	N	240 J	100 J	370 U	3400 U	300 J	570 J
3-Nitroaniline	0.0%	0	500 or MDL	0	870 U	970 U	N	1200 U	990 U	890 U	8400 U	880 U	2800 U
Acenaphthene	12.5%	210	50,000*	0	360 U	130 J	N	510 U	410 U	370 U	210 J	360 U	1200 U
Dibenzofuran	6.3%	93	6200	0	360 U	93 J	N	510 U	410 U	370 U	3400 U	360 U	1200 U
2,4-Dinitrotoluene	68.8%	8000	50,000*	0	100 J	400 U	N	3000 J	1100	160 J	3400 U	2400	8000
Diethylphthalate	0.0%	0	7100	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Fluorene	6.3%	250	50,000*	0	360 U	250 J	N	510 U	410 U	370 U	3400 U	360 U	1200 U
N-Nitrosodiphenylamine	37.5%	1500	50,000*	0	360 U	400 U	N	470 J	610	370 U	3400 U	640	1500
Hexachlorobenzene	6.3%	28	410	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	28 J	1200 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	870 U	970 U	N	1200 U	990 U	890 U	8400 U	880 U	2800 U
Phenanthrene	56.3%	1000	50,000*	0	34 J	790	N	49 J	34 J	32 J	1000 J	22 J	54 J
Anthracene	6.3%	39	50,000*	0	360 U	39 J	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Carbazole	0.0%	0	50,000*	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Di-n-butylphthalate	56.3%	3100	8100	0	270 J	400 U	N	280 J	180 J	230 J	3400 U	330 J	1200
Fluoranthene	25.0%	66	50,000*	0	21 J	60 J	N	26 J	410 U	370 U	3400 U	360 U	1200 U
Pyrene	0.0%	0	50,000*	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Butylbenzylphthalate	0.0%	0	50,000*	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Benzo(a)anthracene	0.0%	0	220 or MDL	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Chrysene	0.0%	0	400	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
bis(2-Ethylhexyl)phthalate	37.5%	800	50,000*	0	620	710	N	800	410 U	370 U	3400 U	360 U	1200 U
Di-n-octylphthalate	6.3%	220	50,000*	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Benzo(b)fluoranthene	0.0%	0	1100	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
benzo(k)fluoranthene	0.0%	0	1100	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Benzo(a)pyrene	0.0%	0	61 or MDL	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	360 U	400 U	N	510 U	410 U	370 U	3400 U	360 U	1200 U

TABLE 4–9

PAD F
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0–2 01/13/93 PBF–2–1	OB 4–6 01/13/93 PBF–2–3	OB 6–8 01/13/93 PBF–2–4	OB 0–2 01/13/93 PBF–2–6	OB 0–2 03/12/93 PBF–3–1	OB 0–2 03/12/93 PBF–3–2	OB 0–2 03/12/93 PBF–4–1	OB 0–2 03/12/93 PBF–5–1	OB 0–2 03/12/93 PBF–6–1
Pesticides/PCBs (ug/kg)													
beta–BHC	0.0%	0	200	0	1.9 U	2.1 U	N	1.8 U	2.1 U	1.9 U	1.8 U	9.2 U	2.1 U
delta–BHC	6.3%	2.4	300	0	1.9 U	2.1 U	N	1.8 U	2.1 U	1.9 U	1.8 U	9.2 U	2.1 U
gamma–BHC (Lindane)	0.0%	0	60	0	1.9 U	2.1 U	N	1.8 U	2.1 U	1.9 U	1.8 U	9.2 U	2.1 U
Heptachlor	0.0%	0	100	0	1.9 U	2.1 U	N	1.8 U	2.1 U	1.9 U	1.8 U	9.2 U	2.1 U
Aldrin	18.8%	3.3	41	0	1.9 U	2.1 U	N	1.8 U	1.9 J	1 J	3.3	9.2 U	2.1 U
Heptachlor epoxide	0.0%	0	20	0	1.9 U	2.1 U	N	1.8 U	2.1 U	1.9 U	1.8 U	9.2 U	2.1 U
Endosulfan I	12.5%	3.7	900	0	1.9 U	2.1 U	N	1.8 U	2.1 U	3.7 J	1.4 J	9.2 U	2.1 U
Dieldrin	0.0%	0	44	0	3.6 U	4 U	N	3.5 U	4.1 U	3.7 U	3.4 U	18 U	4.1 U
4,4'–DDE	12.5%	1.6	2100	0	1.5 J	4 U	N	1.6 J	4.1 U	3.7 U	3.4 U	18 U	4.1 U
Endrin	12.5%	2.4	100	0	2.4 J	4 U	N	2.4 J	4.1 U	3.7 U	3.4 U	18 U	4.1 U
Endosulfan II	0.0%	0	900	0	3.6 U	4 U	N	3.5 U	4.1 U	3.7 U	3.4 U	18 U	4.1 U
4,4'–DDD	37.5%	3.6	2900	0	2.3 J	4 U	N	1.8 J	3.6 J	2.1 J	2.4 J	18 U	2.2 J
Endosulfan sulfate	6.3%	2.5	1000	0	3.6 U	4 U	N	3.5 U	4.1 U	3.7 U	2.5 J	18 U	4.1 U
4,4'–DDT	18.8%	5.3	2100	0	3.6 U	4 U	N	3.5 U	4.1 U	2.6 J	3.4 U	18 U	4.1 U
Endrin aldehyde	0.0%	0		NA	3.6 U	4 U	N	3.5 U	4.1 U	3.7 U	3.4 U	18 U	4.1 U
alpha–Chlordane	0.0%	0	540	0	1.9 U	2.1 U	N	1.8 U	2.1 U	1.9 U	1.8 U	9.2 U	2.1 U
Aroclor–1254	0.0%	0	1000	0	36 U	40 U	N	35 U	41 U	37 U	34 U	180 U	41 U
Aroclor–1260	6.3%	180	1000	0	36 U	40 U	N	35 U	41 U	37 U	34 U	180 U	41 U
Explosives (ug/kg)													
HMX	11.8%	580		NA	120 U	120 U	N	120 U	120 U	120 U	120 U	380 U	250 U
RDX	58.8%	1300		NA	120 U	120 U	N	120 U	110 J	73 J	120 U	600 J	270
1,3,5–Trinitrobenzene	52.9%	7800		NA	120 U	120 U	N	120 U	590 J	720 J	92 J	500 J	250 U
1,3–Dinitrobenzene	11.8%	200		NA	120 U	120 U	N	120 U	120 U	120 U	120 U	380 U	250 U
Tetryl	29.4%	1000		NA	120 U	120 U	N	120 U	220 J	860	410 J	1000	230 J
2,4,6–Trinitrotoluene	64.7%	80000		NA	120 U	120 U	N	120 U	520 J	1400 J	110 J	5000 J	520 J
4–amino–2,6–Dinitrotoluene	64.7%	8900		NA	120 U	120 U	N	120 U	1400	2400	280 J	8900	1000
2–amino–4,6–Dinitrotoluene	64.7%	11000		NA	120 U	120 U	N	120 U	1300	2200	350 J	11000	1000
2,6–Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	N	120 U	120 U	120 U	120 U	380 U	250 U
2,4–Dinitrotoluene	76.5%	5100		NA	1700	120 U	N	740	800	850	370	5000	5100
Metals (mg/kg)													
Aluminum	100.0%	21300	17503.0	4	12300	16500	N	11200	14200	12700	14500	14200	17100
Antimony	46.7%	18.4	5	6	14.3 J	6.6 UJ	N	6.3 J	4.8 J	8 J	8.3 J	6 J	18.4 J
Arsenic	80.0%	6.7	7.5	0	6.7 J	4.7 J	N	3.7 J	5.8	6.5	5.8	4.2	6.4
Barium	93.3%	4570	300	12	991	157	N	607	952	798	332	947	2260
Beryllium	66.7%	0.95	1	0	0.56	0.78	N	0.52 J	0.63 J	0.57 J	0.63 J	0.63 J	0.69 J
Cadmium	93.3%	11.4	1.8	8	1.6	0.38 U	N	2.1	1.2	1.1	0.37 J	0.85	1.9
Calcium	100.0%	105000	46825.0	2	17100	3170	N	22700	23600	55600	29000	25000	24500
Chromium	80.0%	31.5	26.6	4	29.5	21.5	N	24.3	29.6	24.1	26.5	25.1	31.5
Cobalt	100.0%	14.4	30	0	11.5	11.8	N	11.3	14.4	11.1	14.3	12.4	14.1
Copper	93.3%	1770	25	14	492	31.8 R	N	1090	303	222	216	255	743
Iron	100.0%	47600	32698.0	5	29900	24100	N	24700	35300	29000	31200	28400	35000
Lead	100.0%	13100	30	15	2850	94.3 J	N	1260	1570	1250	1540	678	13100
Magnesium	100.0%	10600	9071.1	1	5410	3830	N	5430	6570	7960	7460	6240	7240
Manganese	100.0%	836	1065.8	0	399	657	N	439	511	384	425	562	573
Mercury	93.3%	1	0.1	10	0.09 J	0.22	N	0.05 J	0.11 J	0.13	0.15	0.08 J	0.28
Nickel	100.0%	53.1	41.3	5	37.1	22.9	N	35.5	47.5 J	38.1 J	51.7 J	39.4 J	42.7 J
Potassium	100.0%	3030	1529.6	11	1360	1530	N	1160	1570	1860	1630	1440	1920
Selenium	66.7%	1.2	2	0	0.16 J	0.22 J	N	0.28 J	0.27 J	0.18 UJ	0.26 J	0.29 J	1.8 UJ
Silver	40.0%	1	0.6	3	0.47 J	0.65 J	N	0.53 J	1 J	0.6 U	0.68 U	0.63 U	0.74 J
Sodium	86.7%	414	76	12	88.5 J	78.5 J	N	84.7 J	139 J	148 J	121 J	125 J	167 J
Thallium	0.0%	0	0.3	0	0.34 U	0.49 U	N	0.55 U	0.6 U	0.42 U	0.5 U	0.66 U	0.42 U
Vanadium	100.0%	29.2	150	0	17.6	29.1	N	16	20.1	18.5	19.9	20.4	24.7
Zinc	100.0%	2730	89.1	14	465	70.2 J	N	345	304 J	259 J	200 J	1370	617
Cyanide	20.0%	2.2	NA	NA	0.67 U	0.74 U	N	0.64 U	0.73 U	0.68 U	0.64 U	0.66 U	0.77 U

NOTES: a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi–VOCs <500 ppm, Individual Semi–VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2–Dichloroethene (trans) was used for 1,2–Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

sample quantitation limits. The compound tetrachloroethene was the most commonly detected VOC, found in 33 percent of the samples. The highest estimated concentration reported was for acetone in sample PBF-4-1 at a concentration of 51 ug/kg. The remaining reported concentrations of VOCs were all below 10 ug/kg. None of the soil samples contained volatile organic compounds in concentrations that exceeded the TAGM limits.

4.3.6.2 Semivolatile Organic Compounds

Fourteen semivolatile organic compounds were detected in the soil samples collected at Pad F. None of these compounds were detected at concentrations that exceeded the TAGM limits. Semivolatile organic compounds were found at varied concentrations throughout the pad boring and berm samples. The semivolatile compound 2,4-dinitrotoluene was detected in 68 percent of the samples analyzed. The compounds, 2-methylnaphthalene, phenanthrene, and di-n-butylphthalate were also detected in more than half of the samples analyzed.

The pad boring surface soil samples collected at the locations PB-F-2 through PB-F-6 all show the same common distribution of semivolatile compounds, with the four above mentioned SVOCs present at varied concentrations. The maximum concentration of 2,4-dinitrotoluene was detected in sample PB-F-6 where 8,000 ug/kg was reported. Significantly elevated concentrations of 2,4-dinitrotoluene were also detected in samples PBF-2-6 (3,000 ug/kg), PBF-3-1 (1,100 ug/kg), and PBF-5-1 (2,400 ug/kg). This compound was not identified in the surface soil samples PBF-4-1 and PBF-1-1.

The berm excavation sample BE-F-1 had no SVOCs detected. The duplicate sample collected at location BE-F-2 (sample BE-F-2A) had a concentration of 4,200ug/kg of 2,4-dinitrotoluene detected. This sample also shows a distribution of semivolatile compounds similar to the pad boring samples discussed above. The compounds di-n-butylphthalate (estimated concentration of 3,100 ug/kg) and 2,6-dinitrotoluene (estimated concentration of 250 ug/kg) were also identified in this sample. The berm samples BE-F-5 and BE-F-6 have lower SVOC concentrations with compound distributions similar to samples BE-F-2A described above.

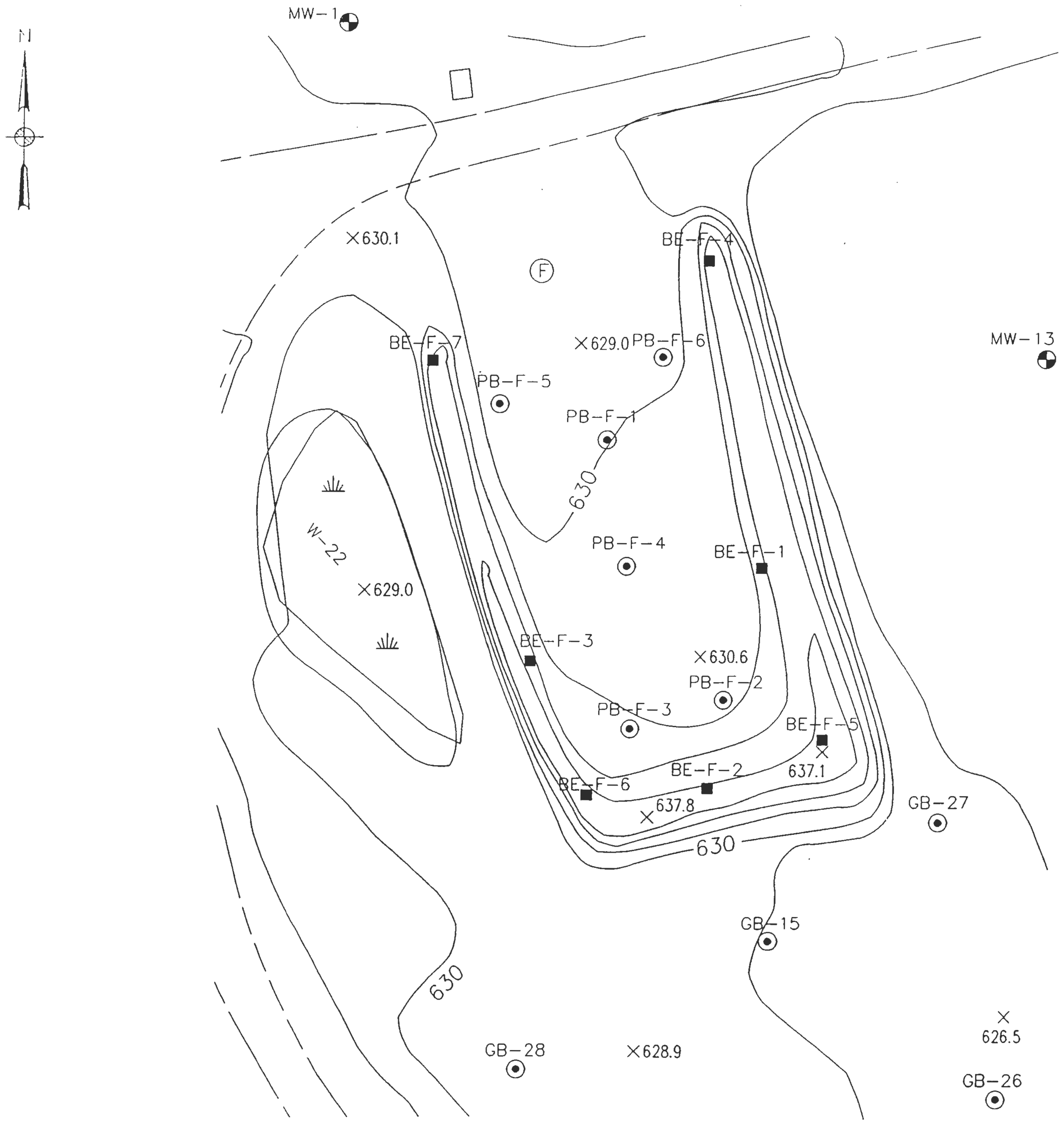
4.3.6.3 Pesticides/PCBs

Nine pesticide and/or PCB compounds were detected in the low parts per billion concentration range in the soil samples collected at Pad F. With the exception of aldrin, reported at a concentration of 3.3 ug/kg in sample PBF-4-1, all of the pesticide compounds were detected at estimated concentrations below the sample quantitation limits. The most commonly detected pesticide was 4,4'-DDD which was found in 37 percent of the samples analyzed, at a maximum estimated concentration of 3.6 ug/kg. This is significantly below the TAGM value of 2900 ug/kg. None of the identified compounds were detected at concentrations that exceed the TAGM. The pad boring samples PBF-2-1, PBF-3-2, and PBF-4-1 had the largest number of compounds identified. The highest concentration detected was for the compound aroclor-1260 which was estimated at 180 ug/kg in the duplicate sample BE-F-2A.

4.3.6.4 Explosives

Figure 4-15 summarizes the explosives results for Pad F. Burning Pad F had the largest number, and highest concentration of explosive compounds identified of all the pads. Of the ten method 8330 analytes, only 2,6-dinitrotoluene was not detected. The explosive compounds 2,4-dinitrotoluene, 2-amino-4,6-dinitrotoluene, 4-amino-2,6-dinitrotoluene, 2,4,6-trinitrotoluene, RDX, and 1,3,5-trinitrobenzene were detected in over half of the sixteen samples analyzed. The compound 2,4-dinitrotoluene was the most frequently detected explosive, with a frequency of detection of 76 percent, and was reported at a maximum concentration of 5,100 ug/kg in sample PBF-6-1. Within the pad boring soil samples, only the two deeper soil samples PB-F-1-4, collected from a depth of 4 to 6 feet in boring PB-F-1, and the sample PBF-2-3, collected from a depth of 4 to 6 feet in boring PB-F-2, had no explosive compounds detected. Along with the Level IV analyses of these deeper Pad F soil samples, the Level II screening results for the deeper soil samples collected on Pad F had no explosives compounds reported above the detection limit of 1 mg/kg suggesting that the explosive contamination is limited to the upper 2 feet,

For the surface soil samples collected on Pad F, total explosives ranged from a low of 1,612 ug/kg in sample PBF-4-1 to a high of 32,000 ug/kg in sample PBF-5-1. The maximum concentration for an individual compound was found in sample PBF-5-1 where 11,000 ug/kg of 2-amino-4,6-dinitrotoluene was reported. While the two amino explosive compounds were determined to be the second most common compounds found based upon the frequency of detection, within the soil samples collected on the pad surface these two compounds were generally found at the highest concentrations. This relationship holds true for the samples PB-F-1-1, PBF-3-1, PBF-4-1, PBF-5-1, and PBF-6-1. For the sample PBF-2-1 only the explosive compound 2,4-dinitrotoluene was detected, at a concentration of 1,700 ug/kg.



BERM EXCAVATIONS

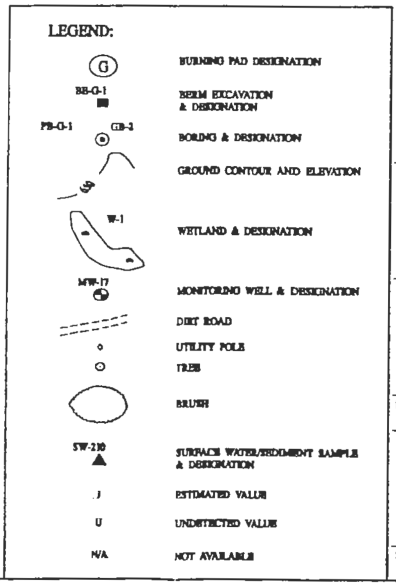
LOCATION	DEPTH	LEVEL II	LEVEL IV								
		TNT	HMX	RDX	1,3,5-T	1,3-D	Tetryl	2,4,6-T	4-amino	2-amino	2,4-D
BE-F-1	2.0'	1020	1000 U	180	110 J	120 U	400 U	150	870	1000	200
BE-F-2	2.0'	69000	1000 U	1100	6800 J	200	400 U	80000 J	150 J	1800	1600 J
BE-F-3	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
BE-F-4	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
BE-F-5	2.0'	1300	580	1300	170	120 U	120 U	280	650	720	300
BE-F-6	2.0'	<1000	150	170	120 U	120 U	120 U	85 J	270	320	110 J
BE-F-7	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA

All concentrations in ug/Kg.

PAD BORINGS

LOCATION	DEPTH	LEVEL II	LEVEL IV								
		TNT	HMX	RDX	1,3,5-T	1,3-D	Tetryl	2,4,6-T	4-amino	2-amino	2,4-D
PB-F-1	0-6"	NA	1000 U	280	160	120 U	400 U	590	2500	2700	570
	0-2'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	1000 U	120 U	120 U	120 U	400 U	120 U	120 U	120 U	120 U
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	8-8.4	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
PB-F-2	0-6"	NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	1700
	0-2'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
	10-12'	<1000	NA	NA	NA	NA	NA	NA	NA	NA	NA
PBF-3	0-2'	NA	120 U	73 J	720 J	120 U	860	1400 J	2400	2200	850
PBF-4	0-2'	NA	120 U	120 U	92 J	120 U	410 J	110 J	280 J	350 J	370
PBF-5	0-2'	NA	380 U	600 J	500 J	380 U	1000	5000 J	8900	11000	5000
PBF-6	0-2'	NA	250 U	270	250 U	250 U	230 J	520 J	1000	1000	5100

All concentrations in ug/Kg.



ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING NO. 720446-01000

FIGURE 4-15
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD F

SCALE 1" = 40'

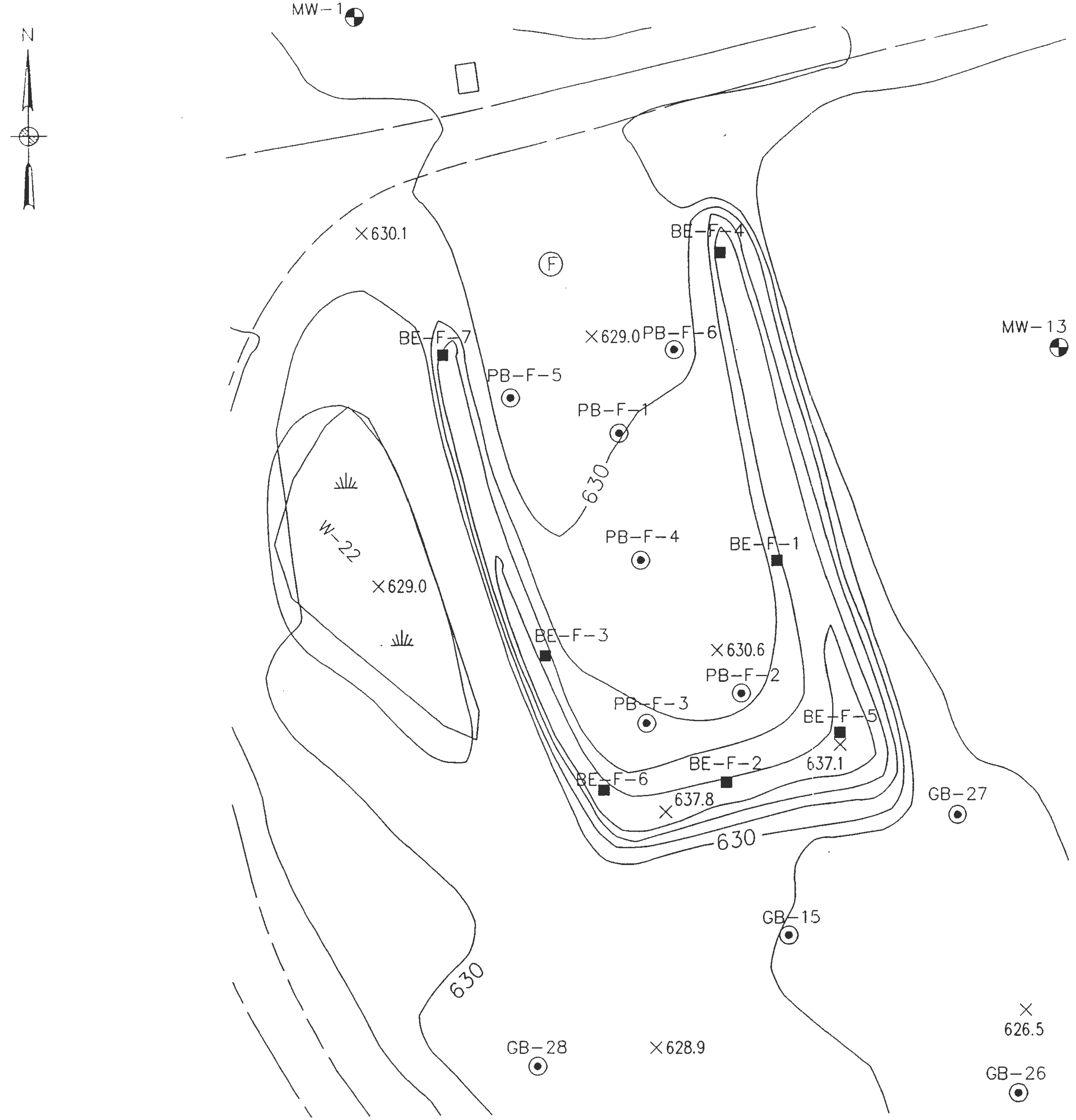
All of the berm excavation soil samples collected at Pad F had explosive compounds detected. The soil samples collected from the berm excavations also show a wide variety of explosive compounds present. Total explosives range from a low of 1,105 ug/kg in sample BE-F-6 to a high of 91,650 ug/kg for the duplicate sample BE-F-2A. The maximum individual concentration was determined for sample BE-F-2A where 80,000 ug/kg of 2,4,6-trinitrotoluene was estimated. The compounds HMX and 1,3-dinitrobenzene were only detected in berm samples and were found at maximum concentrations of 580 ug/kg and 7,800 ug/kg, respectively.

4.3.6.5 Metals

Figure 4-16 summarizes the metals data for Pad F. Barium was detected in all of the soil samples analyzed at Pad F and was found in 12 of the 14 samples at concentrations above the TAGM value. Copper and zinc were detected in all of the soil samples analyzed at Pad F and were found in 14 of the 15 samples at concentrations above the TAGM value. Lead was also detected in all of the soil samples analyzed at Pad F and was found in all 15 samples at concentrations above the TAGM value.

The highest concentration of barium (4,570 mg/kg) was detected in the soil sample collected from the berm excavation BE-F-2. Significantly elevated barium concentrations were identified in all of the samples collected at Pad F except the two deep soil samples collected in pad borings PB-F-1 and PB-F-2. The soil sample PB-F-1-4, collected from a depth of 4 to 6 feet in boring PB-F-1, had a barium concentration of 178 mg/kg which is below the TAGM value of 300 mg/kg. The other subsurface soil sample PBF-2-3, collected from a depth of 4 to 6 feet in boring PB-F-2, had a barium concentration of 157 mg/kg which is also below the TAGM value of 300 mg/kg. For the surface soil samples collected at Pad F, other significantly elevated barium concentrations were detected in samples PB-F-1-1 (1,560 mg/kg), and PBF-6-1 (2,260 mg/kg). For the berm samples, significantly elevated barium concentrations were detected in the sample BE-F-2A (4,570 mg/kg).

The highest concentration of copper (1,770 mg/kg) was detected in the duplicate soil sample collected from berm excavation BE-F-2A. Significantly elevated copper concentrations were identified in all of the samples collected at Pad F except the deep soil sample collected in pad boring PB-F-1. The soil sample PB-F-1-4, collected from a depth of 4 to 6 feet in boring PB-



BERM EXCAVATIONS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
BE-F-1	2.0'	2200	674 R	100	2350 J	138
BE-F-2	2.0'	7700	4570	1770	9340 J	2160
BE-F-3	2.0'	159	NA	NA	NA	NA
BE-F-4	2.0'	159	NA	NA	NA	NA
BE-F-5	2.0'	1800	975	263	2290	389
BE-F-6	2.0'	1890	563	118	2320	134
BE-F-7	2.0'	1440	NA	NA	NA	NA

All concentrations in mg/Kg.

PAD BORINGS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
PB-F-1	0-6"	NA	1560 J	90.9 J	2320 J	494 J
	0-2'	30	NA	NA	NA	NA
	2-4'	55	NA	NA	NA	NA
	4-6'	141	178 J	52 J	59.6	114 J
	6-8'	<10	NA	NA	NA	NA
	8-8.4	28	NA	NA	NA	NA
PBF-2	0-2'	NA	991	492	2850	465
	2-4'	15.8	NA	NA	NA	NA
	4-6'	78	157	31.8 R	94.3 J	70.2 J
	6-8'	13	NA	NA	NA	NA
	8-10'	<10	NA	NA	NA	NA
	10-12'	19.4	NA	NA	NA	NA
PBF-3	0-2'	NA	952	303	1570	304 J
PBF-4	0-2'	NA	332	216	1540	200 J
PBF-5	0-2'	NA	947	255	678	1370
PBF-6	0-2'	NA	2260	743	13100	617

All concentrations in mg/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION	- - - -	DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	○	UTILITY POLE
		○	TREE
PB-G-1 ⊙ GB-2	BORING & DESIGNATION		BRUSH
650	GROUND CONTOUR AND ELEVATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
W-1	WETLAND & DESIGNATION	J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17 ⊕	MONITORING WELL & DESIGNATION	N/A	NOT AVAILABLE

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ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-16
DISTRIBUTION OF METALS
OPEN BURNING PAD F

SCALE 1" = 40'

F-1, had a copper concentration of 52 mg/kg which is only slightly above the TAGM value of 25 mg/kg. Other significantly elevated copper concentrations were detected in surface soil samples PBF-2-1 (492 mg/kg), and PBF-6-1 (743 mg/kg).

The highest concentration of lead (13,100 mg/kg) was detected in the surface soil sample PBF-6-1 collected from pad boring PB-F-6. Significantly elevated lead concentrations were identified in all of the samples collected at Pad F excepting the two deep soil samples collected in pad borings PB-F-1 and PB-F-2. The soil samples PB-F-1-4 and PBF-2-3, collected from a depth of 4 to 6 feet in borings PB-F-1 and PBF-2, respectively, had lead concentrations of 59. 6 mg/kg and 94. 3 mg/kg, respectively which are both only slightly above the TAGM value of 30 mg/kg. Significantly elevated lead concentrations were detected in all of the other surface soil samples.

The highest concentration of zinc (2,730 mg/kg) was detected in the soil sample collected from the berm excavation BE-F-2. Significantly elevated zinc concentrations were identified in all of the samples collected at Pad F excepting the two deep soil samples collected in pad borings PB-F-1 and PB-F-2. The soil samples PB-F-1-4 and PBF-2-3, collected from a depth of 4 to 6 feet in borings PB-F-1 and PBF-2, respectively, had zinc concentrations of 114 mg/kg and 70. 2 mg/kg, respectively which are both only slightly above the TAGM value of 89.1 mg/kg. For the surface soil samples collected at pad F, other significantly elevated zinc concentrations were detected in the samples PBF-5-1 (1,370 mg/kg), and PBF-6-1 (617 mg/kg). For the berm excavation samples collected at Pad F, the zinc concentrations were generally lower than those detected within the pad boring samples, with the exception of sample BE-F-2, as discussed above.

4.3.7 Burning Pad G

In total, nine pad borings, and thirteen berm excavations were completed at Pad G during the Phase I and Phase II investigations. During Phase I, the soil borings PB-G-1 and PB-G-7 were installed, and the berm excavations BEG-1 through BG-6-7 were sampled. In Phase II, two additional soil borings PB-G-8 through PB-G-9 were installed and the berm excavations BE-G-8 through BE-G-13 were sampled.

The surface sample from each pad boring went directly for Level IV analysis. A total of 34 subsurface soil samples were collected and submitted for Level II screening. From these 34 samples, 9 samples (1 from each boring) were sent for subsequent Level IV analysis based upon the results of the screening. A total of 18 pad boring samples collected from Pad G were analyzed using Level IV methods.

All of the 13 soil samples collected at the berm excavation locations BE-G-1 through BE-G-13 were sent for Level II screening. From these 13 samples, seven went for subsequent Level IV analysis. Thus a total of 25 soil samples collected on Pad G were analyzed using Level IV methods.

A summary of the analytical results for the Level IV analyses is presented in Table 4-10. The following sections review the compounds detected within the soil samples collected on Pad G.

4.3.7.1 Volatile Organic Compounds

Six volatile organic compounds were detected in the soil samples collected at Pad G. None of the volatile organic compounds were found at concentrations that exceeded the TAGM values. Chloroform had the highest frequency of detection (20 percent) and was found in 6 soil samples. The maximum concentration of chloroform was found in sample PBG-1-1 (12 ug/kg) which is significantly below the TAGM value of 300 ug/kg. Toluene was the second most prevalent VOC detected, having a frequency of detection of 10 percent, and was found at a maximum concentration of 15 ug/kg in the sample BE-G-2. This is also significantly below the TAGM value of 1500 ug/kg for toluene. All of the remaining VOCs detected in the Pad G soil samples were found at frequencies of less than 10 percent and at concentrations of less than 10 ug/kg.

4.3.7.2 Semivolatile Organic Compounds

Twenty-six semivolatile organic compounds were detected in the soil samples collected at Pad G. The compounds 2,6-dinitrotoluene (2,000 ug/kg), benzo(a)anthracene (3,900 ug/kg and 270 ug/kg), chrysene (8,900 ug/kg), benzo(b)fluoranthene (11,000 ug/kg), benzo(k)fluoranthene (4,500 ug/kg), benzo(a)pyrene (3,700 ug/kg and 230 ug/kg), and dibenz(a,h)anthracene (290 ug/kg) were all detected at concentrations above the associated TAGM values. The compounds benzo(a)anthracene and benzo(a)pyrene were each found in two samples at concentrations above the TAGM value, while the remainder of the compounds were detected in only one sample at a concentration above the TAGM value.

TABLE 4-10

PAD G
SUMMARY OF COMPOUNDS DETECTED
GEOPHYS. ANOMALY EXCAVATIONS, BERM EXCAVATIONS, AND PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GAE-G 2.0' 12/11/91 GAE-G-1	GAE-G 2.0' 12/11/91 GAE-G-2	PAD G 2.5' 12/04/91 BE-G-1-91	PAD-G 2.5' 12/04/91 BE-G-1-91	PAD G 4.0' 12/05/91 BE-G-2-91	PAD G 4.5' 12/05/91 BE-G-3-91	PAD-G 3.0' 12/05/91 BE-G-6-91	OB 2.0 feet 12/04/92 BE-G-11	OB 2.0 feet 12/07/92 BE-G-13	OB 2.0 feet 12/07/92 BE-G13RE	OB 2.0 feet 12/07/92 BE-G-14	OB 2.0 feet 12/07/92 BE-G14RE
VOCs (ug/kg)																
Methylene Chloride	3.3%	2	100	0	6 U	6 U	6 U	N	6 U	6 U	N	12 U	12 U	N	12 U	N
Acetone	0.0%	0	200	0	12 U	12 U	11 U	N	11 U	11 U	N	12 U	12 U	N	12 U	N
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	6 U	6 U	N	6 U	6 U	N	12 U	12 U	N	12 U	N
Chloroform	20.0%	12	300	0	6 U	9	6 U	N	6 U	6 U	N	12 U	12 U	N	12 U	N
2-Butanone	0.0%	0	300	0	12 U	12 U	11 U	N	11 U	11 U	N	12 U	12 U	N	12 U	N
1,1,1-Trichloroethane	3.3%	2	800	0	6 U	6 U	6 U	N	6 U	6 U	N	12 U	12 U	N	12 U	N
Carbon Tetrachloride	0.0%	0	600	0	6 U	6 U	6 U	N	6 U	6 U	N	12 U	12 U	N	12 U	N
Trichloroethene	3.3%	1	700	0	6 U	6 U	1 J	N	6 U	6 U	N	12 U	12 U	N	12 U	N
Benzene	0.0%	0	60	0	6 U	6 U	6 U	N	6 U	6 U	N	12 U	12 U	N	12 U	N
Tetrachloroethene	10.0%	15	1400	0	6 U	11	6 U	N	15	6 U	N	12 U	12 U	N	2 J	N
Toluene	6.7%	2	1500	0	6 U	6 U	6 U	N	6 U	1 J	N	12 U	12 U	N	12 U	N
Chlorobenzene	0.0%	0	1700	0	6 U	6 U	6 U	N	6 U	6 U	N	12 U	12 U	N	12 U	N
Xylene (total)	0.0%	0	1200	0	6 U	6 U	6 U	N	6 U	6 U	N	12 U	12 U	N	12 U	N
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
2-Methylphenol	0.0%	0	100 or MDL	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
4-Methylphenol	0.0%	0	900	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
Benzoic acid	5.3%	98	2700	0	3900 U	14000 U	3500 U	N	3500 U	3600 U	N	N	N	N	N	N
Naphthalene	3.6%	88	13,000	0	800 U	2900 U	730 U	N	730 U	750 U	N	88 J	400 U	N	400 U	400 U
2-Methylnaphthalene	3.6%	52	36,400	0	800 U	2900 U	730 U	N	730 U	750 U	N	52 J	400 U	N	400 U	400 U
2-Chloronaphthalene	0.0%	0	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
2-Nitroaniline	0.0%	0	430 or MDL	0	3900 U	14000 U	3500 U	N	3500 U	3600 U	N	1500 U	980 U	N	980 U	980 U
Acenaphthylene	3.6%	42	41,000	0	800 U	2900 U	730 U	N	730 U	750 U	N	42 J	400 U	N	400 U	400 U
2,6-Dinitrotoluene	21.4%	2000	1000	1	800 U	2000 J	730 U	N	150 J	100 J	N	620 U	400 U	N	400 U	400 U
3-Nitroaniline	0.0%	0	500 or MDL	0	3900 U	14000 U	3500 U	N	3500 U	3600 U	N	1500 U	980 U	N	980 U	980 U
Acenaphthene	3.6%	270	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	270 J	400 U	N	400 U	400 U
Dibenzofuran	3.6%	140	6200	0	800 U	2900 U	730 U	N	730 U	750 U	N	140 J	400 U	N	400 U	400 U
2,4-Dinitrotoluene	42.9%	33000	50,000*	0	800 U	33000	730 U	N	2800	2500	N	290 J	400 U	N	400 U	400 U
Diethylphthalate	3.6%	22	7100	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
Fluorene	3.6%	210	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	210 J	400 U	N	400 U	400 U
N-Nitrosodiphenylamine (1)	32.1%	7000	50,000*	0	800 U	7000	730 U	N	530 J	270 J	N	500 J	400 U	N	400 U	400 U
Hexachlorobenzene	0.0%	0	410	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	3900 U	14000 U	3500 U	N	3500 U	3600 U	N	1500 U	980 U	N	980 U	980 U
Phenanthrene	14.3%	2600	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	2600	14 J	N	400 U	400 U
Anthracene	3.6%	440	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	440 J	400 U	N	400 U	400 U
Carbazole	11.1%	1000	50,000*	0	N	N	N	N	N	N	N	1000	400 U	N	400 U	400 U
Di-n-hutylphthalate	28.6%	5800	8100	0	800 U	730 J	730 U	N	730 U	140 J	N	130 J	13 J	N	400 U	400 U
Fluoranthene	17.9%	4400	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	4400	22 J	N	400 U	400 U
Pyrene	17.9%	5600	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	5600 J	17 J	N	400 U	400 U
Butylbenzylphthalate	0.0%	0	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
Benzo(a)anthracene	10.7%	3900	220 or MDL	2	800 U	2900 U	730 U	N	730 U	750 U	N	3900	400 U	N	400 U	400 U
Chrysene	10.7%	8900	400	1	800 U	2900 U	730 U	N	730 U	750 U	N	8900 J	400 U	N	400 U	400 U
his(2-Ethylhexyl)phthalate	28.6%	420	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	360 J	42 J	N	400 U	30 J
Di-n-octylphthalate	0.0%	0	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	620 U	400 U	N	400 U	400 U
Benzo(b)fluoranthene	17.9%	11000	1100	1	800 U	2900 U	730 U	N	730 U	750 U	N	11000 J	14 J	N	400 U	400 U
benzo(k)fluoranthene	10.7%	4500	1100	1	800 U	2900 U	730 U	N	730 U	750 U	N	4500	400 U	N	400 U	400 U
Benzo(a)pyrene	10.7%	3700	61 or MDL	2	800 U	2900 U	730 U	N	730 U	750 U	N	3700	400 U	N	400 U	400 U
Indeno(1,2,3-cd)pyrene	7.1%	2300	3200	0	800 U	2900 U	730 U	N	730 U	750 U	N	2300	400 U	N	400 U	400 U
Dibenz(a,h)anthracene	3.6%	290	14 or MDL	1	800 U	2900 U	730 U	N	730 U	750 U	N	290 J	400 U	N	400 U	400 U
Benzo(g,h,i)perylene	10.7%	810	50,000*	0	800 U	2900 U	730 U	N	730 U	750 U	N	810	400 U	N	400 U	400 U

TABLE 4-10

PAD G
SUMMARY OF COMPOUNDS DETECTED
GEOPHYS. ANOMALY EXCAVATIONS, BERM EXCAVATIONS, AND PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GAE-G 2.0' 12/11/91 GAE-G-1	GAE-G 2.0' 12/11/91 GAE-G-2	PAD G 2.5' 12/04/91 BE-G-1-91	PAD-G 2.5' 12/04/91 BE-G-1-91	PAD G 4.0' 12/05/91 BE-G-2-91	PAD G 4.5' 12/05/91 BE-G-3-91	PAD-G 3.0' 12/05/91 BE-G-6-91	OB 2.0 feet 12/04/92 BE-G-11	OB 2.0 feet 12/07/92 BE-G-13	OB 2.0 feet 12/07/92 BE-G13RE	OB 2.0 feet 12/07/92 BE-G-14	OB 2.0 feet 12/07/92 BE-G14RE
Pesticides/PCBs (ug/kg)																
beta-BHC	0.0%	0	200	0	20 U	18 U	18 U	N	18 U	18 U	N	21 U	2.1 U	2.1 U	2 U	N
delta-BHC	0.0%	0	300	0	20 U	18 U	18 U	N	18 U	18 U	N	21 U	2.1 U	2.1 U	2 U	N
gamma-BHC (Lindane)	0.0%	0	60	0	20 U	18 U	18 U	N	18 U	18 U	N	21 U	2.1 U	2.1 U	2 U	N
Heptachlor	0.0%	0	100	0	20 U	18 U	18 U	N	18 U	18 U	N	21 U	2.1 U	2.1 U	2 U	N
Aldrin	0.0%	0	41	0	20 U	18 U	18 U	N	18 U	18 U	N	21 U	2.1 U	2.1 U	2 U	N
Heptachlor epoxide	0.0%	0	20	0	20 U	18 U	18 U	N	18 U	18 U	N	21 U	2.1 U	2.1 U	2 U	N
Endosulfan I	0.0%	0	900	0	20 U	18 U	18 U	N	18 U	18 U	N	21 U	2.1 U	2.1 U	2 U	N
Dieldrin	0.0%	0	44	0	39 U	36 U	35 U	N	35 U	36 U	N	41 U	4.1 U	4.1 U	4 U	N
4,4'-DDE	14.3%	32	2100	0	39 U	36 U	35 U	N	35 U	36 U	N	32 J	4.1 U	2.7 J	3.8 J	N
Endrin	0.0%	0	100	0	39 U	36 U	35 U	N	35 U	36 U	N	41 U	4.1 U	4.1 U	4 U	N
Endosulfan II	0.0%	0	900	0	39 U	36 U	35 U	N	35 U	36 U	N	41 U	4.1 U	4.1 U	4 U	N
4,4'-DDD	0.0%	0	2900	0	39 U	36 U	35 U	N	35 U	36 U	N	41 U	4.1 U	4.1 U	4 U	N
Endosulfan sulfate	0.0%	0	1000	0	39 U	36 U	35 U	N	35 U	36 U	N	41 U	4.1 U	4.1 U	4 U	N
4,4'-DDT	14.3%	92	2100	0	39 U	36 U	35 U	N	35 U	36 U	N	92 J	4.1 U	3.7 J	4.4 J	N
EndrinAldehyde	0.0%	0		NA	N	N	N	N	N	N	N	41 U	4.1 U	4.1 U	4 U	N
alpha-Chlordane	3.6%	3.5	540	0	200 U	180 U	180 U	N	180 U	180 U	N	21 U	2.1 U	2.1 U	2 U	N
Aroclor-1254	0.0%	0	1000	0	390 U	360 U	350 U	N	350 U	360 U	N	410 U	41 U	41 U	40 U	N
Aroclor-1260	0.0%	0	1000	0	390 U	360 U	350 U	N	350 U	360 U	N	410 U	41 U	41 U	40 U	N
Explosives (ug/kg)																
HMX	7.1%	1300		NA	1000 U	1000 U	1100 UJ	960 UJ	980 U	930 U	N	120 U	120 U	N	120 U	N
RDX	14.3%	4800		NA	120 U	120 U	83 J	120 UJ	120 U	120 U	N	120 U	120 U	N	120 U	N
1,3,5-Trinitrobenzene	35.7%	3900		NA	120 U	120 U	127 J	86 J	3900	350	N	170	120 U	N	120 U	N
1,3-Dinitrobenzene	3.6%	160		NA	120 U	120 U	140 UJ	120 UJ	160	120 U	N	120 U	120 U	N	120 U	N
Tetryl	0.0%	0		NA	400 U	400 U	450 UJ	380 UJ	390 U	370 U	N	120 U	120 U	N	120 U	N
2,4,6-Trinitrotoluene	17.9%	2100		NA	120 U	120 U	140 UJ	150 J	2100	760	N	120 U	120 U	N	120 U	N
4-amino-2,6-Dinitrotoluene	35.7%	1300		NA	120 U	120 U	710 J	370 J	1300	300	N	70 J	120 U	N	120 U	N
2-amino-4,6-Dinitrotoluene	35.7%	1800		NA	120 U	120 U	880 J	480 J	1800	320	N	110 J	120 U	N	120 U	N
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	140 UJ	120 UJ	120 U	120 U	N	120 U	120 U	N	120 U	N
2,4-Dinitrotoluene	67.9%	4000		NA	120 U	4000	100 J	78 J	670	800	N	260	120 U	N	120 U	N
Metals (mg/kg)																
Aluminum	100.0%	38900	17503.0	17	20400	14100	N	N	20700	21100	38900	26100	15000	N	13000	N
Antimony	18.5%	13.6	5	5	12.5 U R	30 R	N	N	115 R	35.7 R	8.7 R	23 R	6 U R	N	12.8 R	N
Arsenic	92.6%	20	7.5	2	6 J	6.1 J	N	N	20	11.7 R	0.86 R	8 J	6.2 J	N	5.6 J	N
Barium	88.9%	4740	300	10	190 J	270 J	N	N	4740	1400	2890	1650	206	N	191	N
Beryllium	29.6%	0.97	1	0	1.2 R	0.78 R	N	N	0.87 R	1 R	0.99 R	0.65	0.82	N	0.77	N
Cadmium	85.2%	27.9	1.8	20	3.3	4.7	N	N	6.9 J	9 J	27.9	26	0.52 J	N	0.73	N
Calcium	100.0%	138000	46825.0	3	4350 J	4810 J	N	N	14800	18000	30000	41900	9190	N	7140	N
Chromium	88.9%	1430	26.6	15	28.6	1430	N	N	32.2 R	71 R	87.8 R	109	24.4	N	20.7	N
Cobalt	100.0%	15.4	30	0	11.5	9.1	N	N	12.2	11.9	11.2	12.7	12.1	N	11.2	N
Copper	81.5%	15500	25	21	21.6 J	316 J	N	N	5300	632	998	918	66.1	N	69.2	N
Iron	100.0%	48800	32698.0	10	27000 J	32800 J	N	N	34200	35200	29700	36200	28600	N	23700	N
Lead	88.9%	22400	30	21	18	390 J	N	N	22400 J	7800 J	8710 J	5450	249 J	N	5250 J	N
Magnesium	100.0%	10900	9071.1	6	4580	3520	N	N	9910	6080	8230	9540	5200	N	4140	N
Manganese	100.0%	948	1065.8	0	705	710	N	N	662	947	584	602	557	N	513	N
Mercury	44.4%	0.42	0.1	4	0.08 J	0.04 J	N	N	0.19 J	0.42 J	0.1 J	0.06 J	0.12 J	N	0.13	N
Nickel	100.0%	64.5	41.3	8	33.1	20.1	N	N	39.9	33.9	64.5	57.7	33.1	N	28.2	N
Potassium	100.0%	3430	1529.6	18	3160	1890	N	N	2100 J	3430 J	2680 J	2530	1120	N	974	N
Selenium	55.6%	3.3	2	2	0.25 J	0.77 J	N	N	1.9 R	0.17 R	0.12 R	0.92 J	1.4 J	N	1.2 J	N
Silver	37.0%	15.3	0.6	5	2 U	0.86 U	N	N	2.1 R	1.2 R	15.3	3.7	0.35 U	N	0.57 J	N
Sodium	88.9%	618	76	23	141 J	318 J	N	N	368 J	235 J	516 J	656 R	54.2 R	N	39.9 R	N
Thallium	14.8%	0.59	0.3	4	0.5 U	0.35 U	N	N	0.35 U	0.35 U	0.39 U	0.49 U	0.57 U	N	0.46 U	N
Vanadium	96.3%	41.4	150	0	31	25.7	N	N	26.9	33.8	41.4	35.6	25.8	N	22.7	N
Zinc	100.0%	6380	89.1	26	108 J	637 J	N	N	1650	862	5300	4040	281	N	239	N
Cyanide	0.0%	0	NA	NA	0.55 U	0.59 U	N	N	0.64 U	0.64 U	0.7 U	0.72 U	0.75 U	N	0.73 U	N

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TABLE 4-10

PAD G
SUMMARY OF COMPOUNDS DETECTED
GEOPHYS. ANOMALY EXCAVATIONS, BERM EXCAVATIONS, AND PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD G 0-6" 01/08/92 PBG-1-1	PAD G 0-6" 01/08/92 PBG-1-1RE	PAD G 2-4' 01/08/92 PBG-1-3	PAD G 0-6" 01/09/92 PBG-2-1	PAD G 0-2' 01/09/92 PBG-2-2	PAD G 0-6" 01/09/92 PBG-3-1	PAD G 0-2' 01/09/92 PBG-3-2	PAD G 0-6" 01/09/92 PBG-4-1	PAD G 0-2' 01/09/92 PBG-4-2	PAD G 0-6" 01/10/92 PBG-5-1	PAD G 0-2' 01/10/92 PBG-5-2	PAD G 2-4' 01/10/92 PBG-5-3
VOCs (ug/kg)																
Methylene Chloride	3.3%	2	100	0	9 U J	8 U J	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Acetone	0.0%	0	200	0	13 U J	13 U J	12 U	11 U	13 U	12 U	12 U	13 U	12 U	12 U	N	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Chloroform	20.0%	12	300	0	12 J	9 J	6 U	6	6 U	10	6 U	6 U	6 U	6 U	N	6 U
2-Butanone	0.0%	0	300	0	13 U J	13 U J	12 U	11 U	13 U	12 U	12 U	13 U	12 U	12 U	N	12 U
1,1,1-Trichloroethane	3.3%	2	800	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Carbon Tetrachloride	0.0%	0	600	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Trichloroethene	3.3%	1	700	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Benzene	0.0%	0	60	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Tetrachloroethene	10.0%	15	1400	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Toluene	6.7%	2	1500	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Chlorobenzene	0.0%	0	1700	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Xylene (total)	0.0%	0	1200	0	6 U J	6 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N	6 U
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
2-Methylphenol	0.0%	0	100 or MDL	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
4-Methylphenol	0.0%	0	900	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
2,4-Dimethylphenol	0.0%	0	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Benzoic acid	5.3%	98	2700	0	3800 U	N	3800 U	3900 U	3600 U	3900 U	3700 U	4100 U	3800 U	3800 U	3800 U	N
Naphthalene	3.6%	88	13,000	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
2-Methylnaphthalene	3.6%	52	36,400	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
2-Chloronaphthalene	0.0%	0	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
2-Nitroaniline	0.0%	0	430 or MDL	0	3800 U	N	3800 U	3900 U	3600 U	3900 U	3700 U	4100 U	3800 U	3800 U	3800 U	N
Acenaphthylene	3.6%	42	41,000	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
2,6-Dinitrotoluene	21.4%	2000	1000	1	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	86 J	N
3-Nitroaniline	0.0%	0	500 or MDL	0	3800 U	N	3800 U	3900 U	3600 U	3900 U	3700 U	4100 U	3800 U	3800 U	3800 U	N
Acenaphthene	3.6%	270	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Dibenzofuran	3.6%	140	6200	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
2,4-Dinitrotoluene	42.9%	33000	50,000*	0	790 U	N	780 U	800 U	81 J	810 U	770 U	840 U	790 U	510 J	1300	N
Diethylphthalate	3.6%	22	7100	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Fluorene	3.6%	210	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
N-Nitrosodiphenylamine (1)	32.1%	7000	50,000*	0	790 U	N	780 U	190 J	750 U	810 U	770 U	840 U	790 U	780 U	280 J	N
Hexachlorobenzene	0.0%	0	410	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Pentachlorophenol	0.0%	0	1000 or MDL	0	3800 U	N	3800 U	3900 U	3600 U	3900 U	3700 U	4100 U	3800 U	3800 U	3800 U	N
Phenanthrene	14.3%	2600	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Anthracene	3.6%	440	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Carbazole	11.1%	1000	50,000*	0	N	N	N	N	N	N	N	N	N	N	N	N
Di-n-butylphthalate	28.6%	5800	8100	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Fluoranthene	17.9%	4400	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Pyrene	17.9%	5600	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Butylbenzylphthalate	0.0%	0	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Benzo(a)anthracene	10.7%	3900	220 or MDL	2	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Chrysene	10.7%	8900	400	1	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
bis(2-Ethylhexyl)phthalate	28.6%	420	50,000*	0	790 U	N	200 J	800 U	420 J	810 U	770 U	840 U	790 U	780 U	790 U	N
Di-n-octylphthalate	0.0%	0	50,000*	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Benzo(b)fluoranthene	17.9%	11000	1100	1	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
benzo(k)fluoranthene	10.7%	4500	1100	1	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Benzo(a)pyrene	10.7%	3700	61 or MDL	2	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Indeno(1,2,3-cd)pyrene	7.1%	2300	3200	0	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Dibenz(a,h)anthracene	3.6%	290	14 or MDL	1	790 U	N	780 U	800 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N
Benzo(g,h,i)perylene	10.7%	810	50,000*	0	790 U	N	780 U	300 U	750 U	810 U	770 U	840 U	790 U	780 U	790 U	N

TABLE 4-10

PAD G
SUMMARY OF COMPOUNDS DETECTED
GEOPHYS. ANOMALY EXCAVATIONS, BERM EXCAVATIONS, AND PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD G 0-6" 01/08/92 PBG-1-1	PAD G 0-6" 01/08/92 PBG-1-IRE	PAD G 2-4' 01/08/92 PBG-1-3	PAD G 0-6" 01/09/92 PBG-2-1	PAD G 0-2' 01/09/92 PBG-2-2	PAD G 0-6" 01/09/92 PBG-3-1	PAD G 0-2' 01/09/92 PBG-3-2	PAD G 0-6" 01/09/92 PBG-4-1	PAD G 0-2' 01/09/92 PBG-4-2	PAD G 0-6" 01/10/92 PBG-5-1	PAD G 0-2' 01/10/92 PBG-5-2	PAD G 2-4' 01/10/92 PBG-5-3
Pesticides/PCBs (ug/kg)																
beta-BHC	0.0%	0	200	0	19 U	N	19 U	19 U	18 U	20 U	19 U	20 U	19 U	19 U	19 U	N
delta-BHC	0.0%	0	300	0	19 U	N	19 U	19 U	18 U	20 U	19 U	20 U	19 U	19 U	19 U	N
gamma-BHC (Lindane)	0.0%	0	60	0	19 U	N	19 U	19 U	18 U	20 U	19 U	20 U	19 U	19 U	19 U	N
Heptachlor	0.0%	0	100	0	19 U	N	19 U	19 U	18 U	20 U	19 U	20 U	19 U	19 U	19 U	N
Aldrin	0.0%	0	41	0	19 U	N	19 U	19 U	18 U	20 U	19 U	20 U	19 U	19 U	19 U	N
Heptachlor epoxide	0.0%	0	20	0	19 U	N	19 U	19 U	18 U	20 U	19 U	20 U	19 U	19 U	19 U	N
Endosulfan I	0.0%	0	900	0	19 U	N	19 U	19 U	18 U	20 U	19 U	20 U	19 U	19 U	19 U	N
Dieldrin	0.0%	0	44	0	38 U	N	38 U	39 U	36 U	39 U	37 U	41 U	38 U	38 U	38 U	N
4,4'-DDE	14.3%	32	2100	0	38 U	N	38 U	39 U	36 U	39 U	37 U	41 U	38 U	38 U	38 U	N
Endrin	0.0%	0	100	0	38 U	N	38 U	39 U	36 U	39 U	37 U	41 U	38 U	38 U	38 U	N
Endosulfan II	0.0%	0	900	0	38 U	N	38 U	39 U	36 U	39 U	37 U	41 U	38 U	38 U	38 U	N
4,4'-DDD	0.0%	0	2900	0	38 U	N	38 U	39 U	36 U	39 U	37 U	41 U	38 U	38 U	38 U	N
Endosulfan sulfate	0.0%	0	1000	0	38 U	N	38 U	39 U	36 U	39 U	37 U	41 U	38 U	38 U	38 U	N
4,4'-DDT	14.3%	92	2100	0	33 J	N	38 U	39 U	36 U	39 U	37 U	41 U	38 U	38 U	38 U	N
EndrinAldehyde	0.0%	0		NA	N	N	N	N	N	N	N	N	N	N	N	N
alpha-Chlordane	3.6%	3.5	540	0	190 U	N	190 U	190 U	180 U	200 U	190 U	200 U	190 U	190 U	190 U	N
Aroclor-1254	0.0%	0	1000	0	380 U	N	380 U	390 U	360 U	390 U	370 U	410 U	380 U	380 U	380 U	N
Aroclor-1260	0.0%	0	1000	0	380 U	N	380 U	390 U	360 U	390 U	370 U	410 U	380 U	380 U	380 U	N
Explosives (ug/kg)																
HMX	7.1%	1300		NA	980 J	N	1000 U	1300	1000 U	1000 U	1000 U	1000 U J	1000 U	1000 U J	1000 U	N
RDX	14.3%	4800		NA	2900	N	120 U	4800	170 J	120 U	120 U	120 U J	120 U	120 U J	120 U	N
1,3,5-Trinitrobenzene	35.7%	3900		NA	250	N	210	260	120 U	120 U	120 U	120 U J	120 U	120 U J	120 U	N
1,3-Dinitrobenzene	3.6%	160		NA	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U J	120 U	120 U J	120 U	N
Tetryl	0.0%	0		NA	400 U	N	400 U	400 U	400 U	400 U	400 U	400 U J	400 U	400 U J	400 U	N
2,4,6-Trinitrotoluene	17.9%	2100		NA	390	N	290	120 U	120 U	120 U	120 U	120 U J	120 U	120 U J	120 U	N
4-amino-2,6-Dinitrotoluene	35.7%	1300		NA	600	N	270	250	120 U	120 U	120 U	120 U J	120 U	120 U J	120 U	N
2-amino-4,6-Dinitrotoluene	35.7%	1800		NA	480	N	530	150	120 U	120 U	120 U	120 U J	120 U	120 U J	120 U	N
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U J	120 U	120 U J	120 U	N
2,4-Dinitrotoluene	67.9%	4000		NA	180	N	110 J	240	300	76 J	120 U	120 U J	120 U	120 U J	120 U	N
Metals (mg/kg)																
Aluminum	100.0%	38900	17503.0	17	22500	N	18500	9370	14200	18900	18200	18000	21200	18100	19200	N
Antimony	18.5%	13.6	5	5	6 U J	N	13.6 J	6 U J	5.6 U J	5.8 U J	7.4 J	6.7 U J	6.2 U J	6 U J	5.9 U J	N
Arsenic	92.6%	20	7.5	2	4 J	N	9 J	4.7 J	3.7 J	6 J	5.7 J	5.2 J	5.1 J	4.6 J	4.4 J	N
Barium	88.9%	4740	300	10	709	N	1390	422	481	554	233	157	134	167	161	N
Beryllium	29.6%	0.97	1	0	0.64 R	N	0.99 R	0.56 R	0.82 R	0.91 R	0.94 R	0.88 R	0.86 R	0.86 R	0.91 R	N
Cadmium	85.2%	27.9	1.8	20	11.3	N	4.3	9.6	9.2	6.7	4.2	20.7	3.4	5.9	3.1	N
Calcium	100.0%	138000	46825.0	3	92100	N	6310	138000	34400	23000	6040	26200	3410	4080	5170	N
Chromium	88.9%	1430	26.6	15	37.3 J	N	30.5 J	24.4 J	26.5 J	41.4 J	29.4 J	25.6 J	28.5 J	21 J	23.9 J	N
Cobalt	100.0%	15.4	30	0	10.7	N	13.7	7.4	12.5	13.4	15.3	12.3	12.1	11	12.2	N
Copper	81.5%	15500	25	21	466	N	1650	108	75.4	688	46.3	80.8	27	28	37.8	N
Iron	100.0%	48800	32698.0	10	35800	N	37400	25700	28500	32700	30300	26500	31400	21200	22400	N
Lead	88.9%	22400	30	21	509	N	3360	203	7.7	212	65.7	639	43.3 R	88.5	50.2 R	N
Magnesium	100.0%	10900	9071.1	6	7720	N	6730	10700	9650	6720	5640	5050	4660	3680	3970	N
Manganese	100.0%	948	1065.8	0	505	N	618	359	610	799	948	693	736	750	826	N
Mercury	44.4%	0.42	0.1	4	0.15 R	N	0.15 R	0.1 R	0.2 R	0.13 R	0.13 R	0.17 R	0.19 R	0.28 R	0.29 R	N
Nickel	100.0%	64.5	41.3	8	48.2 J	N	43.2 J	34.8 J	35.5 J	39.9 J	53.5 J	30.7 J	29.1 J	19.8 J	22.4 J	N
Potassium	100.0%	3430	1529.6	18	1650 J	N	1500 J	1410 J	1730 J	2450 J	1630 J	1810 J	2160 J	1680 J	1890 J	N
Selenium	55.6%	3.3	2	2	1.2	N	0.27 J	0.28 J	0.35 J	0.3 J	0.14 U	0.19 U	0.22 U	0.38 J	0.97 U	N
Silver	37.0%	15.3	0.6	5	1.2	N	2.9	0.99 J	0.59 J	0.37 J	0.36 U	0.56 J	0.39 U	0.39 U	0.38 U	N
Sodium	88.9%	618	76	23	385 J	N	130 J	324 J	344 J	151 J	92.6 J	129 J	128 J	83.1 J	115 J	N
Thallium	14.8%	0.59	0.3	4	0.51 U	N	0.46 U	0.39 U	0.49 U	0.62 U	0.34 U	0.48 J	0.52 U	0.51 U	0.46 U	N
Vanadium	96.3%	41.4	150	0	20.2	N	25.8	16.9 R	21.6	27.8	27.2	25.4	30.3	25.9	27.1	N
Zinc	100.0%	6380	89.1	26	1600	N	615	740	297	585	172	216	93.1	127	129	N
Cyanide	0.0%	0	NA	NA	0.55 U	N	0.64 U	0.7 U	0.62 U	0.6 U	0.66 U	0.62 U	0.68 U	0.64 U	0.67 U	N

TABLE 4–10

PAD G
SUMMARY OF COMPOUNDS DETECTED
GEOPHYS. ANOMALY EXCAVATIONS, BERM EXCAVATIONS, AND PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD G 0–6" 01/13/92 PBG–6–1	PAD G 4' + 01/13/92 PBG–6–4	PAD G 4' + 01/13/13 PBG–6–4RE	PAD G 0–6" 01/13/92 PBG–7–1	PAD G 0–6" 01/13/92 PBG–7–1RE	PAD G 0–2' 01/13/92 PBG–7–2	OB 0–2 01/14/93 PBG–8–1	OB 2–4 01/14/93 PBG–8–2	OB 4–6 01/14/93 PBG–8–3	OB 0–2 01/14/93 PBG–8–6	OB 0–2 01/12/93 PBG–9–1	OB 2–4 01/12/93 PBG–9–2
VOCs (ug/kg)																
Methylene Chloride	3.3%	2	100	0	6 U	6 U J	12 U	6 U J	11 U J	6 U	12 U	N	11 U	12 U	2 J	12 U
Acetone	0.0%	0	200	0	12 U	11 U J	11 U	11 U J	11 U J	12 U	12 U	N	11 U	12 U	13 U	12 U
1,2–Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	6 U J	6 U	6 U J	6 U J	6 U	12 U	N	11 U	12 U	13 U	12 U
Chloroform	20.0%	12	300	0	6 U	6 U J	6 U	6 U J	1 J	6 U	12 U	N	11 U	12 U	13 U	12 U
2–Butanone	0.0%	0	300	0	12 U	11 U J	11 U	11 U J	11 U J	12 U	12 U	N	11 U	12 U	13 U	12 U
1,1,1–Trichloroethane	3.3%	2	800	0	6 U	6 U J	6 U	6 U J	6 U J	2 J	12 U	N	11 U	12 U	13 U	12 U
Carbon Tetrachloride	0.0%	0	600	0	6 U	6 U J	6 U	6 U J	6 U J	6 U	12 U	N	11 U	12 U	13 U	12 U
Trichloroethene	3.3%	1	700	0	6 U	6 U J	6 U	6 U J	6 U J	6 U	12 U	N	11 U	12 U	13 U	12 U
Benzene	0.0%	0	60	0	6 U	6 U J	6 U	6 U J	6 U J	6 U	12 U	N	11 U	12 U	13 U	12 U
Tetrachloroethene	10.0%	15	1400	0	6 U	6 U J	6 U	6 U J	6 U J	6 U	12 U	N	11 U	12 U	13 U	12 U
Toluene	6.7%	2	1500	0	6 U	6 U J	6 U	6 U J	6 U J	6 U	12 U	N	11 U	12 U	13 U	2 J
Chlorobenzene	0.0%	0	1700	0	6 U	6 U J	6 U	6 U J	6 U J	6 U	12 U	N	11 U	12 U	13 U	12 U
Xylene (total)	0.0%	0	1200	0	6 U	6 U J	6 U	6 U J	6 U J	6 U	12 U	N	11 U	12 U	13 U	12 U
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
2–Methylphenol	0.0%	0	100 or MDL	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
4–Methylphenol	0.0%	0	900	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
2,4–Dimethylphenol	0.0%	0	50,000*	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Benzoic acid	5.3%	98	2700	0	98 J	3700 U	N	3600 U	N	3500 U	N	N	N	N	N	N
Naphthalene	3.6%	88	13,000	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
2–Methylnaphthalene	3.6%	52	36,400	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
2–Chloronaphthalene	0.0%	0	50,000*	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
2–Nitroaniline	0.0%	0	430 or MDL	0	3800 U	3700 U	N	3600 U	N	3500 U	970 U	960 U	N	3000 U	860 U	930 U
Acenaphthylene	3.6%	42	41,000	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
2,6–Dinitrotoluene	21.4%	2000	1000	1	780 U	760 U	N	740 U	N	150 J	400 U	390 U	N	380 J	360 U	380 U
3–Nitroaniline	0.0%	0	500 or MDL	0	3800 U	3700 U	N	3600 U	N	3500 U	970 U	960 U	N	3000 U	860 U	930 U
Acenaphthene	3.6%	270	50,000*	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Dibenzofuran	3.6%	140	6200	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
2,4–Dinitrotoluene	42.9%	33000	50,000*	0	290 J	78 J	N	740 U	N	3600	170 J	390 U	N	6600 J	360 U	380 U
Diethylphthalate	3.6%	22	7100	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	22 J
Fluorene	3.6%	210	50,000*	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
N–Nitrosodiphenylamine (1)	32.1%	7000	50,000*	0	780 U	760 U	N	740 U	N	480 J	58 J	390 U	N	290 J	360 U	380 U
Hexachlorobenzene	0.0%	0	410	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	3800 U	3700 U	N	3600 U	N	3500 U	970 U	960 U	N	3000 U	860 U	930 U
Phenanthrene	14.3%	2600	50,000*	0	96 J	760 U	N	230 J	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Anthracene	3.6%	440	50,000*	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Carbazole	11.1%	1000	50,000*	0	N	N	N	N	N	N	400 U	390 U	N	1200 U	360 U	380 U
Di–n–butylphthalate	28.6%	5800	8100	0	780 U	760 U	N	320 J	N	720 U	21 J	28 J	N	5800 J	360 U	380 U
Fluoranthene	17.9%	4400	50,000*	0	120 J	760 U	N	420 J	N	720 U	400 U	390 U	N	1200 U	13 J	380 U
Pyrene	17.9%	5600	50,000*	0	110 J	760 U	N	400 J	N	720 U	400 U	390 U	N	1200 U	13 J	380 U
Butylbenzylphthalate	0.0%	0	50,000*	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Benzo(a)anthracene	10.7%	3900	220 or MDL	2	75 J	760 U	N	270 J	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Chrysene	10.7%	8900	400	1	100 J	760 U	N	330 J	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
bis(2–Ethylhexyl)phthalate	28.6%	420	50,000*	0	780 U	760 U	N	740 U	N	720 U	210 J	210 J	N	230 J	360 U	380 U
Di–n–octylphthalate	0.0%	0	50,000*	0	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Benzo(b)fluoranthene	17.9%	11000	1100	1	120 J	760 U	N	400 J	N	720 U	400 U	390 U	N	1200 U	17 J	380 U
benzo(k)fluoranthene	10.7%	4500	1100	1	75 J	760 U	N	210 J	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Benzo(a)pyrene	10.7%	3700	61 or MDL	2	780 U	760 U	N	230 J	N	720 U	400 U	390 U	N	1200 U	14 J	380 U
Indeno(1,2,3–cd)pyrene	7.1%	2300	3200	0	780 U	760 U	N	180 J	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Dibenz(a,h)anthracene	3.6%	290	14 or MDL	1	780 U	760 U	N	740 U	N	720 U	400 U	390 U	N	1200 U	360 U	380 U
Benzo(g,h,i)perylene	10.7%	810	50,000*	0	780 U	760 U	N	210 J	N	720 U	400 U	390 U	N	1200 U	120 J	380 U

TABLE 4−10

PAD G
SUMMARY OF COMPOUNDS DETECTED
GEOPHYS. ANOMALY EXCAVATIONS, BERM EXCAVATIONS, AND PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD G 0−6' 01/13/92 PBG−6−1	PAD G 4' + 01/13/92 PBG−6−4	PAD G 4' + 01/13/13 PBG−6−4RE	PAD G 0−6' 01/13/92 PBG−7−1	PAD G 0−6' 01/13/92 PBG−7−1RE	PAD G 0−2' 01/13/92 PBG−7−2	OB 0−2 01/14/93 PBG−8−1	OB 2−4 01/14/93 PBG−8−2	OB 4−6 01/14/93 PBG−8−3	OB 0−2 01/14/93 PBG−8−6	OB 0−2 01/12/93 PBG−9−1	OB 2−4 01/12/93 PBG−9−2
Pesticides/PCBs (ug/kg)																
beta−BHC	0.0%	0	200	0	19 U	19 U	N	18 U	N	17 U	2.1 U	2 U	N	2 U	1.9 U	2 U
delta−BHC	0.0%	0	300	0	19 U	19 U	N	18 U	N	17 U	2.1 U	2 U	N	2 U	1.9 U	2 U
gamma−BHC (Lindane)	0.0%	0	60	0	19 U	19 U	N	18 U	N	17 U	2.1 U	2 U	N	2 U	1.9 U	2 U
Heptachlor	0.0%	0	100	0	19 U	19 U	N	18 U	N	17 U	2.1 U	2 U	N	2 U	1.9 U	2 U
Aldrin	0.0%	0	41	0	19 U	19 U	N	18 U	N	17 U	2.1 U	2 U	N	2 U	1.9 U	2 U
Heptachlor epoxide	0.0%	0	20	0	19 U	19 U	N	18 U	N	17 U	2.1 U	2 U	N	2 U	1.9 U	2 U
Endosulfan I	0.0%	0	900	0	19 U	19 U	N	18 U	N	17 U	2.1 U	2 U	N	2 U	1.9 U	2 U
Dieldrin	0.0%	0	44	0	38 U	37 U	N	36 U	N	35 U	4.1 U	3.9 U	N	3.8 U	3.6 U	3.8 U
4,4'−DDE	14.3%	32	2100	0	38 U	37 U	N	36 U	N	35 U	4.1 U	3.9 U	N	3.8 U	1.9 J	3.8 U
Endrin	0.0%	0	100	0	38 U	37 U	N	36 U	N	35 U	4.1 U	3.9 U	N	3.8 U	3.6 U	3.8 U
Endosulfan II	0.0%	0	900	0	38 U	37 U	N	36 U	N	35 U	4.1 U	3.9 U	N	3.8 U	3.6 U	3.8 U
4,4'−DDD	0.0%	0	2900	0	38 U	37 U	N	36 U	N	35 U	4.1 U	3.9 U	N	3.8 U	3.6 U	3.8 U
Endosulfan sulfate	0.0%	0	1000	0	38 U	37 U	N	36 U	N	35 U	4.1 U	3.9 U	N	3.8 U	3.6 U	3.8 U
4,4'−DDT	14.3%	92	2100	0	38 U	37 U	N	36 U	N	35 U	4.1 U	3.9 U	N	3.8 U	3.6 U	3.8 U
EndrinAldehyde	0.0%	0		NA	N	N	N	N	N	N	4.1 U	3.9 U	N	3.8 U	3.6 U	3.8 U
alpha−Chlordane	3.6%	3.5	540	0	190 U	190 U	N	180 U	N	170 U	2.1 U	2 U	N	2 U	3.5 J	2 U
Aroclor−1254	0.0%	0	1000	0	380 U	370 U	N	360 U	N	350 U	41 U	39 U	N	38 U	36 U	38 U
Aroclor−1260	0.0%	0	1000	0	380 U	370 U	N	360 U	N	350 U	41 U	39 U	N	38 U	36 U	38 U
Explosives (ug/kg)																
HMX	7.1%	1300		NA	1000 U	1000 U	N	1000 U	N	1000 U	120 U	120 U	N	120 U	120 U	120 U
RDX	14.3%	4800		NA	120 U	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	120 U	120 U
1,3,5−Trinitrobenzene	35.7%	3900		NA	250	120 U	N	80 J	N	120 U	120 U	120 U	N	120 U	120 U	120 U
1,3−Dinitrobenzene	3.6%	160		NA	120 U	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	120 U	120 U
Tetryl	0.0%	0		NA	400 U	400 U	N	400 U	N	400 U	120 U	120 U	N	120 U	120 U	120 U
2,4,6−Trinitrotoluene	17.9%	2100		NA	120 U	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	120 U	120 U
4−amino−2,6−Dinitrotoluene	35.7%	1300		NA	590	120 U	N	120 U	N	210	120 U	120 U	N	120 U	120 U	120 U
2−amino−4,6−Dinitrotoluene	35.7%	1800		NA	360	120 U	N	120 U	N	220	120 U	120 U	N	120 U	120 U	120 U
2,6−Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	N	120 U	N	120 U	120 U	120 U	N	120 U	120 U	120 U
2,4−Dinitrotoluene	67.9%	4000		NA	1200	260	N	79 J	N	4000	3000 J	75 J	N	410 J	120 J	120 U
Metals (mg/kg)																
Aluminum	100.0%	38900	17503.0	17	13300	22800	N	24900	N	19600	18100	14600	N	14500	13300	14400
Antimony	18.5%	13.6	5	5	5.8 U J	6.2 U J	N	6.1 J	N	9.8 J	6.2 UJ	5.8 UJ	N	9.1 J	5.7 UJ	6 UJ
Arsenic	92.6%	20	7.5	2	5.3	3.9	N	6.8	N	3.7	5 J	4 J	N	4.6 J	6.2 J	4.7 J
Barium	88.9%	4740	300	10	511 R	354 R	N	1860	N	366 R	155	114	N	163	141	122
Beryllium	29.6%	0.97	1	0	0.75 R	1.1 R	N	0.88 R	N	1 R	0.97	0.69	N	0.65	0.74	0.72
Cadmium	85.2%	27.9	1.8	20	7.8 J	6.1 J	N	17 J	N	7.1 J	0.36 U	0.33 U	N	0.34 U	0.51 J	0.34 U
Calcium	100.0%	138000	46825.0	3	21200	12600	N	30200	N	25300	9770	52900	N	14100	14600	29400
Chromium	88.9%	1430	26.6	15	45.7 J	156 J	N	54.7 J	N	53.4 J	263	28.6	N	129	19.9	22.9
Cobalt	100.0%	15.4	30	0	11.4	15	N	15.1	N	15.4	13.6	11	N	12.5	10.5	11.9
Copper	81.5%	15500	25	21	439	162	N	15500	N	185	36.5 R	28.7 R	N	52.1 R	23.4 R	37.7 R
Iron	100.0%	48800	32698.0	10	23400	34600	N	48800	N	42900	28200	26200	N	24900	21600	26800
Lead	88.9%	22400	30	21	291	37.5 R	N	1700	N	332	64.3 J	23.8 J	N	145 J	24.4 J	38.1 J
Magnesium	100.0%	10900	9071.1	6	5630	7190	N	9300	N	8340	5530	10900	N	5220	4500	6080
Manganese	100.0%	948	1065.8	0	477	730	N	616	N	520	590	871	N	490	644	537
Mercury	44.4%	0.42	0.1	4	0.08 R	0.13 R	N	0.08 R	N	0.09 R	0.03 U	0.04 J	N	0.04 J	0.04 J	0.04 J
Nickel	100.0%	64.5	41.3	8	36	47.1	N	52.6	N	50.8	33.5	37.9	N	35.2	26.7	38.3
Potassium	100.0%	3430	1529.6	18	1990 J	3240 J	N	2580 J	N	2920 J	1470	1290	N	1420	1370	1260
Selenium	55.6%	3.3	2	2	2.1 J	0.18 U J	N	3.3 J	N	0.7 J	0.26 UJ	0.23 UJ	N	0.2 UJ	0.41 J	0.14 UJ
Silver	37.0%	15.3	0.6	5	0.37 U	0.39 U	N	2	N	0.36 U	0.37 U	0.34 U	N	0.35 U	0.34 U	0.35 U
Sodium	88.9%	618	76	23	441 J	380 J	N	618	N	227 J	87.6 J	124 J	N	86.5 J	74 J	114 J
Thallium	14.8%	0.59	0.3	4	0.51 J	0.59 J	N	0.33 U	N	0.53 J	0.61 U	0.54 U	N	0.47 U	0.48 U	0.32 U
Vanadium	96.3%	41.4	150	0	18.7 J	30.4 J	N	29 J	N	27.2 J	28.6	22.3	N	22.6	22.3	22.3
Zinc	100.0%	6380	89.1	26	1560	799	N	6380	N	772	116 J	95.2 J	N	197 J	77.5 J	118 J
Cyanide	0.0%	0	NA	NA	0.58 U	0.69 U	N	0.62 U	N	0.65 U	0.74 U	0.69 U	N	0.7 U	0.66 U	0.71 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi−VOCs <500 ppm, Individual Semi−VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2−Dichloroethene (trans) was used for 1,2−Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

The compound 2,4-dinitrotoluene was the most commonly detected compound, having a frequency of detection of 43 percent, and was found at a maximum concentration of 33,000 ug/kg in sample GAE-G-2 collected from a depth of 2 feet. The second most common SVOC detected in Pad G soil samples was n-nitrosodiphenylamine which was found in 32 percent of the samples with a maximum concentration of 7,000 ug/kg (also identified in sample GAE-G-2). Di-n-butylphthalate and bis(2-ethylhexyl)phthalate were the third most common SVOCs detected, being found in 28 percent of the samples. Di-n-butylphthalate was found at a maximum concentration of 5,800 ug/kg in the duplicate sample PBG-8-6, and bis(2-ethylhexyl)phthalate was reported at a maximum concentration of 420 ug/kg in sample PBG-2-2.

Of the 18 soil samples collected from pad borings on Pad G, five of these (PBG-1-1, PBG-3-1, PBG-3-2, PBG-4-1, PBG-4-2) had no SVOCs detected. In addition, eight of the pad boring samples, (PBG-1-3, PBG-2-1, PBG-2-2, PBG-5-1, PBG-8-1, PBG-8-2, PBG-9-1, and PBG-9-2, had very few SVOCs detected, all of which were reported at estimated concentrations below the sample quantitation limits. Samples PBG-6-1, PBG-7-1, and PBG-7-2 had the most SVOCs detected and also had the highest total SVOCs for soil samples collected on Pad G.

The deeper soil samples analyzed had only one semivolatile compound detected in each of them. The compound bis(2-ethylhexyl)phthalate was detected in sample PBG-1-3 (collected from the 2- to 4-foot interval) at an estimated concentration of 200 ug/kg. In the sample PBG-6-4, collected from below a depth of 4 feet, 2,6-dinitrotoluene was detected at an estimated concentration of 78 ug/kg. Finally diethylphthalate was reported in sample PBG-9-2, collected from the 2- to 4-foot interval, at an estimated concentration of 22 ug/kg. Based upon these results, it appears that the extent of semivolatile contamination at Pad G is limited primarily to the upper two feet of soils on the pad surface.

Of the five berm excavation soil samples collected at pad G, only one of these (BE-G-1) had no SVOCs detected. By comparison, the berm sample BE-G-11 contained 23 of the 28 SVOC compounds detected on Pad G, and also had the highest measured concentration of 14 of these compounds. The highest individual SVOC detected in this sample was 11,000 ug/kg of benzo(b)fluoranthene. Other significantly elevated SVOCs present in this sample were chrysene (8,900 ug/kg), benzo(a)anthracene (3,900 ug/kg), benzo(k)fluoranthene (4,500 ug/kg), and benzo(a)pyrene (3,700 ug/kg). All of these SVOCs were reported in this sample at concentrations above the associated TAGM values. The two berm excavation samples BE-

G-2 and BE-G-3 had relatively few SVOCs detected, but did have elevated concentrations (of 2,4-dinitrotoluene) of 2,800 ug/kg and 2,500 ug/kg, respectively.

4.3.7.3 Pesticides/PCBs

Three pesticide compounds were detected in the low parts per billion concentration range in the soil samples collected at Pad G. Of the 28 soil samples collected at pad G, only five had pesticide compounds present. None of the identified compounds were detected at concentrations that exceed the TAGM limits. The three compounds 4,4'-DDE, 4,4'-DDT, and alpha-chlordane were reported at frequencies of detection of 14, 14, and 4 percent, respectively. The maximum concentration of 4,4'-DDE was found in sample BE-G-11, an estimated concentration of 32 ug/kg which is well below the TAGM value of 2,100 ug/kg. The maximum concentration of 4,4'-DDT was also found in sample BE-G-11, an estimated concentration of 92 ug/kg which is also well below the TAGM value of 2,100 ug/kg. The maximum concentration of alpha-chlordane was found in the pad boring sample PBG-9-1, an estimated concentration of 3. 5 ug/kg, well below the TAGM value of 540 ug/kg.

4.3.7.4 Explosives

Figure 4-17 summarizes the explosives data for Pad G. A wide variety of explosive compounds were identified within the soil samples collected at Pad G. Of the ten method 8300 analytes only tetryl and 2,6-dinitrotoluene were not detected. The explosive compound 2,4-dinitrotoluene was detected in over half of the 28 samples analyzed. The compounds 1,3,5-trinitrobenzene, 4-amino-2,6-dinitrotoluene, and 2-amino-4,6-dinitrotoluene were detected in approximately one-third of the soil samples collected at Pad G. Among the soil samples collected on the burning pad surface, six soil samples had no explosives detected. These non detect samples were PBG-3-2, PBG-4-1, PBG-4-2, PBG-5-1, PBG-5-2, and PBG-9-2. For samples where explosives were found, the total explosive concentrations ranged from a low of 75 ug/kg in sample PBG-8-2, to a high of 7,000 ug/kg in sample PBG-2-1.

Other pad boring samples that had significantly elevated total explosives included samples PBG-1-1 (5,780 ug/kg), PBG-1-3 (1,410 ug/kg), PBG-6-1 (2,400 ug/kg), PBG-7-2 (4,430 ug/kg), and PBG-8-1 (3,000 ug/kg). The maximum concentrations of the explosive compounds HMX and RDX were found in pad boring sample PBG-2-1 where 1,300 ug/kg of HMX and 4,800 ug/kg of RDX were detected.

BERM EXCAVATIONS

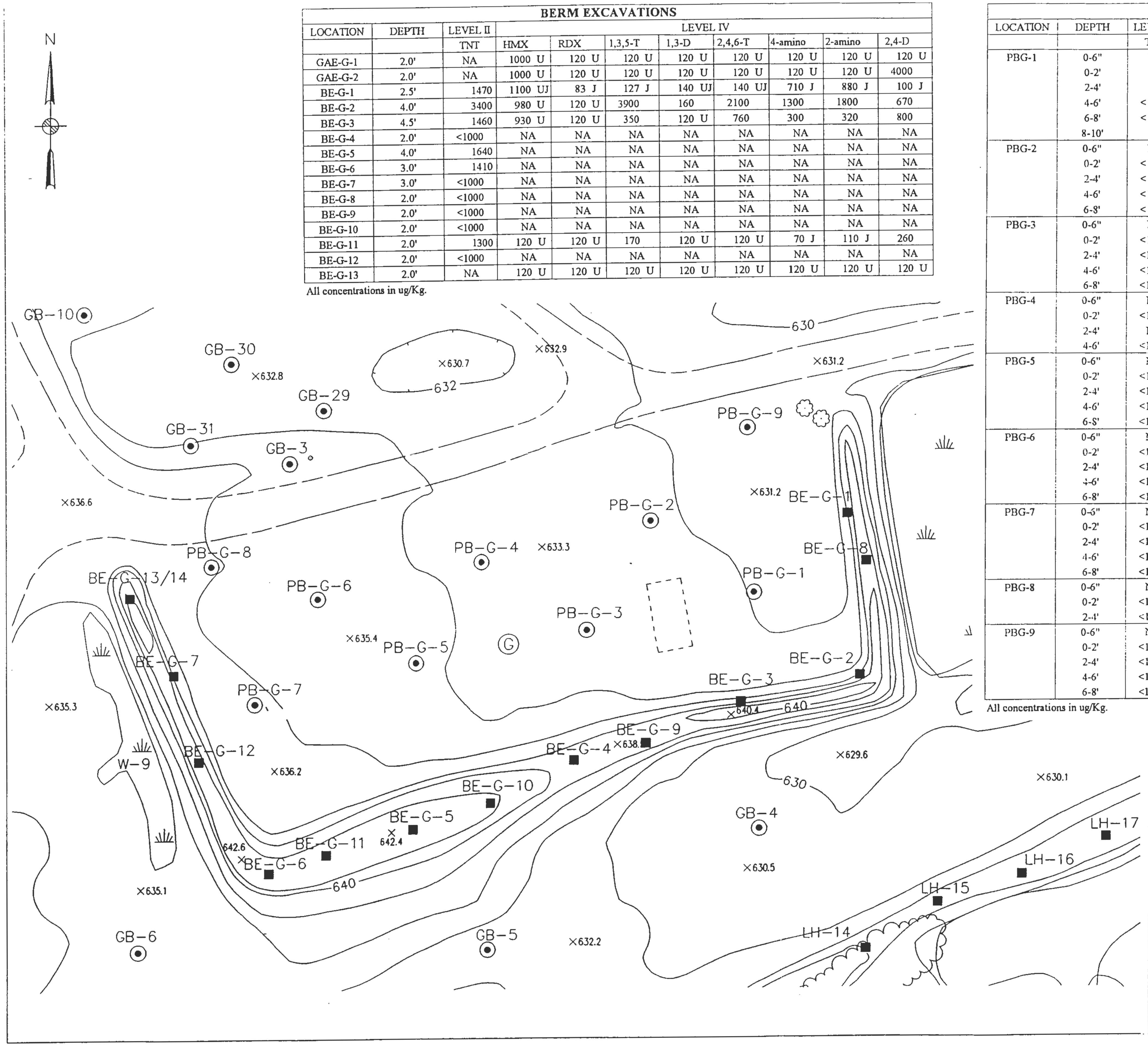
LOCATION	DEPTH	LEVEL II	LEVEL IV							
		TNT	HMX	RDX	1,3,5-T	1,3-D	2,4,6-T	4-amino	2-amino	2,4-D
GAE-G-1	2.0'	NA	1000 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
GAE-G-2	2.0'	NA	1000 U	120 U	120 U	120 U	120 U	120 U	120 U	4000
BE-G-1	2.5'	1470	1100 UJ	83 J	127 J	140 UJ	140 UJ	710 J	880 J	100 J
BE-G-2	4.0'	3400	980 U	120 U	3900	160	2100	1300	1800	670
BE-G-3	4.5'	1460	930 U	120 U	350	120 U	760	300	320	800
BE-G-4	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
BE-G-5	4.0'	1640	NA	NA	NA	NA	NA	NA	NA	NA
BE-G-6	3.0'	1410	NA	NA	NA	NA	NA	NA	NA	NA
BE-G-7	3.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
BE-G-8	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
BE-G-9	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
BE-G-10	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
BE-G-11	2.0'	1300	120 U	120 U	170	120 U	120 U	70 J	110 J	260
BE-G-12	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
BE-G-13	2.0'	NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U

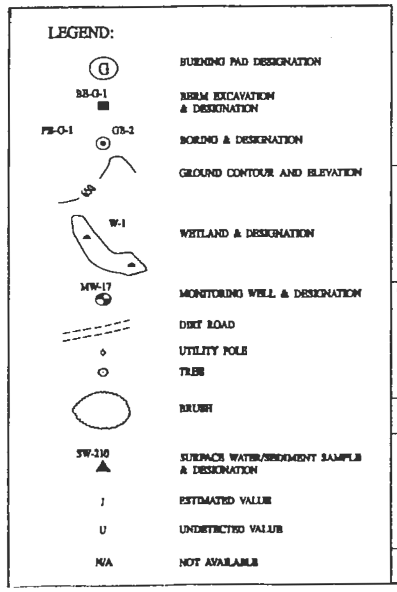
All concentrations in ug/Kg.

PAD BORINGS

LOCATION	DEPTH	LEVEL II	LEVEL IV							
		TNT	HMX	RDX	1,3,5-T	1,3-D	2,4,6-T	4-amino	2-amino	2,4-D
PBG-1	0-6"	NA	980 J	2900	250	120 U	390	600	480	180
	0-2'	2600	NA	NA	NA	NA	NA	NA	NA	NA
	2-4'	24000	1000 U	120 U	210	120 U	290	270	530	110 J
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	8-10'	1110	NA	NA	NA	NA	NA	NA	NA	NA
PBG-2	0-6"	NA	1300	4800	260	120 U	120 U	250	150	240
	0-2'	<1000	1000 U	170 J	120 U	120 U	120 U	120 U	120 U	300
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBG-3	0-6"	NA	1000 U	120 U	120 U	120 U	120 U	120 U	120 U	76 J
	0-2'	<1000	1000 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBG-4	0-6"	NA	1000 UJ	120 UJ	120 UJ	120 UJ	120 UJ	120 UJ	120 UJ	120 UJ
	0-2'	<1000	1000 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
	2-4'	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBG-5	0-6"	NA	1000 UJ	120 UJ	120 UJ	120 UJ	120 UJ	120 UJ	120 UJ	120 UJ
	0-2'	<1000	1000 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBG-6	0-6"	NA	1000 U	120 U	250	120 U	120 U	590	360	1200
	0-2'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	1000 U	120 U	120 U	120 U	120 U	120 U	120 U	260
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBG-7	0-6"	NA	1000 U	120 U	80 J	120 U	120 U	120 U	120 U	79 J
	0-2'	<1000	1000 U	120 U	120 U	120 U	120 U	210	220	4000
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBG-8	0-6"	NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	3000 J
	0-2'	<1000	120 U	120 U	120 U	120 U	120 U	120 U	120 U	75 J
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBG-9	0-6"	NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 J
	0-2'	<1000	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA

All concentrations in ug/Kg.





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ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING | NO 720446-01000

FIGURE 4-17
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD G

SCALE 1" = 60'

From the Pad G soil boring samples, four samples were collected from below the two foot depth. Sample PBG-1-3 (collected from the interval 2 to 4 feet) had total explosives of 1,410 ug/kg, PBG-6-4 (collected from the interval 4 to 6 feet) had total explosives of 260 ug/kg, PBG-8-2 (collected from the interval 2 to 4 feet) had total explosives of 75 ug/kg, and finally, PBG-9-2 (collected from the interval 2 to 4 feet) had no explosives detected.

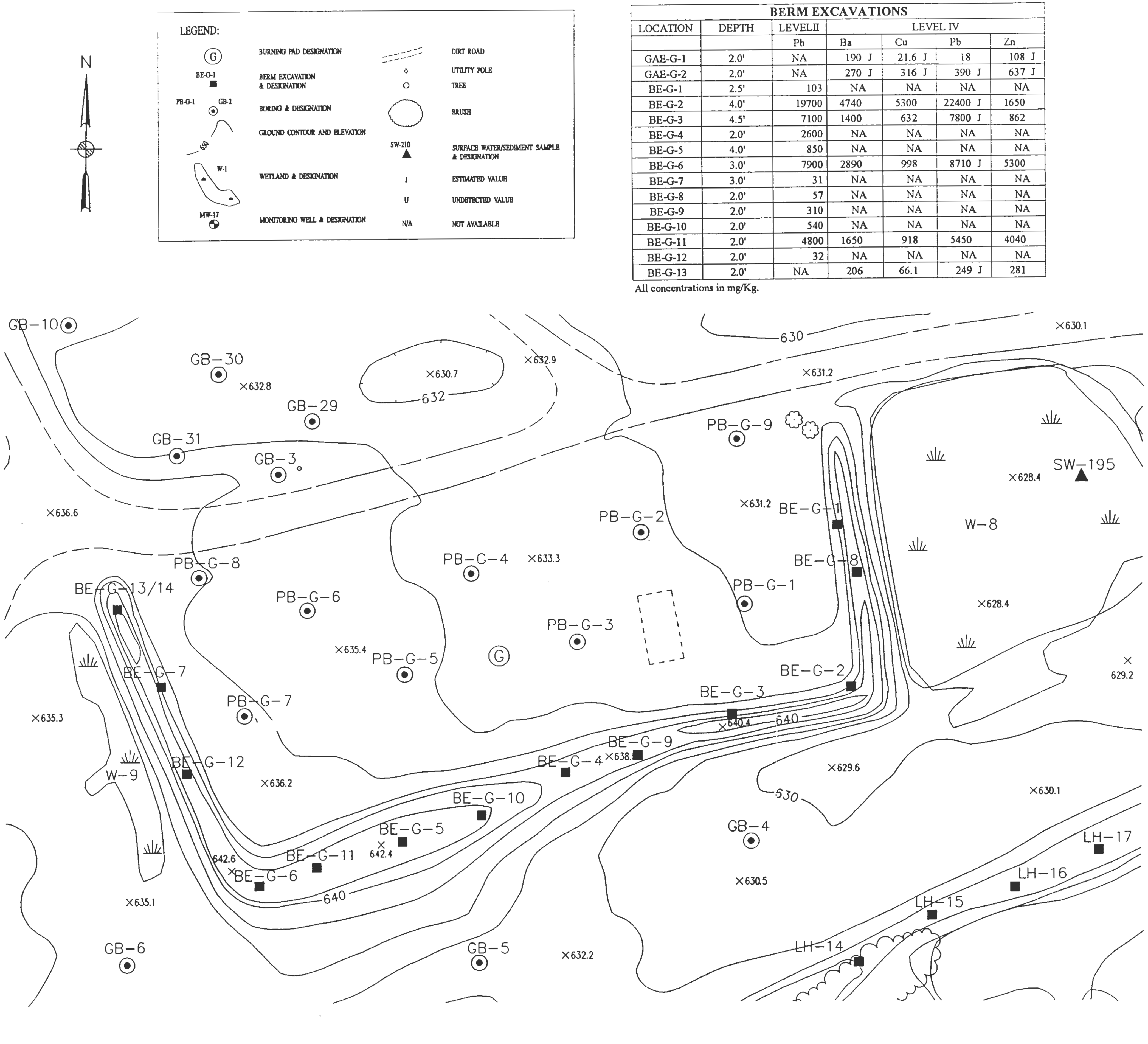
By comparison, the Level II screening results for the deeper soil samples collected on Pad G had no explosives detected above 1 ug/kg. The single exception to this is the sample collected from the 8- to 10-foot interval in pad boring PB-G-1 where the Level II screening results indicated an explosives concentration of 1,110 ug/kg which is just above the method detection limit of 1,000 ug/kg. Along with the Level IV analyses of the deeper Pad G soil samples, these data suggest that the explosive contamination on Pad G is primarily limited to the upper two feet of soils.

The soil samples collected from the berm excavations also show a wide variety of explosive compounds present. Total explosives range from non-detect in sample BE-G-13 to a high of 9,930 ug/kg for the sample BE-G-2. The maximum individual concentration of an explosive compound was found in sample BE-G-2 where 3,900 ug/kg of 1,3,5-trinitrotoluene was detected. This sample also had the highest Pad G measured concentrations for the compounds 1,3-dinitrobenzene, 2,4,6-trinitrotoluene, 4-amino-2,6-dinitrotoluene, and 2-amino-4,6-dinitrotoluene. Other berm excavation samples with significantly elevated explosive concentrations included BE-G-1 (1900 ug/kg), and BE-G-3 (2,530 ug/kg).

4.3.7.5 Metals

Figure 4-18 summarizes the metals data for Pad G. Barium was detected in all of the soil samples analyzed at Pad G and was found in 10 of the 24 samples at concentrations above the TAGM value of 300 mg/kg. Copper was detected in all of the soil samples analyzed at Pad G and was found in 21 of the 22 samples at concentrations above the TAGM value of 25 mg/kg. Lead was also detected in all of the soil samples analyzed at Pad G and was found in 21 of the 24 samples analyzed at concentrations above the TAGM value of 30 mg/kg. Zinc was detected in all of the soil samples analyzed at pad G and was found in 26 of the 27 samples analyzed at concentrations above the TAGM value of 89.1 mg/kg.

Significantly elevated barium concentrations were identified in numerous surface soil samples collected on Pad G. The surface samples collected at the pad boring locations PB-G-1 (709



BERM EXCAVATIONS						
LOCATION	DEPTH	LEVELII	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
GAE-G-1	2.0'	NA	190 J	21.6 J	18	108 J
GAE-G-2	2.0'	NA	270 J	316 J	390 J	637 J
BE-G-1	2.5'	103	NA	NA	NA	NA
BE-G-2	4.0'	19700	4740	5300	22400 J	1650
BE-G-3	4.5'	7100	1400	632	7800 J	862
BE-G-4	2.0'	2600	NA	NA	NA	NA
BE-G-5	4.0'	850	NA	NA	NA	NA
BE-G-6	3.0'	7900	2890	998	8710 J	5300
BE-G-7	3.0'	31	NA	NA	NA	NA
BE-G-8	2.0'	57	NA	NA	NA	NA
BE-G-9	2.0'	310	NA	NA	NA	NA
BE-G-10	2.0'	540	NA	NA	NA	NA
BE-G-11	2.0'	4800	1650	918	5450	4040
BE-G-12	2.0'	32	NA	NA	NA	NA
BE-G-13	2.0'	NA	206	66.1	249 J	281

All concentrations in mg/Kg.

PAD BORINGS						
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
PBG-1	0-6"	NA	709	466	509	1600
	0-2'	14100	NA	NA	NA	NA
	2-4'	2100	1390	1650	3360	615
	4-6'	590	NA	NA	NA	NA
	6-8'	135	NA	NA	NA	NA
	8-10'	23	NA	NA	NA	NA
PBG-2	0-6"	NA	422	108	203	740
	0-2'	1250	481	75.4	7.7	297
	2-4'	18	NA	NA	NA	NA
	4-6'	64	NA	NA	NA	NA
	6-8'	14.8	NA	NA	NA	NA
PBG-3	0-6"	NA	554	688	212	585
	0-2'	350	233	46.3	65.7	172
	2-4'	<10	NA	NA	NA	NA
	4-6'	21	NA	NA	NA	NA
	6-8'	<10	NA	NA	NA	NA
PBG-4	0-6"	NA	157	80.8	639	216
	0-2'	15.9	134	27	43.3 R	93.1
	2-4'	NA	NA	NA	NA	NA
	4-6'	11.7	NA	NA	NA	NA
PBG-5	0-6"	NA	167	28	88.5	127
	0-2'	31	161	37.8	50.2 R	129
	2-4'	11	NA	NA	NA	NA
	4-6'	17.2	NA	NA	NA	NA
	6-8'	21	NA	NA	NA	NA
PBG-6	0-6"	NA	511 R	439	291	1560
	0-2'	44	NA	NA	NA	NA
	2-4'	51	NA	NA	NA	NA
	4-6'	900	354 R	162	37.5 R	799
	6-8'	21	NA	NA	NA	NA
PBG-7	0-6"	NA	1860	15500	1700	6380
	0-2'	280	366 R	185	332	772
	2-4'	15.7	NA	NA	NA	NA
	4-6'	191	NA	NA	NA	NA
	6-8'	22	NA	NA	NA	NA
PBG-8	0-6"	NA	155	36.5 R	64.3 J	116 J
	0-2'	24	114	28.7 R	23.2 J	95.2 J
	2-4'	<10	NA	NA	NA	NA
PBG-9	0-6"	NA	141	23.4 R	24.4 J	77.5 J
	0-2'	27	122	37.7 R	38.1 J	118 J
	2-4'	17.3	NA	NA	NA	NA
	4-6'	8.8	NA	NA	NA	NA
	6-8'	11.4	NA	NA	NA	NA

All concentrations in mg/Kg.

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ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO 720446-01000

FIGURE 4-18
DISTRIBUTION OF METALS
OPEN BURNING PAD G

SCALE 1" = 60'

mg/kg), PB-G-2 (422 mg/kg), PB-G-3 (554 mg/kg), and PB-G-7 (1,860 mg/kg) had barium concentration above the 300 mg/kg TAGM value. The surface soil samples collected at the remaining Pad G boring locations all had barium concentrations below the 300 mg/kg TAGM value. A total of four soil samples were collected on Pad G from a depth of below 2 feet and analyzed using Level IV methods. Of these four, sample PBG-1-3 (collected from a depth of 2 to 4 feet) had a barium concentration of 1,390 mg/kg, while the remaining three deep soil samples, collected at pad boring locations PB-G-6, PB-G-8, and PB-G-9, all had barium concentrations below 300 mg/kg.

For the berm excavation soil samples, three of the six samples had barium detected at concentrations above the TAGM value of 300 mg/kg. The highest concentration of barium (4,740 mg/kg) was detected in the soil sample collected from the berm excavation BE-G-2. Barium concentrations measured at BE-G-3 (1,400 mg/kg) and BE-G-6 (2,890 mg/kg) were also above the 300 mg/kg limit.

The highest concentration of copper (15,500 mg/kg) was detected in the soil sample PBG-7-1, collected from pad boring PB-G-7. Significantly elevated copper concentrations were identified in numerous surface soil samples collected on Pad G. Only the surface soil sample PBG-5-1 (28 mg/kg) had a reported concentration below the 25 mg/kg TAGM value. A total of four soil samples were collected on Pad G from a depth of below 2 feet and analyzed using Level IV methods. Of these four samples, two were rejected for copper values during the data validation process. Of the remaining two, sample PBG-1-3 (collected from a depth of 2 to 4 feet) had a copper concentration of 1,650 mg/kg, while the remaining deep soil sample PBG-6-4, collected at Pad boring locations PB-G-6, had a copper concentration of 162 mg/kg.

For the berm excavation samples, all five samples had copper concentrations above the TAGM value of 25 mg/kg. The maximum copper concentration detected in berm excavations samples was collected from BE-G-2 (5,300 mg/kg). Other elevated concentrations of copper were identified in the samples BE-G-6 (998 mg/kg), BE-G-11 (918 mg/kg), and BE-G-3 (632 mg/kg). The berm excavation sample BE-G-13 had a copper concentration of 66. 1 mg/kg which is only slightly above the TAGM value of 25 mg/kg.

Significantly elevated lead concentrations were identified in numerous surface soil samples collected on Pad G. Only the surface soil samples PBG-2-2 (7.7 mg/kg) and PBG-9-1 (24.4 mg/kg) had lead concentrations below the TAGM value of 30 mg/kg. While the bulk of the surface soil samples collected on Pad G exceed the TAGM value for lead concentrations, the data appear to be bimodal in distribution. The highest concentration in pad boring surface soils was 1,700 mg/kg identified in sample PBG-7-1. Other elevated lead concentrations were identified in samples PBG-4-1 (639 mg/kg), PBG-1-1 (509 mg/kg), and PBG-6-1 (291 mg/kg).

A total of four soil samples were collected on Pad G from a depth of below 2 feet and analyzed using Level IV methods. One of these samples, one was rejected during the data validation process. Of the remaining three samples, sample PBG-1-3 (collected from a depth of 2 to 4 feet) had a lead concentration of 3,360 mg/kg, while the two remaining deep soil samples, collected at pad boring locations PB-G-8, and PB-G-9, both had lead concentrations below 40 mg/kg.

The maximum reported lead concentration for all of the Pad G soil samples was in the berm excavation sample BE-G-2 where 22,400 mg/kg of lead was detected. Five of the six berm samples collected at Pad G had lead concentrations that exceeded 5,000 mg/kg. The only sample that did not was collected at location BE-G-13 where a lead concentration of 249 mg/kg was determined.

The highest concentration of zinc (6,380 mg/kg) was detected in the surface soil sample collected from boring PB-G-7. Significantly elevated zinc concentrations were identified in numerous surface soil samples collected on Pad G. Only the surface soil sample PBG-9-1 (77.5 mg/kg) had a reported concentration below the 89.1 mg/kg TAGM value. The remainder of the surface soil samples collected throughout Pad G all had concentrations that exceeded this TAGM limit. Other significantly elevated zinc concentrations were identified in the surface soil samples PGB-1-1 (1,600 mg/kg) and PBG-6-1 (1,560 mg/kg).

A total of four soil samples were collected on Pad G from a depth below 2 feet and analyzed using Level IV methods. Of these four, sample PBG-1-1 (615 mg/kg), and PBG-6-4 (799 mg/kg) had zinc concentrations above the TAGM value of 89.1 mg/kg. The other samples, PBG-8-2 (95. 2 mg/kg) and PBG-9-2 (118 mg/kg), had zinc concentrations just above the TAGM value of 89.1 mg/kg.

For the berm excavation samples, all five samples had zinc concentrations above the TAGM value of 89.1 mg/kg. The maximum zinc concentration in berm excavations was collected from sample BE-G-6 where 5,300 mg/kg of zinc was detected. Other elevated concentrations of copper were identified in the samples BE-G-2 (1,650 mg/kg) , BE-G-11 (4,040 mg/kg), and BE-G-3 (862 mg/kg).

4.3.8 Burning Pad H

A total of six pad borings and six berm excavations were installed at Pad H. During Phase I, the soil borings PB-H-1 and PB-H-2 were installed, and the berm excavations BE-H-1 through BE-H-4 were sampled. In Phase II, four additional soil samples were collected at borings PB-H-3 through PB-H-6 from the 0 to 2 foot depth. The berm excavations BE-H-5 and BE-H-6 were also sampled in Phase II.

The surface soil and shallow boring samples from each boring went directly for Level IV analysis. Six subsurface soil samples were collected from the borings PB-H-1 and PB-H-2 and sent for Level II screening. In addition, six soil samples were collected from the berm excavations BE-H-1 through BE-H-6 and submitted for Level II screening.

Six subsurface soil samples collected from the two borings PB-H-1 and PB-H-2, and all of the six berm excavation samples collected at Pad H underwent Level II screening for lead, TNT, and VOCs. From these 12 samples, five went for subsequent Level IV analyses, these being three of the berm samples (BE-H-1, BE-H-3, and BE-H-5) and one additional sample each from borings PB-H-1 and PB-H-2.

A summary of the analytical results for the Level IV analyses is presented in Table 4-11. The following sections review the compounds detected within the soil samples collected on Burning Pad H.

4.3.8.1 Volatile Organic Compounds

Six volatile organic compounds were detected in the soil samples collected at Pad H. No volatile organic compounds were reported at concentrations above the TAGM values. The compound tetrachloroethene was the most frequently detected compound being found in 33 percent of the soil samples. The highest concentration was found in the sample BE-H-2 where 110 ug/kg was reported for tetrachloroethane. Toluene was also detected in 26 percent of the samples with the highest estimated concentration of 3 ug/kg reported in three separate samples.

TABLE 4-11

PAD H
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD H 4.0' 12/12/91 BE-H-2-91	PAD H 4.0' 12/10/91 BE-H-3-91	OB 2.0 feet 12/04/92 BE-H-5	PAD-H 0-6" 12/12/91 PBH-1-1	PAD-H 0-2' 12/12/91 PBH-1-2	PAD H 0-2' 12/12/91 PBH-1-2RE	OB 0-2' 01/14/93 PBH-2-1	OB 0-2' 01/14/93 PBH2-1RE	OB 2-4' 01/14/93 PBH-2-2	OB 0-2' 03/12/93 PBH-3-1	OB 0-2' 03/12/93 PBH3-1RE	OB 0-2' 03/12/93 PBH-4-1	OB 0-2' 03/12/93 PBH4-1RE	OB 0-2' 03/12/93 PBH-5-1	OB 0-2' 03/12/93 PBH-6-1
VOCs (ug/kg)																			
Methylene Chloride	0.0%	0	100	0	6 U	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 U	11 U	11 U	10 U	10 U	11 U	11 U
Acetone	6.7%	100	200	0	11 U	12 U	11 U	11 U	10 U J	18 U J	11 U	11 U	100	11 U	11 U	10 U	10 U	11 U	11 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 U	11 U	11 U	10 U	10 U	11 U	11 U
Chloroform	6.7%	2	300	0	2 J	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 U	11 U	11 U	10 U	10 U	11 U	11 U
2-Butanone	6.7%	22	300	0	11 U	12 U	11 U	11 U	10 U J	10 U J	11 U	11 U	22	11 U	11 U	10 U	10 U	11 U	11 U
1,1,1-Trichloroethane	0.0%	0	800	0	6 U	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 U	11 U	11 U	10 U	10 U	11 U	11 U
Carbon Tetrachloride	0.0%	0	600	0	6 U	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 U	11 U	11 U	10 U	10 U	11 U	11 U
Trichloroethene	0.0%	0	700	0	6 U	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 U	11 U	11 U	10 U	10 U	11 U	11 U
Benzene	0.0%	0	60	0	6 U	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 U	11 U	11 U	10 U	10 U	11 U	11 U
Tetrachloroethene	33.3%	110	1400	0	110	6 U	11 U	5 U	5 U J	2 J	11 U	11 U	11 U	11 U	11 U	4 J	4 J	2 J	11 U
Toluene	26.7%	3	1500	0	6 U	6 U	11 U	5 U	3 J	1 J	11 U	11 U	11 U	11 U	11 U	3 J	3 J	11 U	11 U
Chlorobenzene	0.0%	0	1700	0	6 U	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 U	11 U	11 U	10 U	10 U	11 U	11 U
Xylene (total)	6.7%	11	1200	0	6 U	6 U	11 U	5 U	5 U J	5 U J	11 U	11 U	11 J	11 U	11 U	10 U	10 U	11 U	11 U
Semivolatiles (ug/kg)																			
Phenol	0.0%	0	30 or MDL	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
2-Methylphenol	0.0%	0	100 or MDL	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
4-Methylphenol	0.0%	0	900	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Benzoic acid	0.0%	0	2700	0	3500 U	3600 U	N	3400 U	3300 U	N	N	N	N	N	N	N	N	N	N
Naphthalene	18.2%	570	13,000	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	570 J	360 U	N	250 J	N	350 U	1800 U
2-Methylnaphthalene	27.3%	4700	36,400	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	4700	360 U	N	1100	N	350 U	280 J
2-Chloronaphthalene	0.0%	0	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
2-Nitroaniline	9.1%	20	430 or MDL	0	3500 U	3600 U	960 U	3400 U	3300 U	N	850 U	N	1800 U	860 U	N	850 U	N	20 J	4300 U
Acenaphthylene	0.0%	0	41,000	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
2,6-Dinitrotoluene	81.8%	760	1000	0	200 J	760	43 J	510 J	680 U	N	220 J	N	140 J	110 J	N	83 J	N	170 J	1800 U
3-Nitroaniline	0.0%	0	500 or MDL	0	3500 U	3600 U	960 U	3400 U	3300 U	N	850 U	N	1800 U	860 U	N	850 U	N	850 U	4300 U
Acenaphthene	27.3%	480	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	480 J	360 U	N	120 J	N	350 U	100 J
Dibenzofuran	9.1%	62	6200	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	62 J	N	350 U	1800 U
2,4-Dinitrotoluene	90.9%	12000	50,000*	0	3600	12000 J	520 J	2200	760	N	590	N	730 U	400	N	610	N	660	1600 J
Diethylphthalate	18.2%	18	7100	0	730 U	750 U	14 J	710 U	680 U	N	350 U	N	730 U	18 J	N	350 U	N	350 U	1800 U
Fluorene	27.3%	710	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	710 J	360 U	N	160 J	N	350 U	170 J
N-Nitrosodiphenylamine	27.3%	1500	50,000*	0	120 J	1500	400 U	71 J	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Hexachlorobenzene	0.0%	0	410	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	3500 U	3600 U	960 U	3400 U	3300 U	N	850 U	N	1800 U	860 U	N	850 U	N	850 U	4300 U
Phenanthrene	27.3%	1700	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	1700	360 U	N	260 J	N	350 U	330 J
Anthracene	18.2%	69	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	53 J	N	350 U	69 J
Carbazole	0.0%	0	50,000*	0	N	N	400 U	N	N	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Di-n-butylphthalate	90.9%	1500	8100	0	540 J	430 J	400 U	1500	110 J	N	500	N	98 J	160 J	N	140 J	N	250 J	140 J
Fluoranthene	0.0%	0	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Pyrene	18.2%	69	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	30 J	N	350 U	69 J
Butylbenzylphthalate	0.0%	0	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Benzo(a)anthracene	0.0%	0	220 or MDL	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Chrysene	0.0%	0	400	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
bis(2-Ethylhexyl)phthalate	18.2%	400	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	190 J	N	400 J	360 U	N	350 U	N	350 U	1800 U
Di-n-octylphthalate	0.0%	0	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Benzo(b)fluoranthene	0.0%	0	1100	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
benzo(k)fluoranthene	0.0%	0	1100	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Benzo(a)pyrene	0.0%	0	61 or MDL	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	730 U	750 U	400 U	710 U	680 U	N	350 U	N	730 U	360 U	N	350 U	N	350 U	1800 U

TABLE 4-11

PAD H
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS & PAD BORINGS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD H 4.0' 12/12/91 BE-H-2-91	PAD H 4.0' 12/10/91 BE-H-3-91	OB 2.0 feet 12/04/92 BE-H-5	PAD-H 0-6' 12/12/91 PBH-1-1	PAD-H 0-2' 12/12/91 PBH-1-2	PAD H 0-2' 12/12/91 PBH-1-2RE	OB 0-2' 01/14/93 PBH-2-1	OB 0-2' 01/14/93 PBH2-1RE	OB 2-4' 01/14/93 PBH-2-2	OB 0-2' 03/12/93 PBH-3-1	OB 0-2' 03/12/93 PBH3-1RE	OB 0-2' 03/12/93 PBH-4-1	OB 0-2' 03/12/93 PBH4-1RE	OB 0-2' 03/12/93 PBH-5-1	OB 0-2' 03/12/93 PBH-6-1
Pesticides/PCBs (ug/kg)																			
beta-BHC	9.1%	2.1	200	0	18 U	18 U	2 U	17 U	17 U	N	1.8 U	N	1.9 U	1.8 U	N	3.6 U	N	2.1 J	3.6 U
delta-BHC	0.0%	0	300	0	18 U	18 U	2 U	17 U	17 U	N	1.8 U	N	1.9 U	1.8 U	N	3.6 U	N	1.8 U	3.6 U
gamma-BHC (Lindane)	0.0%	0	60	0	18 U	18 U	2 U	17 U	17 U	N	1.8 U	N	1.9 U	1.8 U	N	3.6 U	N	1.8 U	3.6 U
Heptachlor	0.0%	0	100	0	18 U	18 U	2 U	17 U	17 U	N	1.8 U	N	1.9 U	1.8 U	N	3.6 U	N	1.8 U	3.6 U
Aldrin	0.0%	0	41	0	18 U	18 U	2 U	17 U	17 U	N	1.8 U	N	1.9 U	1.8 U	N	3.6 U	N	1.8 U	3.6 U
Heptachlor epoxide	0.0%	0	20	0	18 U	18 U	2 U	17 U	17 U	N	1.8 U	N	1.9 U	1.8 U	N	3.6 U	N	1.8 U	3.6 U
Endosulfan I	0.0%	0	900	0	18 U	18 U	2 U	17 U	17 U	N	1.8 U	N	1.9 U	1.8 U	N	3.6 U	N	1.8 U	3.6 U
Dieldrin	0.0%	0	44	0	35 U	36 U	3.9 U	34 U	33 U	N	3.5 U	N	3.7 U	3.5 U	N	6.9 U	N	3.5 U	7.1 U
4,4'-DDE	18.2%	4.5	2100	0	35 U	36 U	3.2 J	34 U	33 U	N	3.5 U	N	3.7 U	3.5 U	N	6.9 U	N	3.5 U	4.5 J
Endrin	0.0%	0	100	0	35 U	36 U	3.9 U	34 U	33 U	N	3.5 U	N	3.7 U	3.5 U	N	6.9 U	N	3.5 U	7.1 U
Endosulfan II	0.0%	0	900	0	35 U	36 U	3.9 U	34 U	33 U	N	3.5 U	N	3.7 U	3.5 U	N	6.9 U	N	3.5 U	7.1 U
4,4'-DDD	0.0%	0	2900	0	35 U	36 U	3.9 U	34 U	33 U	N	3.5 U	N	3.7 U	3.5 U	N	6.9 U	N	3.5 U	7.1 U
Endosulfan sulfate	0.0%	0	1000	0	35 U	36 U	3.9 U	34 U	33 U	N	3.5 U	N	3.7 U	3.5 U	N	6.9 U	N	3.5 U	7.1 U
4,4'-DDT	18.2%	3.6	2100	0	35 U	36 U	3.6 J	34 U	33 U	N	3.5 U	N	3.7 U	3.5 U	N	6.9 U	N	3.5 U	3.6 J
Endrin aldehyde	0.0%	0		NA	N	N	3.9 U	N	N	N	3.5 U	N	3.7 U	3.5 U	N	6.9 U	N	3.5 U	7.1 U
alpha-Chlordane	0.0%	0	540	0	180 U	180 U	2 U	170 U	170 U	N	1.8 U	N	1.9 U	1.8 U	N	3.6 U	N	1.8 U	3.6 U
Aroclor-1254	0.0%	0	1000	0	350 U	360 U	39 U	340 U	330 U	N	35 U	N	37 U	35 U	N	69 U	N	35 U	71 U
Aroclor-1260	0.0%	0	1000	0	350 U	360 U	39 U	340 U	330 U	N	35 U	N	37 U	35 U	N	69 U	N	35 U	71 U
Explosives (ug/kg)																			
HMX	0.0%	0		NA	1000 U	1000 U	120 U	1000 U	1000 U	N	120 U	N	120 U	120 U	N	120 U	N	120 U	120 U
RDX	18.2%	71		NA	120 U	120 U	120 U	120 U	120 U	N	120 U	N	120 U	120 U	N	120 U	N	71 J	71 J
1,3,5-Trinitrobenzene	72.7%	350		NA	330	320	80 J	200	350	N	120 U	N	120 U	120 U	N	130 J	N	79 J	200 J
1,3-Dinitrobenzene	54.5%	440		NA	120 U	120 U	120 U	440	150	N	230	N	120 U	160	N	120	N	110 J	120 U
Tetryl	27.3%	270		NA	400 U	400 U	120 U	400 U	400 U	N	120 U	N	120 U	120 U	N	180 J	N	100 J	270 J
2,4,6-Trinitrotoluene	45.5%	910		NA	110 J	210	120 U	120 U	910	N	120 U	N	120 U	120 U	N	75 J	N	120 U	210 J
4-amino-2,6-Dinitrotoluene	72.7%	810		NA	190	540	66 J	120 U	810	N	120 U	N	120 U	83 J	N	440 J	N	250	400 J
2-amino-4,6-Dinitrotoluene	63.6%	1300		NA	110 J	440	71 J	120 U	1300	N	120 U	N	120 U	120 U	N	860	N	250	640
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	120 U	120 U	120 U	N	120 U	N	120 U	120 U	N	120 U	N	120 U	120 U
2,4-Dinitrotoluene	100.0%	3900		NA	230	1500 J	240	3900	1500	N	3800	N	260	2300	N	2000	N	3400	930
Metals (mg/kg)																			
Aluminum	100.0%	19100	17503.0	2	13400	18700	19100	14000	13300	N	9080	N	13100	14400	N	14200	N	10600	6410
Antimony	9.1%	13.7	5	1	40.8 R	108 R	6.5 U R	6.1 R	5.3 R	N	5.8 UJ	N	13.7 J	4.4 UJ	N	4.6 UJ	N	4.4 UJ	3.1 UJ
Arsenic	100.0%	25.8	7.5	4	25.8	25	11.5 J	4.7 J	3.7 J	N	2.5 J	N	11.7 J	4.7	N	4.3	N	4	4.6
Barium	100.0%	4400	300	6	2580	4400	883	1810	571 J	N	144	N	708	131	N	96	N	39.6	124
Beryllium	63.6%	0.89	1	0	0.59 R	0.73 R	0.89	0.56 R	0.59 R	N	0.44 J	N	0.56	0.63 J	N	0.62 J	N	0.48 J	0.32 J
Cadmium	54.5%	6.1	1.8	4	6.1 J	5.6 J	0.95	4.5	3.6	N	0.33 U	N	0.52 J	0.33 U	N	0.33 U	N	0.32 U	0.23 U
Calcium	100.0%	34700	46825.0	0	6580	9640	15500	25200	26700	N	30200	N	13300	34700	N	26400	N	20000	16600
Chromium	81.8%	33.6	26.6	3	27.8 R	35.4 R	26.9	21.9	22.1	N	17.5	N	33.6	26.8	N	25.7	N	19.7	12
Cobalt	100.0%	14.4	30	0	8	12.7	12.7	11.2	11.2	N	8.5	N	12.7	14.3	N	14.4	N	13.9	8.6
Copper	90.9%	2900	25	10	1930	2900	427	43.5	42.6	N	27.9 R	N	742	44.2	N	44.7	N	33.2	39
Iron	100.0%	38000	32698.0	1	25900	38000	26500	25400	26900	N	19400	N	22100	32300	N	31000	N	26600	15000
Lead	100.0%	24200	30	10	6900 J	24200 J	1370	75.8	58.8	N	15.5	N	2760	75.6	N	68.7	N	30.5	51.6
Magnesium	100.0%	8450	9071.1	0	5620	8450	5660	6980	6380	N	4650	N	4890	7420	N	7220	N	5570	3480
Manganese	100.0%	732	1065.8	0	487	732	699	315	336	N	292	N	522	410	N	348	N	271	209
Mercury	72.7%	0.52	0.1	4	0.13 J	0.52 J	0.13	0.09	0.04 U	N	0.04 J	N	0.06 J	0.04 U	N	0.05 U	N	0.05 J	0.12
Nickel	100.0%	51.8	41.3	5	25.9	42.5	29.6	41.6	39.8	N	32.1	N	26.8	51.8 J	N	51.3 J	N	48.5 J	27.6 J
Potassium	100.0%	2670	1529.6	4	1120 J	1900 J	2670	1440	1430	N	961	N	1400	1580	N	1570	N	967	596
Selenium	54.5%	1.2	2	0	0.34 R	2.4 R	1.2 J	0.24 J	0.11 J	N	0.26 J	N	0.24 UJ	0.25 UJ	N	0.17 J	N	0.27 UJ	0.34 J
Silver	9.1%	0.44	0.6	0	0.98 R	1.4 R	0.38 U	0.99 U	0.87 U	N	0.34 U	N	0.44 J	0.7 U	N	0.72 U	N	0.69 U	0.49 U
Sodium	90.9%	312	76	8	110 J	312 J	82.8 R	109 J	113 J	N	70.7 J	N	112 J	139 J	N	126 J	N	82.6 J	58.8 J
Thallium	0.0%	0	0.3	0	0.34 U	0.35 U	0.42 U	0.52 U	0.33 U	N	0.34 U	N	0.56 U	0.58 U	N	0.37 U	N	0.62 U	0.52 U
Vanadium	100.0%	32.5	150	0	20.5	28.2	32.5	16.7	16.3	N	12.1	N	20.7	19.5	N	19.8	N	14.9	9
Zinc	100.0%	1590	89.1	8	1590	992	303	217	402	N	70 J	N	457	89.9 J	N	93.5 J	N	77.6 J	43.7 J
Cyanide	0.0%	0	NA	NA	0.59 U	0.6 U	0.67 U	0.63 U	0.59 U	N	0.63 U	N	0.65 U	0.64 U	N	0.63 U	N	0.64 U	0.65 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

4.3.8.2 Semivolatile Organic Compounds

Fifteen semivolatile organic compounds were detected in the soil samples collected at burning Pad H. None of these compounds were detected at concentrations that exceeded the TAGM limits. Semivolatile organic compounds were found at varied concentrations in all of the soil samples analyzed.

The compounds 2,4-dinitrotoluene and di-n-butylphthalate were detected in over 90 percent of the samples analyzed. The compound 2,6-dinitrotoluene, which was found in approximately 80 percent of the samples, was the third most prevalent explosive detected. These three compounds are by far the most common semivolatile s found on Pad H. The fourth frequency ranking is for five other semivolatile compounds which were found in approximately 25 percent of the samples.

For the surface soil samples collected on Pad H, low levels of SVOCs were reported in all of the samples. The distribution of compounds is reflective of the previous use of explosives on the pad. In sample PBH-1-1 2,200 ug/kg of 2,4-dinitrotoluene was reported along with 1,500 ug/kg of di-n-butylphthalate. The surface boring samples PBH-1-1 (4,281 ug/kg), PBH-4-1 (2,866 ug/kg) and PBH-6-1 (2,758 ug/kg) had the highest total SVOCs of the six surface samples analyzed. Total SVOCs were generally lower in the samples PBH-2-1 (1,500 ug/kg), PBH-3-1 (688 ug/kg), and PBH-5-1 (1,100 ug/kg).

Pad boring sample PBH-2-2, which was collected from a depth of 2 to 4 feet, also showed elevated levels of SVOCs. Total SVOCs in this sample were the second highest of all soil samples collected on Pad H at 8,798 ug/kg. The compounds 2-methylnaphthalene (4,700 ug/kg), acenaphthene (480 ug/kg), phenanthrene (1,700) ug/kg, and bis(2-ethylhexyl)phthalate (400 ug/kg) were all detected at maximum Pad H concentrations within this sample.

For the berm excavations, SVOCs were identified within in all the samples analyzed by level IV methods. The highest individual SVOC concentration was identified in sample BE-H-3 where 2,4-dinitrotoluene was found at 12,000 ug/kg. This sample also had the highest concentration of di-n-butylphthalate at 1,500 ug/kg and of 2-6,dinitrotoluene at 760 ug/kg. Total SVOCs for sample BE-H-3 were 14,690 ug/kg. This sample was collected on the southwest corner of the berm. Berm excavation samples BE-H-2 (3,920 ug/kg) and BE-H-5 (577 ug/kg) had lower total SVOC concentrations.

4.3.8.3 Pesticides/PCBs

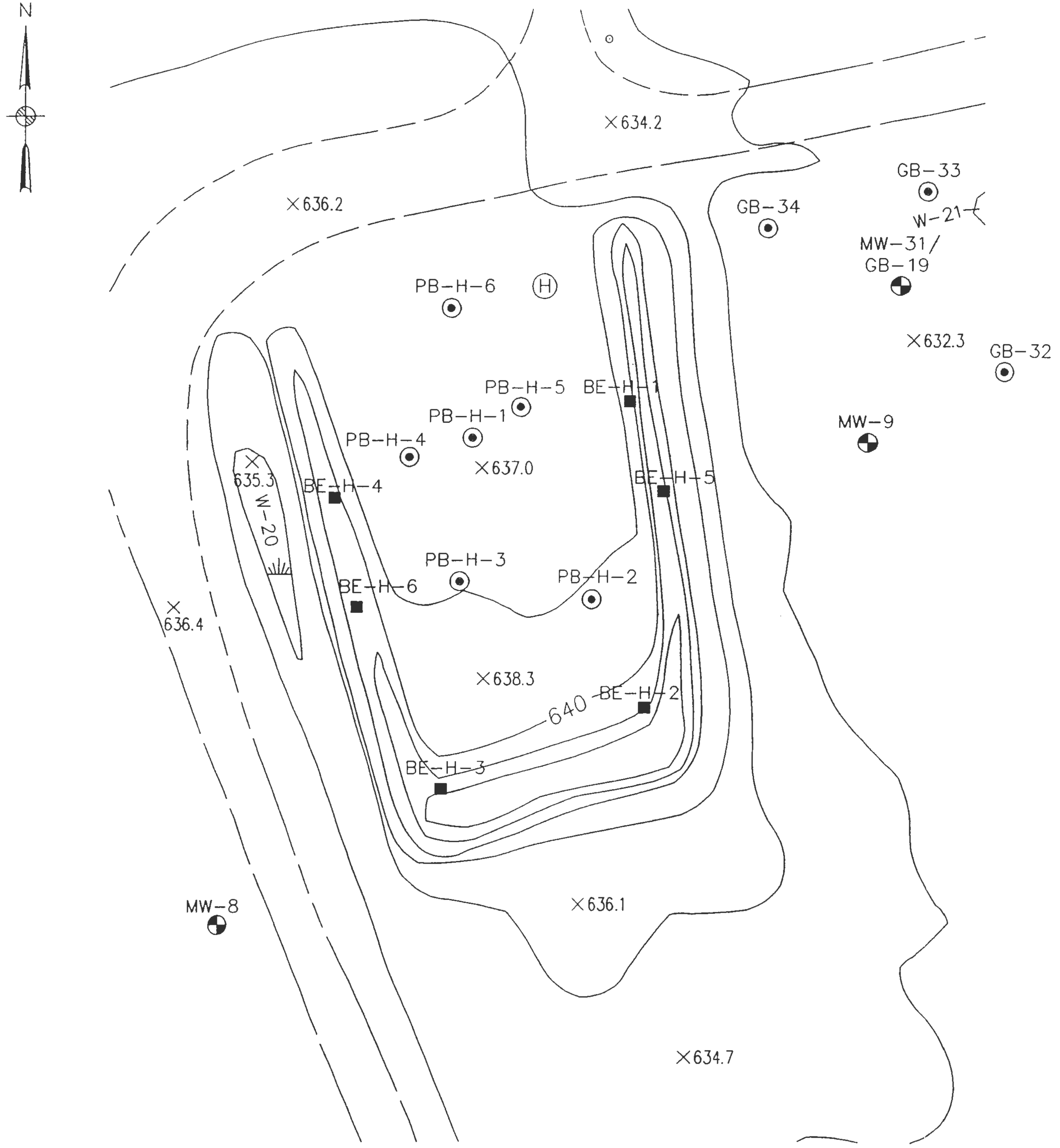
Only 3 pesticides were detected all in the very low parts per billion concentration range in the soil samples collected at burning Pad H. All of the identified compounds were detected at estimated concentrations below the sample quantitation limits. The pesticide 4,4'-DDE was found in 2 of the 11 samples analyzed at a maximum estimated concentration of 4.5 ug/kg. The pesticide 4,4'-DDT was also found in only 2 samples at a maximum estimated concentration of 3.6 ug/kg. The compound beta-BHC was identified in one soil sample (PBH-5-1) at an estimated concentration of 2.1 ug/kg.

4.3.8.4 Explosives

Figure 4-19 summarizes the explosives data for Pad H. Similar to Pad F, a wide variety of explosive compounds were identified within the soil samples collected at Pad H. Eight explosive compounds were identified in soil samples collected on Pad H. Of the 10 method 8330 analytes, only the explosive compounds HMX and 2,6-dinitrotoluene were not detected. The compound 2,4-dinitrotoluene was found in all 11 of the soil samples collected at Pad H. In addition, 4-amino-2,6-dinitrotoluene, 1,3,5-trinitrobenzene, 2-amino-4,6-dinitrotoluene, and 1,3-dinitrobenzene were all found in over half of the 11 samples analyzed.

All of the soil samples collected from borings and analyzed by Level IV methods had explosive compounds detected. For the surface soil samples collected on Pad H, total explosives ranged from a low of 2,721 ug/kg in sample PBH-6-1 to a high of 5,020 ug/kg in sample PBH-1-2. The maximum concentration for an individual compound was found in sample PBH-1-1 where 3,900 ug/kg of 2,4-dinitrotoluene was reported. In all of the boring soil samples, 2,4-dinitrotoluene was always the highest concentration explosive detected. Boring sample PBH-1-2 had the highest concentrations of four of the explosive compounds identified on Pad H.

Only one deep (i.e., greater than 2 feet) soil sample was collected on Pad H. This sample, from the depth interval 2 to 4 feet, was collected at boring location PB-H-2. While the surface soil sample collected at this location (PBH-2-1) had total explosives of 4,030 ug/kg, the deeper sample PBH-2-2 only had 260 ug/kg of 2,4-dinitrotoluene detected. In addition, the Level II screening data for the deeper soil samples collected in borings PB-H-1 and PB-H-2 had no explosives detected above the 1,000 ug/kg detection limit. These data suggest that the explosives contamination at Pad H is primarily limited to the upper 2 feet.



BERM EXCAVATIONS

LOCATION	DEPTH	LEVEL II	LEVEL IV							
		TNT	RDX	1,3,5-T	1,3-D	Tetryl	2,4,6-T	4-amino	2-amino	2,4-D
BE-H-1	3.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
BE-H-2	4.0'	1180	120 U	330	120 U	400 U	110 J	190	110 J	230
BE-H-3	4.0'	1120	120 U	320	120 U	400 U	210	540	440	1500 J
BE-H-4	4.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
BE-H-5	2.0'	<1000	120 U	80 J	120 U	120 U	120 U	66 J	71 J	240
BE-H-6	2.0'	<1000	NA	NA	NA	NA	NA	NA	NA	NA

All concentrations in ug/Kg.

PAD BORINGS

LOCATION	DEPTH	LEVEL II	LEVEL IV							
		TNT	RDX	1,3,5-T	1,3-D	Tetryl	2,4,6-T	4-amino	2-amino	2,4-D
PBH-1	0-6"	NA	120 U	200	440	400 U	120 U	120 U	120 U	3900
	0-2'	<1000	120 U	350	150	400 U	910	810	1300	1500
	2-4'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBH-2	0-2'	NA	120 U	120 U	230	120 U	120 U	120 U	120 U	3800
	2-4'	<1000	120 U	120 U	120 U	120 U	120 U	120 U	120 U	260
	4-6'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
	6-8'	<1000	NA	NA	NA	NA	NA	NA	NA	NA
PBH-3	0-2'	NA	120 U	120 U	160	120 U	120 U	83 J	120 U	2300
PBH-4	0-2'	NA	120 U	130 J	120	180 J	75 J	440 J	860	2000
PBH-5	0-2'	NA	71 J	79 J	110 J	100 J	120 U	250	250	3400
PBH-6	0-2'	NA	71 J	200 J	120 U	270 J	210 J	400 J	640	930

All concentrations in ug/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION	- - -	DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	◇	UTILITY POLE
		○	TREE
PB-G-1 GB-2 ⊙	BORING & DESIGNATION	⬭	BRUSH
650	GROUND CONTOUR AND ELEVATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
W-1	WETLAND & DESIGNATION	J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17 ⊕	MONITORING WELL & DESIGNATION	N/A	NOT AVAILABLE

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING NO 720446-01000

FIGURE 4-19
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD H

SCALE 1" = 40'

All of the berm excavation soil samples collected at Pad H had explosive compounds detected. The soil samples collected from the berm excavations also show a wide variety of explosive compounds present with total explosive concentrations ranging from a low of 457 ug/kg in sample BE-H-5 to a high of 3,010 ug/kg for the sample BE-H-3. The maximum individual concentration was found in sample BE-H-3 where 1,500 ug/kg of 2,4-dinitrotoluene was estimated.

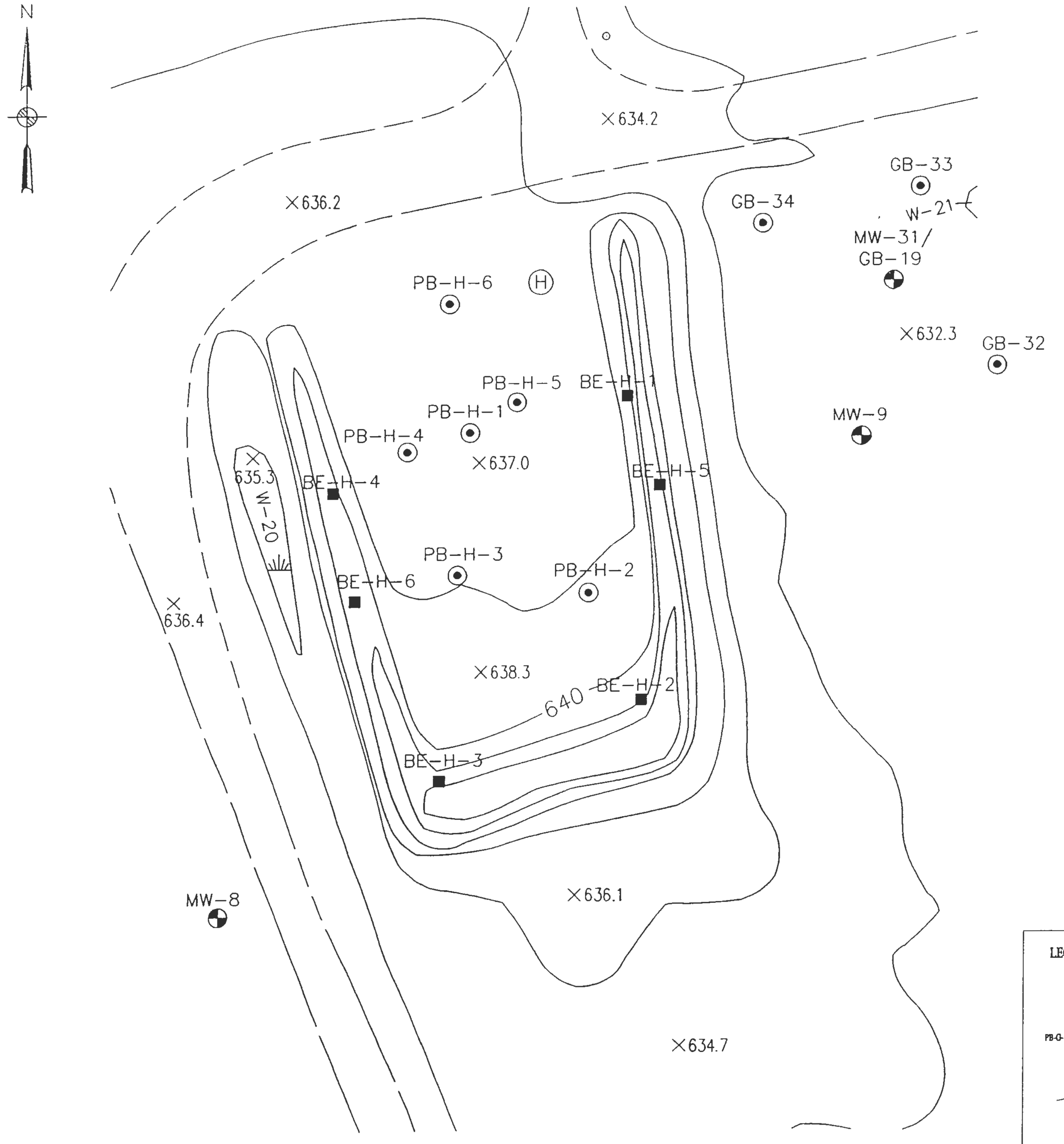
4.3.8.5 Metals

Figure 4-20 summarizes the metals data for Pad H. Barium was found in 6 of the 11 samples collected at Pad H at concentrations above the associated TAGM values. Zinc was detected in 8 of the 11 samples at concentrations above the TAGM value. Copper and lead were detected in 10 of the 11 samples at concentrations above the TAGM value.

The distribution of these metals in the soil samples collected at Pad H appears to follow a consistent pattern with the berm excavation samples showing significantly higher heavy metal concentrations than boring samples. Within the boring samples, the highest concentrations of barium, copper, lead, and zinc were all identified within the sample PBH-2-2 collected from a depth of 2 to 4 feet in soil boring PB-H-2.

Elevated barium concentrations in the boring samples PBH-1-1 (1,810 mg/kg), PBH-1-2 (571 mg/kg), and PBH-2-2 (708 mg/kg) were identified. This last soil sample, which was collected from a depth of 2 to 4 feet in boring PB-H-2, has a barium concentration which exceeds the TAGM value of 300 mg/kg. For the remainder of the five soil samples collected from the soil borings completed on Pad H, barium concentrations were all significantly below the 300 mg/kg limit. Significantly elevated barium concentrations were identified in all of the berm excavation soil samples. In general, the berm samples collected on Pad H show significantly higher concentrations of barium than do the boring soil samples. The average barium concentration for the berm samples was 2,621 mg/kg versus an average of 453 mg/kg for boring soils. The highest barium concentration was found in sample BE-H-3 where 4,400 mg/kg were detected.

Copper concentrations in the boring samples PBH-1-1 (43.5 mg/kg) and PBH-1-2 (42.6 mg/kg) were low, whereas the copper concentration in PBH-2-2 (742 mg/kg) was high. This last soil sample, which was collected from a depth of 2 to 4 feet in boring PB-H-2, has a copper concentration which exceeds the TAGM value 25 mg/kg. For the remainder of the



BERM EXCAVATIONS

LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
BE-H-1	3.0'	35	NA	NA	NA	NA
BE-H-2	4.0'	6000	2580	1930	6900 J	1590
BE-H-3	4.0'	17400	4400	2900	24200 J	992
BE-H-4	4.0'	260	NA	NA	NA	NA
BE-H-5	2.0'	1170	883	427	1370	303
BE-H-6	2.0'	115	NA	NA	NA	NA

All concentrations in mg/Kg.

PAD BORINGS

LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
PBH-1	0-6"	NA	1810	43.5	75.8	217
	0-2'	92	571 J	42.6	58.8	402
	2-4'	16	NA	NA	NA	NA
	4-6'	<10	NA	NA	NA	NA
PBH-2	0-2'	NA	144	27.9 R	15.5	70 J
	2-4'	2400	708	742	2760	457
	4-6'	23	NA	NA	NA	NA
	6-8'	16.4	NA	NA	NA	NA
PBH-3	0-2'	NA	131	44.2	75.6	89.9 J
PBH-4	0-2'	NA	96	44.7	68.7	93.5 J
PBH-5	0-2'	NA	39.6	33.2	30.5	77.6 J
PBH-6	0-2'	NA	124	39	51.6	43.7 J

All concentrations in mg/Kg.

LEGEND:

Ⓖ	BURNING PAD DESIGNATION		DIRT ROAD
BE-G-1 ■	BERM EXCAVATION & DESIGNATION	◊	UTILITY POLE
		○	TREE
PB-G-1 GB-2 ⊙	BORING & DESIGNATION		BRUSH
650	GROUND CONTOUR AND ELEVATION	SW-210 ▲	SURFACE WATER/SEDIMENT SAMPLE & DESIGNATION
W-1	WETLAND & DESIGNATION	J	ESTIMATED VALUE
		U	UNDETECTED VALUE
MW-17	MONITORING WELL & DESIGNATION	NA	NOT AVAILABLE

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-20
DISTRIBUTION OF METALS
OPEN BURNING PAD H

SCALE 1" = 40'

five soil samples collected from the soil borings completed on Pad H, the copper concentrations were all just at or below the TAGM value. Significantly elevated copper concentrations were found within all of the berm excavation soil samples analyzed. In general, the berm samples collected on Pad H show significantly higher concentrations of copper than do the boring soil samples. The average copper concentration for the berm samples was 1,752 mg/kg versus an average of 127 mg/kg for boring soils. The highest copper concentration was also found in sample BE-H-3 where 2,900 mg/kg were detected.

In conjunction with the distribution of copper, lead concentrations in the boring samples PBH-1-1 (75.8 mg/kg) and PBH-1-2 (58.8 mg/kg) were low, whereas the lead concentration in PBH-2-2 (2,760 mg/kg) was also high. For the remainder of the five soil samples collected from the soil borings completed on Pad H, the lead concentrations were generally only slightly above the TAGM value. Significantly elevated lead concentrations were found within all of the berm excavation soil samples analyzed. In general, the berm samples collected on Pad H show significantly higher concentrations of lead than do the boring soil samples. The average lead concentration for the berm samples was 10,800 mg/kg versus an average of only 392 mg/kg for boring soils. The highest lead concentration was also found in sample BE-H-3 where 24,200 mg/kg were detected.

The distribution of zinc appears to mimic the distribution of barium in Pad H soils. Zinc concentrations in the boring samples PBH-1-1 (217 mg/kg), PBH-1-2 (402 mg/kg), and PBH-2-2 (457 mg/kg) were high, as were the associated barium concentrations for these samples. For the remainder of the five soil samples collected from the soil borings completed on Pad H, zinc concentrations were all near or below the 89.1 mg/kg TAGM value. Elevated zinc concentrations were identified in all of the berm excavation soil samples. In general, the berm samples collected on Pad H show significantly higher concentrations of zinc than do the boring soil samples. The average zinc concentration for the berm samples was 960 mg/kg versus an average of 181 mg/kg for boring soils. The highest zinc concentration was found in sample BE-H-2 where 1,590 mg/kg were detected.

4.3.9 Burning Pad J

Twenty eight Level IV analyses were performed on samples collected from surface and subsurface soils at Pad J. During Phase I, the soil borings PB-J-1 through PB-J-8 were installed, and the berm excavations BE-J-1 through BE-J-7 were sampled. In Phase II, one additional soil boring, PB-J-9, was installed and sampled, and the berm excavations BE-J-9 through BE-J-13 were sampled.

The surface soil sample collected at each boring location went directly for Level IV analysis. Twenty eight subsurface soil samples were collected from the borings PB-J-1 through PB-J-9. These subsurface soil samples were sent for Level II screening. In addition, 13 soil samples were collected from the berm excavations and submitted for Level II analyses. From these 41 samples, 19 went for subsequent Level IV analyses, these being the berm excavation samples BE-J-4, BE-J-5, BE-J-6, BE-J-8, BE-J-10, and BE-J-13, along with one additional sample from each of the borings installed.

A summary of the analytical results for the Level IV analyses is presented in Table 4-12. The following sections review the compounds detected within the soil samples collected on Pad J.

4.3.9.1 Volatile Organic Compounds

Seven volatile organic compounds were detected in the soil samples collected at burning Pad J. No volatile organic compounds were reported at concentrations above the TAGM values. Volatile organic compounds were found in only 13 of the 28 samples analyzed. Frequencies of detection for all of the VOCs were generally quite low, with the toluene, the most frequently detected compound, being found in only 16 percent of the soil samples analyzed. The highest concentration of toluene was found in sample PBJ-9-2 where an estimated concentration of 3 ug/kg was reported. The highest individual concentration of a volatile species was found in sample BE-J-13 where 67 ug/kg of tetrachloroethene was found.

4.3.9.2 Semivolatile Organic Compounds

Fifteen semivolatile organic compounds were detected in the soil samples collected at burning Pad J. While semivolatile organic compounds were found in 18 of the 28 samples analyzed, only one SVOC was detected at a concentration that exceeded the TAGM limits.

The compound bis(2-ethylhexyl)phthalate was the most frequently detected SVOC (46 percent), while fluoranthene (25 percent) and pyrene (25 percent) were the second most common SVOCs identified. The highest concentration of bis(2-ethylhexyl)phthalate (1,100 ug/kg) was identified in the sample PBJ-7-2. The highest concentrations of 8 of the 15 SVOCs

TABLE 4-12

PAD J
SUMMARY OF COMPOUNDS DETECTED BERM EXCAVATIONS, PAD BORINGS, & GEOPHYSICAL ANOMALY EXCAVATIONS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD J 3.0' 12/06/91 BE-J-4-91	PAD J 3.0' 12/06/91 BE-J-5-91	PAD J 3.0' 12/06/91 BE-J-6-91	OB 2.0 feet 12/07/92 BE-J-8	OB 2.0 feet 12/07/92 BE-J8RE	OB 2.0 feet 12/07/92 BE-J-10	OB 2.0 feet 12/07/92 BE-J-13	OB 2.0 feet 12/07/92 BE-J13RE	OB 2.0 feet 12/07/92 BE-J-14	OB 2.0 feet 12/07/92 BE-J14RE
VOCs (ug/kg)														
Methylene Chloride	8.1%	5	100	0	6 U	5 U	6 U	5 J	N	12 U	2 J	5 J	13 U	N
Acetone	0.0%	0	200	0	12 U	11 U	11 U	12 U	N	12 U	12 U	12 U	13 U	N
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	5 U	6 U	12 U	N	12 U	12 U	12 U	13 U	N
Chloroform	10.8%	7	300	0	6 U	5 U	6 U	12 U	N	12 U	12 U	12 U	13 U	N
2-Butanone	0.0%	0	300	0	12 U	11 U	11 U	12 U	N	12 U	12 U	12 U	13 U	N
1,1,1-Trichloroethane	0.0%	0	800	0	6 U	5 U	6 U	12 U	N	12 U	12 U	12 U	13 U	N
Carbon Tetrachloride	5.4%	4	600	0	6 U	5 U	6 U	12 U	N	12 U	12 U	12 U	13 U	N
Trichloroethene	5.4%	7	700	0	6 U	5 U	6 U	12 U	N	12 U	12 U	12 U	13 U	N
Benzene	0.0%	0	60	0	6 U	5 U	6 U	12 U	N	12 U	12 U	12 U	13 U	N
Tetrachloroethene	5.4%	67	1400	0	6 U	5 U	6 U	12 U	N	12 U	25	67	13 U	N
Toluene	16.2%	3	1500	0	6 U	5 U	1 J	12 U	N	12 U	12 U	12 U	13 U	N
Chlorobenzene	0.0%	0	1700	0	6 U	5 U	6 U	12 U	N	12 U	12 U	12 U	13 U	N
Xylene (total)	2.7%	3	1200	0	6 U	5 U	6 U	12 U	N	12 U	12 U	12 U	13 U	N
Semivolatiles (ug/kg)														
Phenol	0.0%	0	30 or MDL	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
2-Methylphenol	0.0%	0	100 or MDL	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
4-Methylphenol	0.0%	0	900	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
2,4-Dimethylphenol	0.0%	0	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Benzoic acid	5.0%	88	2700	0	88 J	3400 U	3500 U	N	N	N	N	N	N	N
Naphthalene	3.7%	26	13,000	0	750 U	700 U	720 U	400 U	N	420 U	26 J	N	400 U	N
2-Methylnaphthalene	0.0%	0	36,400	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
2-Chloronaphthalene	0.0%	0	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
2-Nitroaniline	0.0%	0	430 or MDL	0	3600 U	3400 U	3500 U	970 U	N	1000 U	990 U	N	960 U	N
Acenaphthylene	0.0%	0	41,000	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
2,6-Dinitrotoluene	0.0%	0	1000	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
3-Nitroaniline	0.0%	0	500 or MDL	0	3600 U	3400 U	3500 U	970 U	N	1000 U	990 U	N	960 U	N
Acenaphthene	0.0%	0	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Dibenzofuran	0.0%	0	6200	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
2,4-Dinitrotoluene	10.7%	820	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	400 U	N	400 U	N
Diethylphthalate	7.1%	24	7100	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Fluorene	0.0%	0	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
N-Nitrosodiphenylamine	3.6%	81	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Hexachlorobenzene	0.0%	0	410	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Pentachlorophenol	0.0%	0	1000 or MDL	0	3600 U	3400 U	3500 U	970 U	N	1000 U	990 U	N	960 U	N
Phenanthrene	21.4%	270	50,000*	0	750 U	700 U	720 U	400 U	N	17 J	23 J	N	22 J	N
Anthracene	0.0%	0	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Carbazole	0.0%	0	50,000*	0	N	N	N	400 U	N	420 U	410 U	N	400 U	N
Di-n-butylphthalate	17.9%	480	8100	0	750 U	700 U	720 U	20 J	N	21 J	23 J	N	18 J	N
Fluoranthene	25.0%	330	50,000*	0	750 U	700 U	720 U	26 J	N	19 J	20 J	N	25 J	N
Pyrene	25.0%	230	50,000*	0	750 U	700 U	720 U	24 J	N	16 J	17 J	N	20 J	N
Butylbenzylphthalate	0.0%	0	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Benzo(a)anthracene	3.6%	86	220 or MDL	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Chrysene	17.9%	120	400	0	750 U	700 U	720 U	25 J	N	14 J	13 J	N	16 J	N
bis(2-Ethylhexyl)phthalate	46.4%	1100	50,000*	0	750 U	700 U	720 U	32 J	N	27 J	110 J	N	30 J	N
Di-n-octylphthalate	0.0%	0	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Benzo(b)fluoranthene	10.7%	81	1100	0	750 U	700 U	720 U	23 J	N	420 U	410 U	N	15 J	N
benzo(k)fluoranthene	10.7%	96	1100	0	750 U	700 U	720 U	21 J	N	420 U	410 U	N	15 J	N
Benzo(a)pyrene	3.6%	76	61 or MDL	1	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	750 U	700 U	720 U	400 U	N	420 U	410 U	N	400 U	N

TABLE 4–12

PAD J
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS, PAD BORINGS, & GEOPHYSICAL ANOMALY EXCAVATIONS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD J 3.0' 12/06/91 BE–J–4–91	PAD J 3.0' 12/06/91 BE–J–5–91	PAD J 3.0' 12/06/91 BE–J–6–91	OB 2.0 feet 12/07/92 BE–J–8	OB 2.0 feet 12/07/92 BE–J8RE	OB 2.0 feet 12/07/92 BE–J–10	OB 2.0 feet 12/07/92 BE–J–13	OB 2.0 feet 12/07/92 BE–J13RE	OB 2.0 feet 12/07/92 BE–J–14	OB 2.0 feet 12/07/92 BE–J14RE
Pesticides/PCBs (ug/kg)														
beta–BHC	0.0%	0	200	0	18 U	17 U	18 U	2.1 U	2.1 U	2.2 U	2.1 U	N	2 U	2 U
delta–BHC	0.0%	0	300	0	18 U	17 U	18 U	2.1 U	2.1 U	2.2 U	2.1 U	N	2 U	2 U
gamma–BHC (Lindane)	0.0%	0	60	0	18 U	17 U	18 U	2.1 U	2.1 U	2.2 U	2.1 U	N	2 U	2 U
Heptachlor	0.0%	0	100	0	18 U	17 U	18 U	2.1 U	2.1 U	2.2 U	2.1 U	N	2 U	2 U
Aldrin	0.0%	0	41	0	18 U	17 U	18 U	2.1 U	2.1 U	2.2 U	2.1 U	N	2 U	2 U
Heptachlor epoxide	0.0%	0	20	0	18 U	17 U	18 U	2.1 U	2.1 U	2.2 U	2.1 U	N	2 U	2 U
Endosulfan I	0.0%	0	900	0	18 U	17 U	18 U	2.1 U	2.1 U	2.2 U	2.1 U	N	2 U	2 U
Dieldrin	0.0%	0	44	0	36 U	34 U	35 U	4 U	4 U	4.3 U	4.1 U	N	4 U	4 U
4,4'–DDE	46.9%	830	2100	0	36 U	34 U	35 U	4.9 J	18	6.7 J	6.5	N	4 U	3.9 J
Endrin	3.1%	41	100	0	36 U	34 U	35 U	4 U	4 U	4.3 U	4.1 U	N	4 U	4 U
Endosulfan II	0.0%	0	900	0	36 U	34 U	35 U	4 U	4 U	4.3 U	4.1 U	N	4 U	4 U
4,4'–DDD	0.0%	0	2900	0	36 U	34 U	35 U	4 U	4 U	4.3 U	4.1 U	N	4 U	4 U
Endosulfan sulfate	0.0%	0	1000	0	36 U	34 U	35 U	4 U	4 U	4.3 U	4.1 U	N	4 U	4 U
4,4'–DDT	25.0%	320	2100	0	36 U	34 U	35 U	4.6 J	17	8.3 J	9	N	4 U	5.4 J
Endrin aldehyde	0.0%	0		NA	N	N	N	4 U	4 U	4.3 U	4.1 U	N	4 U	4 U
alpha–Chlordane	0.0%	0	540	NA	180 U	170 U	180 U	2.1 U	2.1 U	2.2 U	2.1 U	N	2 U	2 U
Aroclor–1254	0.0%	0	1000	NA	360 U	340 U	350 U	40 U	40 U	43 U	41 U	N	40 U	40 U
Aroclor–1260	0.0%	0	1000	NA	360 U	340 U	350 U	40 U	40 U	43 U	41 U	N	40 U	40 U
Explosives (ug/kg)														
HMX	0.0%	0		NA	990 U	1000 U	990 U	120 U	N	120 U	120 U	N	120 U	N
RDX	3.6%	270		NA	120 U	120 U	120 U	120 U	N	120 U	120 U	N	120 U	N
1,3,5–Trinitrobenzene	3.6%	120		NA	120 U	120 U	120 U	120 U	N	120 U	120 U	N	120 U	N
1,3–Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	N	120 U	120 U	N	120 U	N
Tetryl	0.0%	0		NA	390 U	400 U	390 U	120 U	N	120 U	120 U	N	120 U	N
2,4,6–Trinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	N	120 U	120 U	N	120 U	N
4–amino–2,6–Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	N	120 U	120 U	N	120 U	N
2–amino–4,6–Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	N	120 U	120 U	N	120 U	N
2,6–Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	120 U	120 U	N	120 U	120 U	N	120 U	N
2,4–Dinitrotoluene	42.9%	420		NA	120 U	170	92 J	120 U	N	120 U	120 U	N	120 U	N
Metals (mg/kg)														
Aluminum	100.0%	30200	17503.0	13	16700	13800	16000	15700	N	22400	24500	N	26300	N
Antimony	25.0%	15.3	5	7	5.4 R	5.1 R	5.5 R	7.7 R	N	16 R	18.2 R	N	5.9 U R	N
Arsenic	89.3%	8.1	7.5	2	4.1 R	3.4 R	4.6 R	5.9 J	N	4.9 J	5.3 J	N	5 J	N
Barium	75.0%	34400	300	18	213 R	136 R	470 R	2200	N	28300	22000	N	34400	N
Beryllium	42.9%	0.78	1	0	0.9 R	0.74 R	0.95 R	0.77	N	0.52 J	0.65	N	0.54 J	N
Cadmium	89.3%	10	1.8	23	3.4 J	4.5 J	3.4 J	0.73	N	5.1	3.8	N	5.8	N
Calcium	100.0%	71300	46825.0	2	3310	8200	7930	7430	N	12600	20300	N	7870	N
Chromium	92.9%	52.7	26.6	18	19 R	21.8 R	19.9 J	22.7	N	52.7	34.9	N	22.1	N
Cobalt	100.0%	33.4	30	2	9.7	7.4	7.9	10.4	N	30.7	26.4	N	33.4	N
Copper	85.7%	6560	25	24	29.8	137	59.9	54.1	N	231	348	N	340	N
Iron	100.0%	95800	32698.0	12	24100	18500	20800	23400	N	95800 J	24500	N	17400 J	N
Lead	89.3%	2040	30	21	32.4 J	644 J	48 J	363	N	347	204	N	2040 J	N
Magnesium	100.0%	24100	9071.1	15	3320	3650	4270	5390	N	24100 J	22300	N	23100	N
Manganese	100.0%	1320	1065.8	1	978	451	802	599	N	897	528	N	1320	N
Mercury	57.1%	1.1	0.1	13	0.37 J	0.27 J	0.39 J	0.18	N	0.23	0.36	N	0.15	N
Nickel	100.0%	57.3	41.3	13	15.7	21.9	20	24.5	N	38.2	33.8	N	17.7	N
Potassium	100.0%	3500	1529.6	14	1550 J	1150 J	1380 J	1410	N	1380	1800	N	1070	N
Selenium	60.7%	1.1	2	0	0.1 R	0.1 R	0.1 R	0.53 J	N	1 J	1.1 J	N	0.77 J	N
Silver	32.1%	1.2	0.6	6	0.34 U	0.45 R	0.55 R	0.38 U	N	0.41 U	0.53 J	N	0.35 U	N
Sodium	78.6%	376	76	18	54.7 J	54.5 J	56 J	113 R	N	709 R	519 R	N	319 R	N
Thallium	39.3%	38	0.3	11	0.33 U	0.32 U	0.33 U	0.47 U	N	0.45 U	0.4 U	N	0.52 U	N
Vanadium	100.0%	41.6	150	0	30.1	24	26.5	26.1	N	23.9	25.3	N	20.9	N
Zinc	100.0%	5790	89.1	28	138	903	156	446	N	3190	2390	N	3240	N
Cyanide	0.0%	0	NA	NA	0.66 U	0.62 U	0.44 U	0.71 U	N	0.78 U	0.75 U	N	0.54 U	N

TABLE 4-12

PAD J
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS, PAD BORINGS, & GEOPHYSICAL ANOMALY EXCAVATIONS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD J 0-6" 01/13/92 PBJ-1-1DL	PAD J 0-6" 01/13/92 PBJ-1-1DL1	PAD J 0-6" 01/13/92 PBJ-1-1	PAD J 0-6" 01/13/92 PBJ-1-1RE	PAD J 0-2' 01/13/92 PBJ-1-2	PAD J 0-6" 01/13/92 PBJ-2-1	PAD J 0-2' 01/14/92 PBJ-2-2	PAD J 0-6" 01/14/92 PBJ-3-1	PAD-J 0-6" 01/14/92 PBJ-3-1RE	PAD-J 0-2' 01/15/92 PBJ-3-2	PAD-J 0-6" 01/15/92 PBJ-4-1
VOCs (ug/kg)															
Methylene Chloride	8.1%	5	100	0	N	N	6 U J	6 U J	6 U	7 U	6 U	7 U J	8 U J	6 U	12 U
Acetone	0.0%	0	200	0	N	N	11 U J	11 U J	12 U	12 U	12 U	14 U J	15 U J	12 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	N	N	6 U J	6 U J	6 U	6 U	6 U	7 U J	8 U J	6 U	6 U
Chloroform	10.8%	7	300	0	N	N	6 U J	6 U J	6 U	6 U	2 J	6 J	8 U J	6 U	6 U
2-Butanone	0.0%	0	300	0	N	N	11 U J	11 U J	12 U	12 U	12 U	14 U J	15 U J	12 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	N	N	6 U J	6 U J	6 U	6 U	6 U	7 U J	8 U J	6 U	6 U
Carbon Tetrachloride	5.4%	4	600	0	N	N	6 U J	6 U J	6 U	6 U	6 U	7 U J	8 U J	6 U	6 U
Trichloroethene	5.4%	7	700	0	N	N	6 U J	6 U J	6 U	6 U	6 U	7 U J	8 U J	6 U	6 U
Benzene	0.0%	0	60	0	N	N	6 U J	6 U J	6 U	6 U	6 U	7 U J	8 U J	6 U	6 U
Tetrachloroethene	5.4%	67	1400	0	N	N	6 U J	6 U J	6 U	6 U	6 U	7 U J	8 U J	6 U	6 U
Toluene	16.2%	3	1500	0	N	N	6 U J	6 U J	6 U	1 J	6 U	7 U J	8 U J	6 U	6 U
Chlorobenzene	0.0%	0	1700	0	N	N	6 U J	6 U J	6 U	6 U	6 U	7 U J	8 U J	6 U	6 U
Xylene (total)	2.7%	3	1200	0	N	N	6 U J	6 U J	6 U	6 U	6 U	7 U J	8 U J	6 U	6 U
Semivolatiles (ug/kg)															
Phenol	0.0%	0	30 or MDL	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
2-Methylphenol	0.0%	0	100 or MDL	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
4-Methylphenol	0.0%	0	900	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Benzoic acid	5.0%	88	2700	0	N	N	3900 U	N	3800 U	4000 U	3800 U	3900 U	N	3600 U	3600 U
Naphthalene	3.7%	26	13,000	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
2-Methylnaphthalene	0.0%	0	36,400	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
2-Chloronaphthalene	0.0%	0	50,000*	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
2-Nitroaniline	0.0%	0	430 or MDL	0	N	N	3900 U	N	3800 U	4000 U	3800 U	3900 U	N	3600 U	3600 U
Acenaphthylene	0.0%	0	41,000	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
2,6-Dinitrotoluene	0.0%	0	1000	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
3-Nitroaniline	0.0%	0	500 or MDL	0	N	N	3900 U	N	3800 U	4000 U	3800 U	3900 U	N	3600 U	3600 U
Acenaphthene	0.0%	0	50,000*	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Dibenzofuran	0.0%	0	6200	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
2,4-Dinitrotoluene	10.7%	820	50,000*	0	N	N	130 J	N	770 U	820 J	770 U	800 U	N	750 U	740 U
Diethylphthalate	7.1%	24	7100	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Fluorene	0.0%	0	50,000*	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
N-Nitrosodiphenylamine	3.6%	81	50,000*	0	N	N	800 U	N	770 U	81 J	770 U	800 U	N	750 U	740 U
Hexachlorobenzene	0.0%	0	410	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	N	N	3900 U	N	3800 U	4000 U	3800 U	3900 U	N	3600 U	3600 U
Phenanthrene	21.4%	270	50,000*	0	N	N	93 J	N	770 U	840 U	770 U	800 U	N	750 U	69 J
Anthracene	0.0%	0	50,000*	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	N	N	N	N	N	N
Di-n-butylphthalate	17.9%	480	8100	0	N	N	480 J	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Fluoranthene	25.0%	330	50,000*	0	N	N	96 J	N	770 U	840 U	770 U	800 U	N	750 U	90 J
Pyrene	25.0%	230	50,000*	0	N	N	100 J	N	770 U	840 U	770 U	800 U	N	750 U	78 J
Butylbenzylphthalate	0.0%	0	50,000*	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Benzo(a)anthracene	3.6%	86	220 or MDL	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Chrysene	17.9%	120	400	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
bis(2-Ethylhexyl)phthalate	46.4%	1100	50,000*	0	N	N	800 U	N	770 U	190 J	110 J	800 U	N	750 U	140 J
Di-n-octylphthalate	0.0%	0	50,000*	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Benzo(b)fluoranthene	10.7%	81	1100	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
benzo(k)fluoranthene	10.7%	96	1100	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Benzo(a)pyrene	3.6%	76	61 or MDL	1	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	N	N	800 U	N	770 U	840 U	770 U	800 U	N	750 U	740 U

TABLE 4-12

PAD J
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS, PAD BORINGS,
& GEOPHYSICAL ANOMALY EXCAVATIONS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD J 0-6" 01/13/92 PBJ-1-1DL	PAD J 0-6" 01/13/92 PBJ-1-1DL1	PAD J 0-6" 01/13/92 PBJ-1-1	PAD J 0-6" 01/13/92 PBJ-1-1RE	PAD J 0-2' 01/13/92 PBJ-1-2	PAD J 0-6" 01/13/92 PBJ-2-1	PAD J 0-2' 01/14/92 PBJ-2-2	PAD J 0-6" 01/14/92 PBJ-3-1	PAD-J 0-6" 01/14/92 PBJ-3-1RE	PAD-J 0-2' 01/15/92 PBJ-3-2	PAD-J 0-6" 01/15/92 PBJ-4-1
Pesticides/PCBs (ug/kg)															
beta-BHC	0.0%	0	200	0	58 U	580 U R	N	N	19 U	20 U	19 U	19 U	N	18 U	18 U
delta-BHC	0.0%	0	300	0	58 U	580 U R	N	N	19 U	20 U	19 U	19 U	N	18 U	18 U
gamma-BHC (Lindane)	0.0%	0	60	0	58 U	580 U R	N	N	19 U	20 U	19 U	19 U	N	18 U	18 U
Heptachlor	0.0%	0	100	0	58 U	580 U R	N	N	19 U	20 U	19 U	19 U	N	18 U	18 U
Aldrin	0.0%	0	41	0	58 U	580 U R	N	N	19 U	20 U	19 U	19 U	N	18 U	18 U
Heptachlor epoxide	0.0%	0	20	0	58 U	580 U R	N	N	19 U	20 U	19 U	19 U	N	18 U	18 U
Endosulfan I	0.0%	0	900	0	58 U	580 U R	N	N	19 U	20 U	19 U	19 U	N	18 U	18 U
Dieldrin	0.0%	0	44	0	120 U	1200 U R	N	N	38 U	40 U	38 U	39 U	N	36 U	36 U
4,4'-DDE	46.9%	830	2100	0	980 R	830 J	N	N	32 J	38 J	38 U	21 J	N	36 U	25 J
Endrin	3.1%	41	100	0	120 U	1200 U R	N	N	38 U	40 U	38 U	39 U	N	36 U	36 U
Endosulfan II	0.0%	0	900	0	120 U	1200 U R	N	N	38 U	40 U	38 U	39 U	N	36 U	36 U
4,4'-DDD	0.0%	0	2900	0	120 U	1200 U R	N	N	38 U	40 U	38 U	39 U	N	36 U	36 U
Endosulfan sulfate	0.0%	0	1000	0	120 U	1200 U R	N	N	38 U	40 U	38 U	39 U	N	36 U	36 U
4,4'-DDT	25.0%	320	2100	0	320	1200 U R	N	N	38 U	40 U	38 U	39 U	N	36 U	36 U
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	N	N	N	N	N	N
alpha-Chlordane	0.0%	0	540	NA	580 U	5800 U R	N	N	190 U	200 U	190 U	190 U	N	180 U	180 U
Aroclor-1254	0.0%	0	1000	NA	1200 U	12000 U R	N	N	380 U	400 U	380 U	390 U	N	360 U	360 U
Aroclor-1260	0.0%	0	1000	NA	1200 U	12000 U R	N	N	380 U	400 U	380 U	390 U	N	360 U	360 U
Explosives (ug/kg)															
HMX	0.0%	0		NA	N	N	1000 U	N	1000 U	1000 U	1000 U	1000 U	N	1000 U	1000 U
RDX	3.6%	270		NA	N	N	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U
1,3,5-Trinitrobenzene	3.6%	120		NA	N	N	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U
1,3-Dinitrobenzene	0.0%	0		NA	N	N	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U
Tetryl	0.0%	0		NA	N	N	400 U	N	400 U	400 U	400 U	400 U	N	400 U	400 U
2,4,6-Trinitrotoluene	0.0%	0		NA	N	N	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U
4-amino-2,6-Dinitrotoluene	0.0%	0		NA	N	N	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U
2-amino-4,6-Dinitrotoluene	0.0%	0		NA	N	N	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	N	N	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U
2,4-Dinitrotoluene	42.9%	420		NA	N	N	420	N	120 U	370	120 U	300	N	120 U	86 J
Metals (mg/kg)															
Aluminum	100.0%	30200	17503.0	13	N	N	18800	N	26900	21800	21400	16800	N	17000	19900
Antimony	25.0%	15.3	5	7	N	N	6.1 U J	N	5.8 U J	5.7 U J	5.8 U J	6.1 U J	N	8.6 J	10.3 J
Arsenic	89.3%	8.1	7.5	2	N	N	3.7	N	4.9	4.1	4.3	4.8	N	7.1	8.1
Barium	75.0%	34400	300	18	N	N	8130	N	1660	2520	351 R	3470	N	2830	5610
Beryllium	42.9%	0.78	1	0	N	N	0.7 R	N	1.3 R	1 R	1 R	0.91 R	N	0.83 R	0.82 R
Cadmium	89.3%	10	1.8	23	N	N	4.8 J	N	4.3 J	5.4 J	4.1 J	4.8 J	N	3.8 J	6.9 J
Calcium	100.0%	71300	46825.0	2	N	N	22800	N	11700	34400	19100	27200	N	22700 J	32300
Chromium	92.9%	52.7	26.6	18	N	N	30.1 J	N	35.4 J	38.5 J	30.4 J	34.4 J	N	31.9 J	50.8 J
Cobalt	100.0%	33.4	30	2	N	N	9.1	N	15.5	15.5	15.2	11.9	N	11.8	16.5
Copper	85.7%	6560	25	24	N	N	143	N	58.4	137	69.3	435	N	158	262
Iron	100.0%	95800	32698.0	12	N	N	20700	N	37700	42500	33300	31600	N	31000	39200
Lead	89.3%	2040	30	21	N	N	356	N	80.9	266	115	448	N	29.2 R	1340
Magnesium	100.0%	24100	9071.1	15	N	N	16700	N	8650	10600	7510	10200	N	7730	11400
Manganese	100.0%	1320	1065.8	1	N	N	334	N	774	619	437	393	N	490	475
Mercury	57.1%	1.1	0.1	13	N	N	0.11 R	N	0.12 R	0.17 R	0.1 R	0.19 R	N	0.11 R	0.11 R
Nickel	100.0%	57.3	41.3	13	N	N	38.4	N	42.5	57.3	44.8	46.7	N	36.5	48
Potassium	100.0%	3500	1529.6	14	N	N	1520 J	N	2930 J	2310 J	1980 J	1740 J	N	1730 J	2780 J
Selenium	60.7%	1.1	2	0	N	N	0.33 J	N	0.2 U J	0.24 J	0.21 J	0.31 J	N	0.12 U J	0.22 J
Silver	32.1%	1.2	0.6	6	N	N	0.39 U	N	0.37 U	0.37 U	0.4 J	0.65 J	N	0.74 J	0.61 J
Sodium	78.6%	376	76	18	N	N	244 J	N	164 J	165 J	145 J	341 J	N	224 J	258 J
Thallium	39.3%	38	0.3	11	N	N	0.43 J	N	0.48 U	0.56 J	0.63 J	0.35 J	N	0.59 J	0.35 J
Vanadium	100.0%	41.6	150	0	N	N	17.8 J	N	39 J	27.1 J	26.8 J	20.5 J	N	26 J	27.2 J
Zinc	100.0%	5790	89.1	28	N	N	1380	N	246	512	344	5790	N	700	1510
Cyanide	0.0%	0	NA	NA	N	N	0.7 U	N	0.72 U	0.69 U	0.7 U	0.64 U	N	0.52 U	0.58 U

TABLE 4–12

PAD J
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS, PAD BORINGS, & GEOPHYSICAL ANOMALY EXCAVATIONS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD J 0–2' 01/15/92 PBJ–4–2	PAD–J 4' + 01/15/92 PBJ–4–4	PAD–J 0–6" 01/15/92 PBJ–5–1	PAD–J 0–6" 01/15/92 PBJ–5–1RE	PAD–J 0–2' 01/15/92 PBJ–5–2	PAD–J 0–2' 01/15/92 PBJ–5–2RE	PAD–J 0–6" 01/15/92 PBJ–6–1	PAD–J 0–6" 01/15/92 PBJ–6–1DL	PAD–J 0–6" 01/15/92 PBJ–6–1RE	PAD–J 0–2' 01/15/92 PBJ–6–2	PAD–J 0–2' 01/15/92 PBJ–6–2RE
VOCs (ug/kg)															
Methylene Chloride	8.1%	5	100	0	N	6 U	10 U J	6 U J	6 U J	9 U J	8 U	N	7 U J	9 U J	9 U J
Acetone	0.0%	0	200	0	N	11 U	12 U J	11 U J	11 U J	11 U J	12 U	N	12 U J	11 U J	11 U J
1,2–Dichloroethene (total)	0.0%	0	300 (b)	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	5 U J	5 U J
Chloroform	10.8%	7	300	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	3 J	5 U J
2–Butanone	0.0%	0	300	0	N	11 U	12 U J	11 U J	11 U J	11 U J	12 U	N	12 U J	11 U J	11 U J
1,1,1–Trichloroethane	0.0%	0	800	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	5 U J	5 U J
Carbon Tetrachloride	5.4%	4	600	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	4 J	2 J
Trichloroethene	5.4%	7	700	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	7	4 J
Benzene	0.0%	0	60	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	5 U J	5 U J
Tetrachloroethene	5.4%	67	1400	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	5 U J	5 U J
Toluene	16.2%	3	1500	0	N	6 U	6 U J	6 U J	6 U J	1 J	6 U	N	6 U J	5 U J	5 U J
Chlorobenzene	0.0%	0	1700	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	5 U J	5 U J
Xylene (total)	2.7%	3	1200	0	N	6 U	6 U J	6 U J	6 U J	6 U J	6 U	N	6 U J	5 U J	5 U J
Semivolatiles (ug/kg)															
Phenol	0.0%	0	30 or MDL	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
2–Methylphenol	0.0%	0	100 or MDL	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
4–Methylphenol	0.0%	0	900	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
2,4–Dimethylphenol	0.0%	0	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Benzoic acid	5.0%	88	2700	0	3400 U	N	3700 U	N	3600 U	N	3800 U	N	N	3500 U	N
Naphthalene	3.7%	26	13,000	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
2–Methylnaphthalene	0.0%	0	36,400	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
2–Chloronaphthalene	0.0%	0	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
2–Nitroaniline	0.0%	0	430 or MDL	0	3400 U	N	3700 U	N	3600 U	N	3800 U	N	N	3500 U	N
Acenaphthylene	0.0%	0	41,000	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
2,6–Dinitrotoluene	0.0%	0	1000	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
3–Nitroaniline	0.0%	0	500 or MDL	0	3400 U	N	3700 U	N	3600 U	N	3800 U	N	N	3500 U	N
Acenaphthene	0.0%	0	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Dibenzofuran	0.0%	0	6200	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
2,4–Dinitrotoluene	10.7%	820	50,000*	0	380 J	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Diethylphthalate	7.1%	24	7100	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Fluorene	0.0%	0	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
N–Nitrosodiphenylamine	3.6%	81	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Hexachlorobenzene	0.0%	0	410	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Pentachlorophenol	0.0%	0	1000 or MDL	0	3400 U	N	3700 U	N	3600 U	N	3800 U	N	N	3500 U	N
Phenanthrene	21.4%	270	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	270 J	N
Anthracene	0.0%	0	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	N	N	N	N	N	N
Di–n–butylphthalate	17.9%	480	8100	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Fluoranthene	25.0%	330	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	330 J	N
Pyrene	25.0%	230	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	230 J	N
Butylbenzylphthalate	0.0%	0	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Benzo(a)anthracene	3.6%	86	220 or MDL	0	710 U	N	760 U	N	740 U	N	780 U	N	N	86 J	N
Chrysene	17.9%	120	400	0	710 U	N	760 U	N	740 U	N	780 U	N	N	120 J	N
bis(2–Ethylhexyl)phthalate	46.4%	1100	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	130 J	N
Di–n–octylphthalate	0.0%	0	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Benzo(b)fluoranthene	10.7%	81	1100	0	710 U	N	760 U	N	740 U	N	780 U	N	N	81 J	N
benzo(k)fluoranthene	10.7%	96	1100	0	710 U	N	760 U	N	740 U	N	780 U	N	N	96 J	N
Benzo(a)pyrene	3.6%	76	61 or MDL	1	710 U	N	760 U	N	740 U	N	780 U	N	N	76 J	N
Indeno(1,2,3–cd)pyrene	0.0%	0	3200	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	710 U	N	760 U	N	740 U	N	780 U	N	N	720 U	N

TABLE 4-12

PAD J
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS, PAD BORINGS, & GEOPHYSICAL ANOMALY EXCAVATIONS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD J 0-2' 01/15/92 PBJ-4-2	PAD-J 4' + 01/15/92 PBJ-4-4	PAD-J 0-6" 01/15/92 PBJ-5-1	PAD-J 0-6" 01/15/92 PBJ-5-1RE	PAD-J 0-2' 01/15/92 PBJ-5-2	PAD-J 0-2' 01/15/92 PBJ-5-2RE	PAD-J 0-6" 01/15/92 PBJ-6-1	PAD-J 0-6" 01/15/92 PBJ-6-1DL	PAD-J 0-6" 01/15/92 PBJ-6-1RE	PAD-J 0-2' 01/15/92 PBJ-6-2	PAD-J 0-2' 01/15/92 PBJ-6-2RE
Pesticides/PCBs (ug/kg)															
beta-BHC	0.0%	0	200	0	17 U	N	18 U	N	18 U	N	19 U	57 U R	N	17 U	N
delta-BHC	0.0%	0	300	0	17 U	N	18 U	N	18 U	N	19 U	57 U R	N	17 U	N
gamma-BHC (Lindane)	0.0%	0	60	0	17 U	N	18 U	N	18 U	N	19 U	57 U R	N	17 U	N
Heptachlor	0.0%	0	100	0	17 U	N	18 U	N	18 U	N	19 U	57 U R	N	17 U	N
Aldrin	0.0%	0	41	0	17 U	N	18 U	N	18 U	N	19 U	57 U R	N	17 U	N
Heptachlor epoxide	0.0%	0	20	0	17 U	N	18 U	N	18 U	N	19 U	57 U R	N	17 U	N
Endosulfan I	0.0%	0	900	0	17 U	N	18 U	N	18 U	N	19 U	57 U R	N	17 U	N
Dieldrin	0.0%	0	44	0	34 U	N	37 U	N	36 U	N	38 U	110 U R	N	35 U	N
4,4'-DDE	46.9%	830	2100	0	34 U	N	18 J	N	36 U	N	97 R	79 J	N	19 J	N
Endrin	3.1%	41	100	0	34 U	N	37 U	N	36 U	N	38 U	110 U R	N	35 U	N
Endosulfan II	0.0%	0	900	0	34 U	N	37 U	N	36 U	N	38 U	110 U R	N	35 U	N
4,4'-DDD	0.0%	0	2900	0	34 U	N	37 U	N	36 U	N	38 U	110 U R	N	35 U	N
Endosulfan sulfate	0.0%	0	1000	0	34 U	N	37 U	N	36 U	N	38 U	110 U R	N	35 U	N
4,4'-DDT	25.0%	320	2100	0	34 U	N	37 U	N	36 U	N	23 J	110 U R	N	35 U	N
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	N	N	N	N	N	N
alpha-Chlordane	0.0%	0	540	NA	170 U	N	180 U	N	180 U	N	190 U	570 U R	N	170 U	N
Aroclor-1254	0.0%	0	1000	NA	340 U	N	370 U	N	360 U	N	380 U	1100 U R	N	350 U	N
Aroclor-1260	0.0%	0	1000	NA	340 U	N	370 U	N	360 U	N	380 U	1100 U R	N	350 U	N
Explosives (ug/kg)															
HMX	0.0%	0		NA	1000 U	N	1000 U	N	1000 U	N	1000 U	N	N	1000 U	N
RDX	3.6%	270		NA	120 U	N	120 U	N	120 U	N	270 J	N	N	120 U	N
1,3,5-Trinitrobenzene	3.6%	120		NA	120 U	N	120 U	N	120 U	N	120	N	N	120 U	N
1,3-Dinitrobenzene	0.0%	0		NA	120 U	N	120 U	N	120 U	N	120 U	N	N	120 U	N
Tetryl	0.0%	0		NA	400 U	N	400 U	N	400 U	N	400 U	N	N	400 U	N
2,4,6-Trinitrotoluene	0.0%	0		NA	120 U	N	120 U	N	120 U	N	120 U	N	N	120 U	N
4-amino-2,6-Dinitrotoluene	0.0%	0		NA	120 U	N	120 U	N	120 U	N	120 U	N	N	120 U	N
2-amino-4,6-Dinitrotoluene	0.0%	0		NA	120 U	N	120 U	N	120 U	N	120 U	N	N	120 U	N
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	N	120 U	N	120 U	N	120 U	N	N	120 U	N
2,4-Dinitrotoluene	42.9%	420		NA	130	N	210	N	330	N	77 J	N	N	140	N
Metals (mg/kg)															
Aluminum	100.0%	30200	17503.0	13	20100	N	18800	N	16500	N	20700	N	N	14200	N
Antimony	25.0%	15.3	5	7	6.6 J	N	15.3 J	N	6.4 J	N	5.7 U J	N	N	5.6 U J	N
Arsenic	89.3%	8.1	7.5	2	5.2	N	7.7	N	6.7	N	4.5	N	N	3.8	N
Barium	75.0%	34400	300	18	707 R	N	5650	N	2270	N	5180	N	N	785 R	N
Beryllium	42.9%	0.78	1	0	0.81 R	N	0.74 R	N	0.8 R	N	0.85 R	N	N	0.73 R	N
Cadmium	89.3%	10	1.8	23	4.5 J	N	10 J	N	4.9 J	N	6.9 J	N	N	3.8 J	N
Calcium	100.0%	71300	46825.0	2	37300	N	32800	N	34900	N	37800	N	N	32200	N
Chromium	92.9%	52.7	26.6	18	36.9 J	N	39.8 J	N	35.6 J	N	38.2 J	N	N	27.1 J	N
Cobalt	100.0%	33.4	30	2	17.2	N	13.7	N	13.9	N	13.8	N	N	12.5	N
Copper	85.7%	6560	25	24	104	N	520	N	235	N	6560	N	N	64.9	N
Iron	100.0%	95800	32698.0	12	39800	N	33800	N	33900	N	37400	N	N	33400	N
Lead	89.3%	2040	30	21	105	N	1840	N	530	N	117	N	N	74.3 R	N
Magnesium	100.0%	24100	9071.1	15	9150	N	12800	N	9580	N	12700	N	N	7730	N
Manganese	100.0%	1320	1065.8	1	432	N	464	N	419	N	445	N	N	376	N
Mercury	57.1%	1.1	0.1	13	0.13 R	N	0.07 R	N	0.11 R	N	0.19 R	N	N	0.15 R	N
Nickel	100.0%	57.3	41.3	13	55.2	N	46	N	50.1	N	55.5	N	N	45.4	N
Potassium	100.0%	3500	1529.6	14	1760 J	N	2160 J	N	2070 J	N	2190 J	N	N	1490 J	N
Selenium	60.7%	1.1	2	0	0.29 J	N	0.25 J	N	0.39 J	N	0.42 J	N	N	0.29 J	N
Silver	32.1%	1.2	0.6	6	0.45 J	N	0.89 J	N	0.62 J	N	1.2	N	N	0.36 U	N
Sodium	78.6%	376	76	18	202 J	N	376 J	N	296 J	N	189 J	N	N	106 J	N
Thallium	39.3%	38	0.3	11	0.48 J	N	0.54 J	N	38 J	N	0.39 U	N	N	0.61 J	N
Vanadium	100.0%	41.6	150	0	23.6 J	N	24.6 J	N	23.9 J	N	27.1 J	N	N	19.1 J	N
Zinc	100.0%	5790	89.1	28	245	N	2160	N	985	N	2100	N	N	262	N
Cyanide	0.0%	0	NA	NA	0.62 U	N	0.65 U	N	0.6 U	N	0.64 U	N	N	0.63 U	N

TABLE 4-12

PAD J
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS, PAD BORINGS, & GEOPHYSICAL ANOMALY EXCAVATIONS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD-J 0-6" 01/17/92 PBJ-7-1	PAD-J 0-6" 01/17/92 PBJ-7-1RE	PAD-J 0-2' 01/17/92 PBJ-7-2	PAD-J 0-2' 01/17/92 PBJ-7-2RE	PAD-J 0-6" 01/17/92 PBJ-8-1	PAD-J 0-2' 01/17/92 PBJ-8-2	OB 0-2 01/13/93 PBJ-9-1	OB 2-4 01/13/93 PBJ-9-2	OB 0-2 01/12/93 PBJ-10-1	OB 4-5 01/12/93 PBJ-10-3	GAE-J 1.0' 12/11/91 GAE-J-1
VOCs (ug/kg)															
Methylene Chloride	8.1%	5	100	0	5 U J	7 U J	10 U J	10 U J	7 U	10 U	12 U	12 U	12 U	11 U	6 U
Acetone	0.0%	0	200	0	11 U J	11 U J	20 U J	16 U J	13 U	12 U	12 U	12 U	12 U	11 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	5 U J	6 U J	5 U J	5 U J	7 U	6 U	12 U	12 U	12 U	11 U	6 U
Chloroform	10.8%	7	300	0	5 U J	6 U J	5 U J	7	7 U	6 U	12 U	12 U	12 U	11 U	6 U
2-Butanone	0.0%	0	300	0	11 U J	11 U J	11 U J	11 U J	13 U	12 U	12 U	12 U	12 U	11 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	5 U J	6 U J	5 U J	5 U J	7 U	6 U	12 U	12 U	12 U	11 U	6 U
Carbon Tetrachloride	5.4%	4	600	0	5 U J	6 U J	5 U J	5 U J	7 U	6 U	12 U	12 U	12 U	11 U	6 U
Trichloroethene	5.4%	7	700	0	5 U J	6 U J	5 U J	5 U J	7 U	6 U	12 U	12 U	12 U	11 U	6 U
Benzene	0.0%	0	60	0	5 U J	6 U J	5 U J	5 U J	7 U	6 U	12 U	12 U	12 U	11 U	6 U
Tetrachloroethene	5.4%	67	1400	0	5 U J	6 U J	5 U J	5 U J	7 U	6 U	12 U	12 U	12 U	11 U	6 U
Toluene	16.2%	3	1500	0	5 U J	6 U J	3 J	2 J	7 U	6 U	12 U	3 J	12 U	11 U	6 U
Chlorobenzene	0.0%	0	1700	0	5 U J	6 U J	5 U J	5 U J	7 U	6 U	12 U	12 U	12 U	11 U	6 U
Xylene (total)	2.7%	3	1200	0	5 U J	6 U J	3 J	5 U J	7 U	6 U	12 U	12 U	12 U	11 U	6 U
Semivolatiles (ug/kg)															
Phenol	0.0%	0	30 or MDL	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
2-Methylphenol	0.0%	0	100 or MDL	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
4-Methylphenol	0.0%	0	900	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
Benzoic acid	5.0%	88	2700	0	3600 U	N	3400 U	N	4200 U	3900 U	N	N	N	N	3800 U
Naphthalene	3.7%	26	13,000	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
2-Methylnaphthalene	0.0%	0	36,400	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
2-Chloronaphthalene	0.0%	0	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
2-Nitroaniline	0.0%	0	430 or MDL	0	3600 U	N	3400 U	N	4200 U	3900 U	950 U	870 U	N	930 U	3800 U
Acenaphthylene	0.0%	0	41,000	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
2,6-Dinitrotoluene	0.0%	0	1000	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
3-Nitroaniline	0.0%	0	500 or MDL	0	3600 U	N	3400 U	N	4200 U	3900 U	950 U	870 U	N	930 U	3800 U
Acenaphthene	0.0%	0	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	N	380 U	790 U
Dibenzofuran	0.0%	0	6200	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
2,4-Dinitrotoluene	10.7%	820	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Diethylphthalate	7.1%	24	7100	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	24 J	18 J	790 U
Fluorene	0.0%	0	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
N-Nitrosodiphenylamine	3.6%	81	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Hexachlorobenzene	0.0%	0	410	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	3600 U	N	3400 U	N	4200 U	3900 U	950 U	870 U	1000 U	930 U	3800 U
Phenanthrene	21.4%	270	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Anthracene	0.0%	0	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	N	390 U	360 U	420 U	380 U	N
Di-n-butylphthalate	17.9%	480	8100	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Fluoranthene	25.0%	330	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Pyrene	25.0%	230	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Butylbenzylphthalate	0.0%	0	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Benzo(a)anthracene	3.6%	86	220 or MDL	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Chrysene	17.9%	120	400	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
bis(2-Ethylhexyl)phthalate	46.4%	1100	50,000*	0	120 J	N	1100	N	190 J	430 J	530	360 U	420 U	380 U	790 U
Di-n-octylphthalate	0.0%	0	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Benzo(b)fluoranthene	10.7%	81	1100	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
benzo(k)fluoranthene	10.7%	96	1100	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Benzo(a)pyrene	3.6%	76	61 or MDL	1	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	750 U	N	700 U	N	870 U	800 U	390 U	360 U	420 U	380 U	790 U

TABLE 4-12

PAD J
SUMMARY OF COMPOUNDS DETECTED
BERM EXCAVATIONS, PAD BORINGS,
& GEOPHYSICAL ANOMALY EXCAVATIONS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	PAD-J 0-6" 01/17/92 PBJ-7-1	PAD-J 0-6" 01/17/92 PBJ-7-1RE	PAD-J 0-2' 01/17/92 PBJ-7-2	PAD-J 0-2' 01/17/92 PBJ-7-2RE	PAD-J 0-6" 01/17/92 PBJ-8-1	PAD-J 0-2' 01/17/92 PBJ-8-2	OB 0-2 01/13/93 PBJ-9-1	OB 2-4 01/13/93 PBJ-9-2	OB 0-2 01/12/93 PBJ-10-1	OB 4-5 01/12/93 PBJ-10-3	GAE-J 1.0' 12/11/91 GAE-J-1
Pesticides/PCBs (ug/kg)															
beta-BHC	0.0%	0	200	0	18 U	N	17 U	N	21 U	19 U	2 U	1.9 U	2.1 U	2 U	19 U
delta-BHC	0.0%	0	300	0	18 U	N	17 U	N	21 U	19 U	2 U	1.9 U	2.1 U	2 U	19 U
gamma-BHC (Lindane)	0.0%	0	60	0	18 U	N	17 U	N	21 U	19 U	2 U	1.9 U	2.1 U	2 U	19 U
Heptachlor	0.0%	0	100	0	18 U	N	17 U	N	21 U	19 U	2 U	1.9 U	2.1 U	2 U	19 U
Aldrin	0.0%	0	41	0	18 U	N	17 U	N	21 U	19 U	2 U	1.9 U	2.1 U	2 U	19 U
Heptachlor epoxide	0.0%	0	20	0	18 U	N	17 U	N	21 U	19 U	2 U	1.9 U	2.1 U	2 U	19 U
Endosulfan I	0.0%	0	900	0	18 U	N	17 U	N	21 U	19 U	2 U	1.9 U	2.1 U	2 U	19 U
Dieldrin	0.0%	0	44	0	36 U	N	34 U	N	42 U	39 U	3.9 U	3.6 U	4.2 U	3.8 U	38 U
4,4'-DDE	46.9%	830	2100	0	36 U	N	34 U	N	42 U	39 U	6.1	3.6 U	4.2 U	2.9 J	38 U
Endrin	3.1%	41	100	0	36 U	N	34 U	N	41 J	39 U	3.9 U	3.6 U	4.2 U	3.8 U	38 U
Endosulfan II	0.0%	0	900	0	36 U	N	34 U	N	42 U	39 U	3.9 U	3.6 U	4.2 U	3.8 U	38 U
4,4'-DDD	0.0%	0	2900	0	36 U	N	34 U	N	42 U	39 U	3.9 U	3.6 U	4.2 U	3.8 U	38 U
Endosulfan sulfate	0.0%	0	1000	0	36 U	N	34 U	N	42 U	39 U	3.9 U	3.6 U	4.2 U	3.8 U	38 U
4,4'-DDT	25.0%	320	2100	0	36 U	N	34 U	N	42 U	39 U	2.8 J	3.6 U	4.2 U	3.8 U	38 U
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	N	3.9 U	3.6 U	4.2 U	3.8 U	N
alpha-Chlordane	0.0%	0	540	NA	180 U	N	170 U	N	210 U	190 U	2 U	1.9 U	2.1 U	2 U	190 U
Aroclor-1254	0.0%	0	1000	NA	360 U	N	340 U	N	420 U	390 U	39 U	36 U	42 U	38 U	380 U
Aroclor-1260	0.0%	0	1000	NA	360 U	N	340 U	N	420 U	390 U	39 U	36 U	42 U	38 U	380 U
Explosives (ug/kg)															
HMX	0.0%	0		NA	1000 U J	N	1000 U	N	1000 U J	1000 U	120 U	120 U	120 U	120 U	1000 U
RDX	3.6%	270		NA	120 U J	N	120 U	N	120 U J	120 U	120 U	120 U	120 U	120 U	120 U
1,3,5-Trinitrobenzene	3.6%	120		NA	120 U J	N	120 U	N	120 U J	120 U	120 U	120 U	120 U	120 U	120 U
1,3-Dinitrobenzene	0.0%	0		NA	120 U J	N	120 U	N	120 U J	120 U	120 U	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	400 U J	N	400 U	N	400 U J	400 U	120 U	120 U	120 U	120 U	400 U
2,4,6-Trinitrotoluene	0.0%	0		NA	120 U J	N	120 U	N	120 U J	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	0.0%	0		NA	120 U J	N	120 U	N	120 U J	120 U	120 U	120 U	120 U	120 U	120 U
2-amino-4,6-Dinitrotoluene	0.0%	0		NA	120 U J	N	120 U	N	120 U J	120 U	120 U	120 U	120 U	120 U	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U J	N	120 U	N	120 U J	120 U	120 U	120 U	120 U	120 U	120 U
2,4-Dinitrotoluene	42.9%	420		NA	120 U J	N	120 U	N	71 J	120 U	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)															
Aluminum	100.0%	30200	17503.0	13	21900 J	N	17900 J	N	15700 J	14200 J	11900	10200	13300	13400	30200
Antimony	25.0%	15.3	5	7	10.3 J	N	5.7 U J	N	8.7 J	6.9 U J	6.1 UJ	5.5 UJ	6.1 UJ	5.8 UJ	8.2 U R
Arsenic	89.3%	8.1	7.5	2	5.6	N	5.1	N	4.7	4.9	4.8 J	6.2 J	4.4 J	4.4 J	6.2 J
Barium	75.0%	34400	300	18	10300 J	N	6130 J	N	7010 J	307 R	407	112	91.7	116	700 J
Beryllium	42.9%	0.78	1	0	0.78	N	0.64	N	0.66	0.7	0.58	0.5 J	0.59	0.59	1.1 R
Cadmium	89.3%	10	1.8	23	4.5	N	3.9	N	7	4.3	0.35 U	0.4 J	0.35 U	0.33 U	3.7
Calcium	100.0%	71300	46825.0	2	31000 J	N	28500 J	N	29800 J	7060 J	12700	70400	71300	35800	4140 J
Chromium	92.9%	52.7	26.6	18	32.1 J	N	27.8 J	N	26.9 J	18.3 J	19.6	16.3	19.2	24.2	33.7
Cobalt	100.0%	33.4	30	2	9.4	N	10.4	N	7.7	9.7	10.6	7.1	8.5	16.6	23
Copper	85.7%	6560	25	24	182	N	108 J	N	155	108 J	31.5 R	19.3 R	19.5 R	23 R	27.6 J
Iron	100.0%	95800	32698.0	12	31400	N	29800	N	25500	37100	23600	18700	24700	29900	33700 J
Lead	89.3%	2040	30	21	1370	N	453	N	317	34.9 R	28.8 J	17.2 J	20.2	25.2 J	50.4
Magnesium	100.0%	24100	9071.1	15	16600 J	N	13600 J	N	7970 J	4610 J	5470	9190	17400	7090	7050
Manganese	100.0%	1320	1065.8	1	536	N	423	N	533	645	401	308	474	512	646
Mercury	57.1%	1.1	0.1	13	0.02 J	N	0.02 J	N	0.33	1.1	0.15	0.11	0.11	0.08	0.74
Nickel	100.0%	57.3	41.3	13	47.6	N	46.9	N	31.4	24.9	34.3	26.5	29.4	46.1	31.8
Potassium	100.0%	3500	1529.6	14	1910	N	1360	N	1470	1210	1000	1020	902	822	3500
Selenium	60.7%	1.1	2	0	0.98 U J	N	0.2 J	N	0.21 U J	0.16 U J	0.24 J	0.2 UJ	0.23 UJ	0.23 UJ	0.31 J
Silver	32.1%	1.2	0.6	6	0.98 U	N	0.93 U	N	1.2 U	1.1 U	0.36 U	0.33 U	0.36 U	0.35 U	1.3 U
Sodium	78.6%	376	76	18	157 J	N	89.3 J	N	41.4 U	39.7 U	67.9 J	129 J	167 J	92 J	84.9 J
Thallium	39.3%	38	0.3	11	0.47 U	N	0.45 U	N	0.5 U	0.48 J	0.52 U	0.47 U	0.54 U	0.55 U	0.62 U
Vanadium	100.0%	41.6	150	0	21	N	17.3	N	19	23.1	19.8	15.5	20.3	17.5	41.6
Zinc	100.0%	5790	89.1	28	2170 J	N	3180 J	N	1840 J	333 J	91.4 J	70.8 J	62.3 J	56.2 J	139 J
Cyanide	0.0%	0	NA	NA	0.68 U	N	0.64 U	N	0.63 U	0.57 U	0.7 U	0.67 U	0.76 U	0.69 U	0.54 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

identified were found in the boring sample PBJ-7-2, collected from a depth of 0 to 2 feet near the northwest corner of the pad. This sample also had a concentration of benzo(a)pyrene estimated at 76 ug/kg that exceeded the TAGM limit of 61 ug/kg. This is the only instance of an SVOC that was found at a concentration above the TAGM limit.

Total SVOCs for all of the boring samples were also quite low. The highest total SVOC concentration was identified in the sample PBJ-6-2 where 1,419 ug/kg of SVOCs was found. The second highest total SVOC concentration for boring soils was identified in sample PBJ-7-2 where 1,100 ug/kg of bis(2-ethylhexyl)phthalate were detected. This was also the only SVOC identified in this sample.

For the berm excavations, SVOCs were identified within four of the five samples analyzed by level IV methods. Within the berm excavation samples, the total SVOC concentrations are all quite low. In samples where SVOCs were found, total concentrations range from a low of 88 ug/kg (BE-J-4) to a high of only 232 ug/kg (BE-J-13).

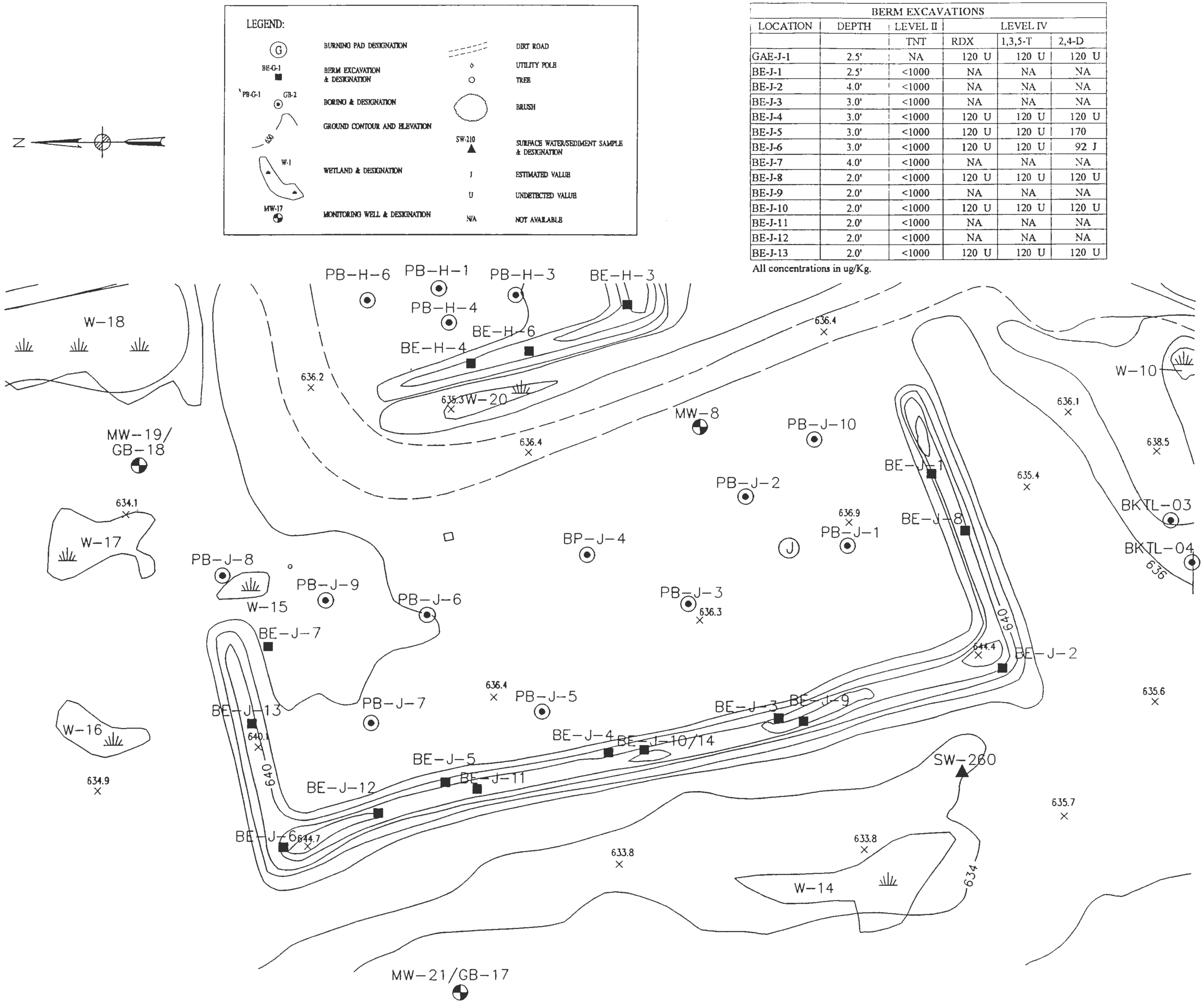
4.3.9.3 Pesticides/PCBs

Only 3 pesticides were detected in the soil samples collected at burning Pad J. All of the identified compounds were detected at estimated concentrations below the sample quantitation limits. The pesticide 4,4'-DDE was the most commonly detected compound being found in 13 of the 28 samples analyzed (47 percent) at a maximum estimated concentration of 830 ug/kg in sample PBJ-1-1. The second highest concentration of 4,4'-DDE was 79 ug/kg found in sample PBJ-6-1. The pesticide 4,4'-DDT was the second most commonly identified compound being found in 7 of the 28 samples analyzed (25 percent) at a maximum estimated concentration of 320 ug/kg also in sample PBJ-1-1DL.

4.3.9.4 Explosives

Figure 4-21 summarizes the explosives data for Pad J. Only three explosive compounds, 2,4-dinitrotoluene, RDX, and 1,3,5-trinitrobenzene were identified within the soil samples collected at Pad J. While RDX, and 1,3,5-trinitrobenzene were identified in only one soil sample (PBJ-6-1), 2,4-dinitrotoluene was found in 12 of the 28 samples analyzed (43 percent).

For the soil samples where explosives were detected, total explosives ranged from a low of 71 ug/kg in sample PBJ-8-1 to a high of 467 ug/kg in sample PBJ-6-1. The maximum



BERM EXCAVATIONS					
LOCATION	DEPTH	LEVEL II	LEVEL IV		
		TNT	RDX	1,3,5-T	2,4-D
GAE-J-1	2.5'	NA	120 U	120 U	120 U
BE-J-1	2.5'	<1000	NA	NA	NA
BE-J-2	4.0'	<1000	NA	NA	NA
BE-J-3	3.0'	<1000	NA	NA	NA
BE-J-4	3.0'	<1000	120 U	120 U	120 U
BE-J-5	3.0'	<1000	120 U	120 U	170
BE-J-6	3.0'	<1000	120 U	120 U	92 J
BE-J-7	4.0'	<1000	NA	NA	NA
BE-J-8	2.0'	<1000	120 U	120 U	120 U
BE-J-9	2.0'	<1000	NA	NA	NA
BE-J-10	2.0'	<1000	120 U	120 U	120 U
BE-J-11	2.0'	<1000	NA	NA	NA
BE-J-12	2.0'	<1000	NA	NA	NA
BE-J-13	2.0'	<1000	120 U	120 U	120 U

All concentrations in ug/Kg.

PAD BORINGS					
LOCATION	DEPTH	LEVEL II	LEVEL IV		
		TNT	RDX	1,3,5-T	2,4-D
PBJ-1	0-6"	NA	120 U	120 U	420
	0-2'	<1000	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA
PBJ-2	0-6"	NA	120 U	120 U	370
	0-2'	<1000	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA
	4-6'	<1000	NA	NA	NA
PBJ-3	0-6"	NA	120 U	120 U	300
	0-2'	<1000	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA
	4-6'	<1000	NA	NA	NA
PBJ-4	0-6"	NA	120 U	120 U	86 J
	0-2'	<1000	120 U	120 U	130
	2-4'	<1000	NA	NA	NA
	4-6'	<1000	NA	NA	NA
PBJ-5	0-6"	NA	120 U	120 U	210
	0-2'	<1000	120 U	120 U	330
	2-4'	<1000	NA	NA	NA
	4-6'	<1000	NA	NA	NA
PBJ-6	0-6"	NA	270 J	120	77 J
	0-2'	<1000	120 U	120 U	140
	2-4'	<1000	NA	NA	NA
	4-6'	<1000	NA	NA	NA
PBJ-7	0-6"	NA	120 UJ	120 UJ	120 UJ
	0-2'	<1000	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA
	4-6'	<1000	NA	NA	NA
	6-8'	<1000	NA	NA	NA
PBJ-8	0-6"	NA	120 UJ	120 UJ	71 J
	0-2'	<1000	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA
	4-6'	<1000	NA	NA	NA
PBJ-9	0-2'	NA	120 U	120 U	120 U
	2-4'	<1000	120 U	120 U	120 U
	4-6'	<1000	NA	NA	NA
PBJ-10	0-2'	NA	120 U	120 U	120 U
	2-4'	<1000	NA	NA	NA
	4-6'	<1000	120 U	120 U	120 U

All concentrations in ug/Kg.

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO 720446-01000

FIGURE 4-21
DISTRIBUTION OF EXPLOSIVES
OPEN BURNING PAD J

SCALE 1" = 60'

concentration for an individual compound was found in sample PBJ-1-1 where 420 ug/kg of 2,4-dinitrotoluene was reported. In all of the boring soil samples analyzed, with the exception of sample PBJ-6-1, 2,4-dinitrotoluene was always the highest concentration explosive detected.

Two soil boring samples collected from deeper (i.e., greater than 2 feet) horizons were analyzed by Level IV methods. These samples, PBJ-9-2 (2- to 4-foot depth), and PBJ-10-3 (4- to 5- foot depth) had no explosives detected based upon the Level IV analytical procedures. In addition, the Level II screening data performed on the 28 samples collected for the deeper horizons in borings had no explosives compounds identified above the 1,000 ug/kg detection limit.

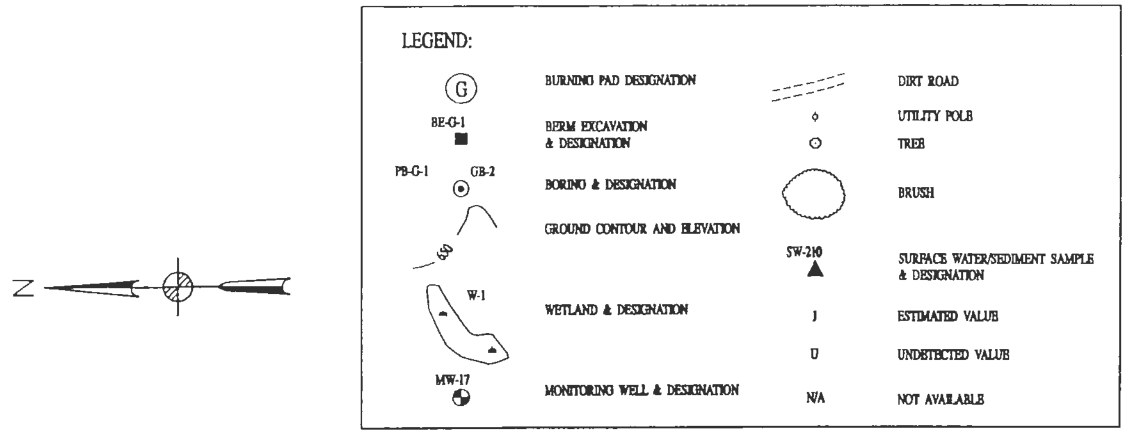
Of the six berm excavation soil samples analyzed by Level IV methods, only two had explosive compounds detected. Concentrations of 2,4-dinitrotoluene of 170 ug/kg (BE-J-5) and 92 ug/kg (BE-J-6) were the highest individual and total explosive concentrations reported. In addition, the Level II screening data performed on the remaining 7 berm excavations had no explosives reported above the 1,000 ug/kg detection limit.

4.3.9.5 Metals

Figure 4-22 summarizes the metals data for Pad J. Barium was found in 18 of the 21 valid results from samples collected at Pad J at concentrations above the TAGM value of 300 mg/kg. Copper was detected in all 24 valid results at concentrations above the TAGM value of 25 mg/kg. Lead was detected in 21 of the 28 samples at concentrations above the TAGM limit of 30 mg/kg. Finally, zinc was detected in 25 of the 28 samples at concentrations above the TAGM value of 89.1 mg/kg.

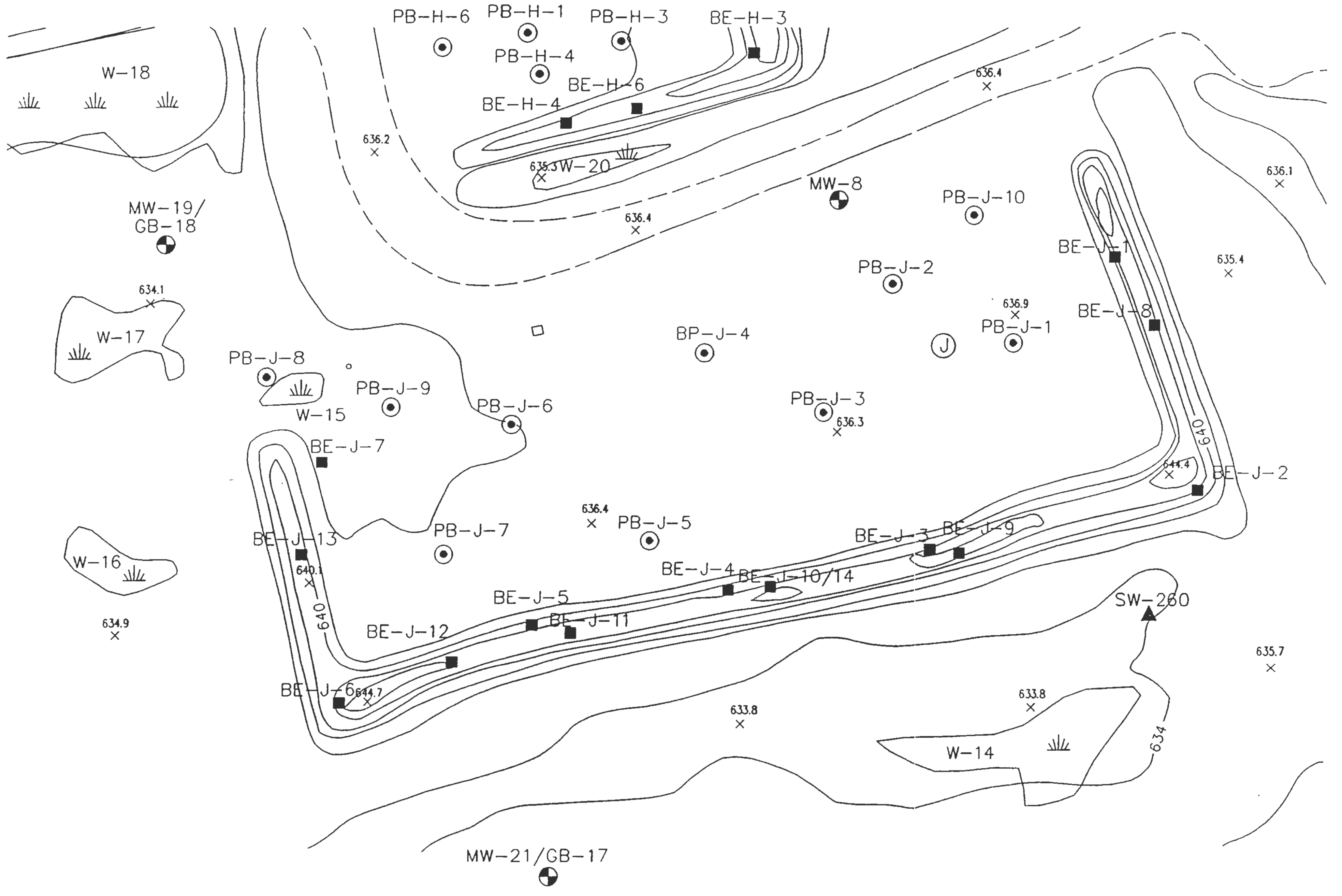
The analysis of these metals in the soil samples collected at Pad J suggests that high concentrations of these metals are present within both boring and berm excavation soil samples. No consistent distribution of metals in Pad J soils was observed.

Significantly elevated barium concentrations were identified in all of the berm excavation samples, and in the majority of the boring soil samples. A maximum concentration of 34,400 mg/kg of barium was identified in sample BE-J-14, the duplicate of sample BE-J-10. In general, the berm samples collected on Pad J generally show significantly higher concentrations of barium than do the boring soil samples. The average barium concentration



	BERM EXCAVATIONS					
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
GAE-J-1	2.5'	NA	700 J	27.6 J	50.4	139 J
BE-J-1	2.5'	18.6	NA	NA	NA	NA
BE-J-2	4.0'	16.7	NA	NA	NA	NA
BE-J-3	3.0'	19.1	NA	NA	NA	NA
BE-J-4	3.0'	22	213 R	29.8	32.4 J	138
BE-J-5	3.0'	690	136 R	137	644 J	903
BE-J-6	3.0'	30	470 R	59.9	48 J	156
BE-J-7	4.0'	NA	NA	NA	NA	NA
BE-J-8	2.0'	260	2200	54.1	363	446
BE-J-9	2.0'	20	NA	NA	NA	NA
BE-J-10	2.0'	NA	28300	231	347	3190
BE-J-11	2.0'	10.6	NA	NA	NA	NA
BE-J-12	2.0'	<10	NA	NA	NA	NA
BE-J-13	2.0'	146	22000	348	204	2390

All concentrations in mg/Kg.



	PAD BORINGS					
LOCATION	DEPTH	LEVEL II	LEVEL IV			
		Pb	Ba	Cu	Pb	Zn
PBJ-1	0-6"	NA	8130	143	356	1380
	0-2'	95	1660	58.4	80.9	246
	2-4'	36	NA	NA	NA	NA
PBJ-2	0-6"	NA	2520	137	266	512
	0-2'	230	351 R	69.3	115	344
	2-4'	17.4	NA	NA	NA	NA
	4-6'	11.9	NA	NA	NA	NA
PBJ-3	0-6"	NA	3470	435	448	5790
	0-2'	880	2830	158	29.2 R	700
	2-4'	21	NA	NA	NA	NA
	4-6'	17.9	NA	NA	NA	NA
PBJ-4	0-6"	NA	5610	262	1340	1510
	0-2'	85	707 R	104	105	245
	2-4'	15.6	NA	NA	NA	NA
	4-6'	11.9	NA	NA	NA	NA
PBJ-5	0-6"	NA	5650	520	1840	2160
	0-2'	450	2270	235	530	985
	2-4'	NA	NA	NA	NA	NA
	4-6'	24	NA	NA	NA	NA
PBJ-6	0-6"	NA	5180	6560	117	2100
	0-2'	51	785 R	64.9	74.3 R	262
	2-4'	<10	NA	NA	NA	NA
	4-6'	10.2	354 R	162	37.5 R	799
PBJ-7	0-6"	NA	10300 J	182	1370	2170 J
	0-2'	400	6130 J	108 J	453	3180 J
	2-4'	<10	NA	NA	NA	NA
	4-6'	27	NA	NA	NA	NA
	6-8'	48	NA	NA	NA	NA
PBJ-8	0-6"	NA	7010 J	155	317	1840 J
	0-2'	55	307 R	108 J	34.9 R	333 J
	2-4'	18.2	NA	NA	NA	NA
	4-6'	10.6	NA	NA	NA	NA
PBJ-9	0-2'	NA	407	31.5 R	28.8 J	91.4 J
	2-4'	25	112	19.3 R	17.2 J	70.8 J
	4-6'	15.9	NA	NA	NA	NA
PBJ-10	0-2'	NA	91.7	19.5 R	20.2	62.3 J
	2-4'	<10	NA	NA	NA	NA
	4-6'	15.7	116	23 R	25.2 J	56.2 J

All concentrations in mg/Kg.

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO 720446-01000

FIGURE 4-22
DISTRIBUTION OF METALS
OPEN BURNING PAD J

SCALE 1" = 60'

for the berm samples was 21,725 mg/kg versus an average of 3,658 mg/kg for boring soils. The boring samples PBJ-1-1 through PBJ-8-1 all had barium concentrations greater than 2,000 mg/kg. Only the boring samples PBJ-9-2, PBJ-10-1, and PBJ-10-3 had barium concentration below the TAGM limit of 300 mg/kg.

Two soil samples were collected from borings within horizons below the 2 foot depth. borings PB-J-9 and PB-J-10 had samples collected from both the surface soils and from the deeper horizons. At location PB-J-9, the deeper sample PBJ-9-2, collected from a depth of 2 to 4 feet, had a barium concentration of 112 mg/kg which is below the TAGM limit of 300 mg/kg. At location PB-J-10, the deeper sample PBJ-10-3, collected from a depth of 4 to 5 feet had a barium concentration of 116 mg/kg which is also below the TAGM limit of 300 mg/kg.

Only moderately elevated copper concentrations were identified in the berm excavation samples, and in the majority of the boring soil samples. While a maximum concentration of 6,560 mg/kg of copper was identified in sample BE-J-14, the second highest copper concentration was only 520 mg/kg reported in sample PBJ-5-1. The average copper concentration for the berm samples was 171 mg/kg versus an average of 548 mg/kg for boring soils.

As with copper, only moderately elevated lead concentrations were identified in the berm excavation samples, and in the majority of the boring soil samples. A maximum concentration of 2,040 mg/kg of lead was identified in sample BE-J-14, the duplicate of sample BE-J-10. The berm samples collected on Pad J show only moderately higher concentrations of lead than do the boring soil samples. The average lead concentration for the berm samples was 525 mg/kg versus an average of 415 mg/kg for boring soils. Other samples with elevated lead concentrations included PBJ-4-1 (1,340 mg/kg), PBJ-5-1 (1,840 mg/kg), and PBJ-7-1 (1,370 mg/kg).

At location PB-J-9, the deeper sample PBJ-9-2, collected from a depth of 2 to 4 feet had a lead concentration of 17.2 mg/kg which is below the TAGM limit of 30 mg/kg. At location PB-J-10, the deeper sample PBJ-10-3, collected from a depth of 4 to 5 feet had a lead concentration of only 25.2 mg/kg which is also below the TAGM limit of 30 mg/kg.

In conjunction with these data, Level II screening was performed on 20 samples collected from borings below a depth of 2 feet. Based upon these data, an average lead concentration of 16.9 mg/kg has been calculated. From these Level II data, only one sample, collected from

PB-J-7 from a depth interval of 6 to 8 feet, had a lead concentration (48 mg/kg) that exceeded the TAGM of 30 mg/kg.

Similar to the results for barium, elevated zinc concentrations were identified in most of the berm excavation samples, and in the majority of the boring soil samples. A maximum concentration of 5,790 mg/kg of barium was identified in sample PBJ-3-1. In general, the berm and boring soil samples have similar average zinc concentrations. For the berm samples, the average zinc concentration was 1,494 mg/kg while the average concentration for the boring samples was 1,151 mg/kg. Zinc concentrations in the boring samples PBJ-1-1, PBJ-3-1, PBJ-4-1, PBJ-5-1, PBJ-6-1, PBJ-7-1, and PBJ-8-1 were all above 1,000 mg/kg. Only the boring samples PBJ-9-2, PBJ-10-1, and PBJ-10-3 had zinc concentrations below the TAGM value of 89.1 mg/kg.

At location PB-J-9, the deeper sample PBJ-9-2, collected from a depth of 2 to 4 feet had a zinc concentration of 70.8 mg/kg which is below the TAGM value of 89.1 mg/kg. At location PB-J-10, the deeper sample PBJ-10-3, collected from a depth of 4 to 5 feet had a zinc concentration of 56.2 mg/kg which is also below the TAGM limit.

4.4 GRID BORINGS, LOW HILLS, AND SEDIMENTS

In order to evaluate the extent of off- pad contamination, the soil samples collected from grid borings and low hill excavations, along with the on-site sediment samples will be discussed as a whole. A review of these data has shown that there is a consistent, predictable distribution of semivolatile, explosive, and metal s present within these three data sets.

The soil samples collected from grid borings and monitoring wells, which were collected both at the ground surface and at depth, along with the sediment samples collected on-site have been used to explain the present understanding of the extent of contamination that has spread off the pads due to activities conducted at the OB grounds. The low hill excavation samples have been included within this group due to the known origin of this morphological feature. SEDA personnel have notified ES that the low hill has been developed over the years by continually scraping the surface soil around the pads and piling this material into the low hill. At present, it is felt that this activity has occurred at approximately 5 year intervals and has been performed to reduce the potential for fires at the site.

The following sections present the results of the Phase I and Phase II sampling conducted at the OB grounds. Summary analytical tables have been generated for the three sample types described above. The main discussion on the nature and extent of contamination has been developed around these tables. For some of the analytical data, i.e. total semivolatiles, total explosives, and the four metals barium, copper, lead, and zinc, composite maps have been developed to show the distribution of these compounds within the near surface soils and sediments.

4.4.1 Distribution of Volatile Organic Compounds

Table 4-13 summarizes the analytical results for the grid boring and monitoring well soil samples analyzed using Level IV methods. A total of 84 grid boring and monitoring well soil samples, 22 low hill samples, and 33 sediment samples were analyzed using Level IV methods.

For the grid borings, a total of 15 samples were found to have VOCs present. No volatile organic compounds were identified in grid boring and monitoring well soil samples at concentrations above the associated TAGM limits. The most commonly detected compounds were chloroform and tetrachloroethene, which were found in only 5 percent of the samples at maximum concentrations of 13 ug/kg and 15 ug/kg, respectively. These were also the second and third highest individual VOC concentrations identified on-site. The highest individual VOC concentration was for the compound trichloroethene which was found at a concentration of 100 ug/kg in the surface sample GB-25-1. This sample, in which only trichloroethene was found, also had the highest total VOCs.

Table 4-14 summarizes the analytical results for the low hill samples analyzed using Level IV methods. For the 22 low hill soil samples analyzed, no volatile organic compounds were identified.

Table 4-15 summarizes the analytical results for the sediment samples analyzed using Level IV methods. A total of 33 sediment samples were analyzed using Level IV methods for volatile organic compounds. No volatile organic compounds were identified in sediment samples at concentrations above the associated sediment criteria. VOCs were detected at low concentrations in 9 of the 33 samples analyzed. For sediments, chloroform was the most commonly identified VOC, being found in approximately 17 percent of the samples. Chloroform was found at an maximum estimated concentration of 20 ug/kg in the sample SW-

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB-01 0-6" 12/03/91 GB01-1	GB-01 2-4' 12/03/91 GB01-3	GB-02 0-6" 12/04/91 GB02-1	GB-02 O-2' 12/04/91 GB02-2	GB-02 4-6' 12/04/91 GB02-4	GB-2 0-2' 12/04/91 GB02-4RE	GB-03 0-6" 12/05/91 GB03-1	GB-03 0-2' 12/04/91 GB03-2	GB-3 0-2' 12/04/91 GB03-2RE	GB-04 0-6" 12/06/91 GB04-1	GB-04 6' + 12/05/91 GB04-5	GB-05 0-6" 12/06/91 GB05-1
VOCs (ug/kg)																
Methylene Chloride	2.1%	4	100	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Acetone	0.0%	0	200	0	13 U	11 U	13 U	12 U	11 U	N	11 U	12 U	N	12 U	12 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Chloroform	5.3%	13	300	0	7 U	6 U	6 U	6 U	10	N	6 U	6 U	N	6 U	6 U	6 U
2-Butanone	0.0%	0	300	0	13 U	11 U	13 U	12 U	11 U	N	11 U	12 U	N	12 U	12 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Carbon Tetrachloride	0.0%	0	600	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Trichloroethene	3.2%	100	700	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Benzene	0.0%	0	60	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Tetrachloroethene	5.3%	15	1400	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Toluene	3.2%	3	1500	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Chlorobenzene	0.0%	0	1700	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Xylene (total)	0.0%	0	1200	0	7 U	6 U	6 U	6 U	6 U	N	6 U	6 U	N	6 U	6 U	6 U
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
2-Methylphenol	0.0%	0	100 or MDL	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
4-Methylphenol	0.0%	0	900	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Benzoic acid	0.0%	0	2700	0	3800 U	3500 U	3900 U J	3800 U	3700 U R	3700 U J	3700 U	3500 U R	1700 U J	3800 U	3600 U	3900 U
Naphthalene	0.0%	0	13,000	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
2-Methylnapbthalene	0.0%	0	36,400	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
2-Chloronaphthalene	0.0%	0	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
2-Nitroaniline	0.0%	0	430 or MDL	0	3800 U	3500 U	3900 U J	3800 U	3700 U R	3700 U J	3700 U	3500 U R	1700 U J	3800 U	3600 U	3900 U
Acenaphthylene	0.0%	0	41,000	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
2,6-Dinitrotoluene	6.1%	340	1000	0	780 U	730 U	790 U J	790 U	770 U R	200 J	340 J	730 U R	110 J	780 U	750 U	800 U
3-Nitroaniline	0.0%	0	500 or MDL	0	3800 U	3500 U	3900 U J	3800 U	3700 U R	3700 U J	3700 U	3500 U R	1700 U J	3800 U	3600 U	3900 U
Acenaphthene	0.0%	0	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Dibenzofuran	0.0%	0	6200	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
2,4-Dinitrotoluene	13.1%	4200	50,000*	0	780 U	730 U	2000 J	790 U	770 U R	4200 J	7000	730 U R	2200 J	780 U	750 U	800 U
Diethylphthalate	11.1%	94	7100	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Fluorene	0.0%	0	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
N-Nitrosodiphenylamine	10.1%	1000	50,000*	0	780 U	730 U	340 J	790 U	770 U R	1000 J	1000	730 U R	510 J	780 U	750 U	800 U
Hexachlorobenzene	3.0%	90	410	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Pentachlorophenol	1.0%	140	1000 or MDL	0	3800 U	3500 U	3900 U J	3800 U	3700 U R	3700 U J	3700 U	3500 U R	1700 U J	3800 U	3600 U	3900 U
Phenanthrene	1.0%	290	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	290 J
Anthracene	1.0%	18	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	N	N	N	N	N	N	N
Di-n-butylphthalate	32.3%	1500	8100	0	780 U	730 U	1100 J	790 U	770 U R	1400 J	840	730 U R	1400 J	780 U	750 U	800 U
Fluoranthene	3.0%	480	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	480 J
Pyrene	3.0%	300	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	300 J
Butylbenzylphthalate	1.0%	64	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Benzo(a)anthracene	1.0%	200	220 or MDL	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	200 J
Chrysene	1.0%	250	400	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	250 J
bis(2-Ethylhexyl)phthalate	37.4%	1400	50,000*	0	780 U	780	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Di-n-octylphthalate	1.0%	19	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Benzo(b)fluoranthene	1.0%	180	1100	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	180 J
benzo(k)fluoranthene	1.0%	190	1100	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	190 J
Benzo(a)pyrene	1.0%	150	61 or MDL	1	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	150 J
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	780 U	730 U	790 U J	790 U	770 U R	770 U J	760 U	730 U R	360 U J	780 U	750 U	800 U

TABLE 4–13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB–01 0–6" 12/03/91 GB01–1	GB–01 2–4' 12/03/91 GB01–3	GB–02 0–6" 12/04/91 GB02–1	GB–02 O–2' 12/04/91 GB02–2	GB–02 4–6' 12/04/91 GB02–4	GB–2 0–2' 12/04/91 GB02–4RE	GB–03 0–6" 12/05/91 GB03–1	GB–03 0–2' 12/04/91 GB03–2	GB–3 0–2' 12/04/91 GB03–2RE	GB–04 0–6" 12/06/91 GB04–1	GB–04 6' + 12/05/91 GB04–5	GB–05 0–6" 12/06/91 GB05–1
Pesticides/PCBs (ug/kg)																
beta–BHC	0.0%	0	200	0	19 U	18 U	19 U	19 U	19 U	N	19 U	18 U	N	19 U	18 U	19 U
delta–BHC	0.0%	0	300	0	19 U	18 U	19 U	19 U	19 U	N	19 U	18 U	N	19 U	18 U	19 U
gamma–BHC (Lindane)	0.0%	0	60	0	19 U	18 U	19 U	19 U	19 U	N	19 U	18 U	N	19 U	18 U	19 U
Heptachlor	0.0%	0	100	0	19 U	18 U	19 U	19 U	19 U	N	19 U	18 U	N	19 U	18 U	19 U
Aldrin	1.1%	2.5	41	0	19 U	18 U	19 U	19 U	19 U	N	19 U	18 U	N	19 U	18 U	19 U
Heptachlor epoxide	0.0%	0	20	0	19 U	18 U	19 U	19 U	19 U	N	19 U	18 U	N	19 U	18 U	19 U
Endosulfan I	1.1%	1.3	900	0	19 U	18 U	19 U	19 U	19 U	N	19 U	18 U	N	19 U	18 U	19 U
Dieldrin	0.0%	0	44	0	38 U	35 U	39 U	38 U	37 U	N	37 U	35 U	N	38 U	36 U	39 U
4,4'–DDE	5.4%	32	2100	0	38 U	35 U	39 U	38 U	37 U	N	32 J	35 U	N	38 U	36 U	39 U
Endrin	0.0%	0	100	0	38 U	35 U	39 U	38 U	37 U	N	37 U	35 U	N	38 U	36 U	39 U
Endosulfan II	0.0%	0	900	0	38 U	35 U	39 U	38 U	37 U	N	37 U	35 U	N	38 U	36 U	39 U
4,4'–DDD	1.1%	4.2	2900	0	38 U	35 U	39 U	38 U	37 U	N	37 U	35 U	N	38 U	36 U	39 U
Endosulfan sulfate	0.0%	0	1000	0	38 U	35 U	39 U	38 U	37 U	N	37 U	35 U	N	38 U	36 U	39 U
4,4'–DDT	2.2%	5.3	2100	0	38 U	35 U	39 U	38 U	37 U	N	37 U	35 U	N	38 U	36 U	39 U
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	N	N	N	N	N	N	N
alpha–Chlordane	0.0%	0	540	0	190 U	180 U	190 U	190 U	190 U	N	190 U	180 U	N	190 U	180 U	190 U
Aroclor–1254	1.1%	430	1000	0	380 U	350 U	390 U	380 U	370 U	N	370 U	350 U	N	380 U	360 U	390 U
Aroclor–1260	1.1%	240	1000	0	380 U	350 U	390 U	380 U	370 U	N	370 U	350 U	N	380 U	360 U	390 U
Explosives (ug/kg)																
HMX	1.1%	75		NA	1000 U	1000 U	1000 U	1000 U	1200 U J	950 U J	1000 U	1100 U J	980 U J	1000 U	980 U	1000 U
RDX	4.4%	240		NA	120 U	120 U	120 U	120 U	150 U J	120 U J	120 U	140 U J	120 U J	120 U	120 U	120 U
1,3,5–Trinitrobenzene	7.8%	280		NA	120 U	120 U	82 J	120 U	150 U J	120 U J	184	280 J	150 J	120 U	120 U	120 U
1,3–Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	150 U J	120 U J	120 U	140 U J	120 U J	120 U	120 U	120 U
Tetryl	0.0%	0		NA	400 U	400 U	400 U	400 U	470 U J	380 U J	400 U	440 U J	390 U J	400 U	390 U	400 U
2,4,6–Trinitrotoluene	5.6%	350		NA	120 U	120 U	120 U	120 U	150 U J	120 U J	150	69 J	120 U J	120 U	120 U	120 U
4–amino–2,6–Dinitrotoluene	10.0%	430		NA	120 U	120 U	120 U	120 U	150 U J	120 U J	370	280 J	200 J	120 U	120 U	120 U
2–amino–4,6–Dinitrotoluene	13.3%	370		NA	120 U	120 U	85 J	73 J	150 U J	120 U J	370	300 J	200 J	120 U	120 U	120 U
2,6–Dinitrotoluene	1.1%	67	1000	0	120 U	120 U	120 U	120 U	150 U J	120 U J	120 U	140 U J	120 U J	67 J	120 U	120 U
2,4–Dinitrotoluene	13.3%	2400		NA	120 U	120 U	270	120 U	150 U J	120 U J	940	850 J	630 J	120 U	120 U	120 U
Metals (mg/kg)																
Aluminum	100.0%	25300	17503.0	33	12900	17500	20900	19000	16600	N	18600	14700	N	18500	15400	16100
Antimony	13.2%	26.6	5	12	12.7 U R	11.4 U R	19.6 R	13.4 U R	10.4 U R	N	6.8 U R	9.8 U R	N	8 U R	11.5 U R	8.2 U R
Arsenic	98.9%	18.5	7.5	8	6.6	4.7	18.5	5.3	3.8	N	4.9	6.1	N	5.1	3.8	5.8
Barium	91.2%	4520	300	15	226	365	2290	906	72.8	N	924	819	N	131	63.6	227
Beryllium	61.5%	1.1	1	1	0.9 R	1.1 R	0.88 R	1.2 R	1.1 R	N	0.83 R	0.9 R	N	0.91 R	1 R	0.7 R
Cadmium	56.0%	7	1.8	44	2.2	2.4	5.9	2.3	2.5	N	3.7	3.5	N	2.4	2.6	3.7
Calcium	100.0%	99000	46825.0	14	11200	10000	8270	6250	5050	N	17500	22200	N	17700	2160	61600
Chromium	100.0%	35.4	26.6	38	21.6	28.3	34.9	27.7	29.5	N	33.3	29.7	N	27.9	28.6	31.6
Cobalt	100.0%	26.6	30	0	10.4 J	9.2 J	12.8	9.5 J	19.3	N	13.4	10.6	N	15.1	15.9	11.8
Copper	100.0%	1680	25	72	1010	256	1060	399	42.8	N	109	108	N	34.1	34.5	730
Iron	100.0%	39700	32698.0	23	26700	32100	37700	28800	35800	N	30100	27600	N	32200	34100	26700
Lead	94.5%	6230	30	48	630	481	5310	3400	27.9	N	194	252	N	36.1	18.1	167
Magnesium	100.0%	16000	9071.1	10	5150	6060	7190	5870	7200	N	6620	6070	N	7290	7010	11200
Manganese	100.0%	1650	1065.8	6	360	449	597	380	466	N	611	499	N	516	336	503
Mercury	71.4%	1.1	0.1	18	0.13	0.04 J	0.15	0.14	0.04 U	N	0.09 J	0.14	N	0.04 U	0.04 U	0.04 U
Nickel	100.0%	76	41.3	38	33.8	39.6	45.4	34.6	62.4	N	40.1	39.1	N	47	55.5	36.6
Potassium	100.0%	3170	1529.6	35	1280	2010	2340	2030	1590	N	2360	1760	N	2540	1580	2150
Selenium	40.7%	1.5	2	0	0.16 U J	0.16 U J	0.91 J	1 U J	0.13 U J	N	0.16 U J	0.42 J	N	0.12 U J	0.22 U J	0.24 U J
Silver	7.7%	3.7	0.6	3	2.1 U	1.9 U	1.6 U	2.2 U	1.7 U	N	1.1 U	1.6 J	N	1.3 U	1.9 U	1.3 U
Sodium	72.5%	227	76	36	73.5 U	66.2 U	160 J	130 J	72.3 J	N	82.2 J	98.8 J	N	78.9 J	66.7 U	160 J
Thallium	9.9%	0.8	0.3	9	0.5 U	0.5 U	0.44 U	0.67 U	0.42 U	N	0.5 U	0.63 U	N	0.38 U	0.71 U	0.75 U
Vanadium	100.0%	38.6	150	0	20.4	28.1	26.7	29.7	24.2	N	25.8	18.1	N	27.3	19.8	25.7
Zinc	100.0%	1200	89.1	58	383	163	780	210	94.9	N	676	445	N	141	51	332
Cyanide	1.1%	2.6	NA	NA	0.67 U	0.61 U	0.7 U	0.62 U	0.51 U	N	0.65 U	0.58 U	N	0.65 U	0.6 U	0.62 U

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TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB-05 0-2' 12/05/91 GB05-2	GB-05 2-4' 12/05/91 GB-5-3	GB-06 0-6" 12/06/91 GB06-1	GB-06 6'+ 12/06/91 GB06-5	GB-07 0-6" 12/09/91 GB-07-1	GB-7 0-6" 12/09/91 GB-07-1RE	GB-07 0-2' 12/09/91 GB-07-2	GB-08 0-6" 12/09/91 GB-08-1	GB-08 0-6" 12/09/91 GB-08-1RE	GB-08 4-6' 12/09/91 GB-08-4	GB-09 0-6" 12/10/91 GB-09-1	GB-9 0-6" 12/10/91 GB-09-1RE
VOCs (ug/kg)																
Methylene Chloride	2.1%	4	100	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Acetone	0.0%	0	200	0	12 U	N	12 U	13 U	11 U	N	12 U	12 U J	12 U J	11 U	12 U	N
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Chloroform	5.3%	13	300	0	6 U	N	6 U	6 U	6 U	N	6 U	13 J	6 U J	6 U	6 U	N
2-Butanone	0.0%	0	300	0	12 U	N	12 U	13 U	11 U	N	12 U	12 U J	12 U J	11 U	12 U	N
1,1,1-Trichloroethane	0.0%	0	800	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Carbon Tetrachloride	0.0%	0	600	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Trichloroethene	3.2%	100	700	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Benzene	0.0%	0	60	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Tetrachloroethene	5.3%	15	1400	0	6 U	N	6 U	6 U	6 U	N	6 U	2 J	13 J	6 U	6 U	N
Toluene	3.2%	3	1500	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Chlorobenzene	0.0%	0	1700	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Xylene (total)	0.0%	0	1200	0	6 U	N	6 U	6 U	6 U	N	6 U	6 U J	6 U J	6 U	6 U	N
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
2-Methylphenol	0.0%	0	100 or MDL	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
4-Methylphenol	0.0%	0	900	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
2,4-Dimethylphenol	0.0%	0	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Benzoic acid	0.0%	0	2700	0	3700 U	N	3800 U	3900 U	4000 U R	2000 U J	3700 U	4100 U R	2000 U J	3700 U	4000 U R	2000 U J
Naphthalene	0.0%	0	13,000	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
2-Methylnaphthalene	0.0%	0	36,400	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
2-Chloronaphthalene	0.0%	0	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
2-Nitroaniline	0.0%	0	430 or MDL	0	3700 U	N	3800 U	3900 U	4000 U R	2000 U J	3700 U	4100 U R	2000 U J	3700 U	4000 U R	2000 U J
Acenaphthylene	0.0%	0	41,000	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
2,6-Dinitrotoluene	6.1%	340	1000	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
3-Nitroaniline	0.0%	0	500 or MDL	0	3700 U	N	3800 U	3900 U	4000 U R	2000 U J	3700 U	4100 U R	2000 U J	3700 U	4000 U R	2000 U J
Acenaphthene	0.0%	0	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Dibenzofuran	0.0%	0	6200	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
2,4-Dinitrotoluene	13.1%	4200	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	780 J	760 U	820 U R	410 U J
Diethylphthalate	11.1%	94	7100	0	760 U	N	780 U	800 U	830 U R	410 U J	94 J	840 U R	410 U J	760 U	820 U R	410 U J
Fluorene	0.0%	0	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
N-Nitrosodiphenylamine	10.1%	1000	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	260 J	760 U	820 U R	410 U J
Hexachlorobenzene	3.0%	90	410	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	90 J	760 U	820 U R	410 U J
Pentachlorophenol	1.0%	140	1000 or MDL	0	3700 U	N	3800 U	3900 U	4000 U R	2000 U J	3700 U	4100 U R	2000 U J	3700 U	4000 U R	2000 U J
Phenanthrene	1.0%	290	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Anthracene	1.0%	18	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	N	N	N	N	N	N	N
Di-n-butylphthalate	32.3%	1500	8100	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	73 J	760 U	820 U R	410 U J
Fluoranthene	3.0%	480	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Pyrene	3.0%	300	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Butylbenzylphthalate	1.0%	64	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Benzo(a)anthracene	1.0%	200	220 or MDL	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Chrysene	1.0%	250	400	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
bis(2-Ethylhexyl)phthalate	37.4%	1400	50,000*	0	300 J	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Di-n-octylphthalate	1.0%	19	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Benzo(b)fluoranthene	1.0%	180	1100	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
benzo(k)fluoranthene	1.0%	190	1100	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Benzo(a)pyrene	1.0%	150	61 or MDL	1	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	760 U	N	780 U	800 U	830 U R	410 U J	770 U	840 U R	410 U J	760 U	820 U R	410 U J

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB-05 0-2' 12/05/91 GB05-2	GB-05 2-4' 12/05/91 GB-5-3	GB-06 0-6" 12/06/91 GB06-1	GB-06 6'+ 12/06/91 GB06-5	GB-07 0-6" 12/09/91 GB-07-1	GB-7 0-6" 12/09/91 GB-07-1RE	GB-07 0-2' 12/09/91 GB-07-2	GB-08 0-6" 12/09/91 GB-08-1	GB-08 0-6" 12/09/91 GB-08-1RE	GB-08 4-6' 12/09/91 GB-08-4	GB-09 0-6" 12/10/91 GB-09-1	GB-9 0-6" 12/10/91 GB-09-1RE
Pesticides/PCBs (ug/kg)																
beta-BHC	0.0%	0	200	0	18 U	N	19 U	19 U	20 U	N	19 U	20 U	N	18 U	20 U	N
delta-BHC	0.0%	0	300	0	18 U	N	19 U	19 U	20 U	N	19 U	20 U	N	18 U	20 U	N
gamma-BHC (Lindane)	0.0%	0	60	0	18 U	N	19 U	19 U	20 U	N	19 U	20 U	N	18 U	20 U	N
Heptachlor	0.0%	0	100	0	18 U	N	19 U	19 U	20 U	N	19 U	20 U	N	18 U	20 U	N
Aldrin	1.1%	2.5	41	0	18 U	N	19 U	19 U	20 U	N	19 U	20 U	N	18 U	20 U	N
Heptachlor epoxide	0.0%	0	20	0	18 U	N	19 U	19 U	20 U	N	19 U	20 U	N	18 U	20 U	N
Endosulfan I	1.1%	1.3	900	0	18 U	N	19 U	19 U	20 U	N	19 U	20 U	N	18 U	20 U	N
Dieldrin	0.0%	0	44	0	37 U	N	38 U	39 U	40 U	N	37 U	41 U	N	37 U	40 U	N
4,4'-DDE	5.4%	32	2100	0	37 U	N	38 U	39 U	40 U	N	37 U	41 U	N	37 U	40 U	N
Endrin	0.0%	0	100	0	37 U	N	38 U	39 U	40 U	N	37 U	41 U	N	37 U	40 U	N
Endosulfan II	0.0%	0	900	0	37 U	N	38 U	39 U	40 U	N	37 U	41 U	N	37 U	40 U	N
4,4'-DDD	1.1%	4.2	2900	0	37 U	N	38 U	39 U	40 U	N	37 U	41 U	N	37 U	40 U	N
Endosulfan sulfate	0.0%	0	1000	0	37 U	N	38 U	39 U	40 U	N	37 U	41 U	N	37 U	40 U	N
4,4'-DDT	2.2%	5.3	2100	0	37 U	N	38 U	39 U	40 U	N	37 U	41 U	N	37 U	40 U	N
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	N	N	N	N	N	N	N
alpha-Chlordane	0.0%	0	540	0	180 U	N	190 U	190 U	200 U	N	190 U	200 U	N	180 U	200 U	N
Aroclor-1254	1.1%	430	1000	0	370 U	N	380 U	390 U	400 U	N	370 U	410 U	N	370 U	400 U	N
Aroclor-1260	1.1%	240	1000	0	370 U	N	380 U	390 U	400 U	N	370 U	240 J	N	370 U	400 U	N
Explosives (ug/kg)																
HMX	1.1%	75		NA	970 U	N	1000 U	960 U	1000 U	N	N	1000 U	N	N	1000 U	N
RDX	4.4%	240		NA	120 U	N	120 U	120 U	120 U	N	N	120 U	N	N	120 U	N
1,3,5-Trinitrobenzene	7.8%	280		NA	120 U	N	120 U	120 U	120 U	N	N	120 U	N	N	120 U	N
1,3-Dinitrobenzene	0.0%	0		NA	120 U	N	120 U	120 U	120 U	N	N	120 U	N	N	120 U	N
Tetryl	0.0%	0		NA	390 U	N	400 U	380 U	400 U	N	N	400 U	N	N	400 U	N
2,4,6-Trinitrotoluene	5.6%	350		NA	120 U	N	120 U	120 U	120 U	N	N	120 U	N	N	120 U	N
4-amino-2,6-Dinitrotoluene	10.0%	430		NA	120 U	N	120 U	120 U	120 U	N	N	86 J	N	N	120 U	N
2-amino-4,6-Dinitrotoluene	13.3%	370		NA	120 U	N	120 U	120 U	120 U	N	N	94 J	N	N	120 U	N
2,6-Dinitrotoluene	1.1%	67	1000	0	120 U	N	120 U	120 U	120 U	N	N	120 U	N	N	120 U	N
2,4-Dinitrotoluene	13.3%	2400		NA	120 U	N	120 U	120 U	120 U	N	N	120 U	N	N	120 U	N
Metals (mg/kg)																
Aluminum	100.0%	25300	17503.0	33	N	10100	21200	18300	17100	N	12800	16800	N	16500	17700	N
Antimony	13.2%	26.6	5	12	N	12.6 U R	6.7 U R	12 U R	13.1 U R	N	11.4 U R	13.1 U R	N	11.3 U R	13.3 U R	N
Arsenic	98.9%	18.5	7.5	8	N	3.1	5.2	4.6	5.9	N	2.8	4.8	N	4.1	4.6	N
Barium	91.2%	4520	300	15	N	73.9	103	94.1	199	N	69.2	348	N	169	131	N
Beryllium	61.5%	1.1	1	1	N	0.81 R	0.75 R	1.2 R	1.4 R	N	0.9 R	1.2 R	N	1.1 R	1.2 R	N
Cadmium	56.0%	7	1.8	44	N	1.8	1.8	2.8	2.7	N	1.8	3.2	N	2	3.2	N
Calcium	100.0%	99000	46825.0	14	N	90400	2580	22700	11100	N	83500	5490	N	31700	6040	N
Chromium	100.0%	35.4	26.6	38	N	18.1	23.2	31.6	26.1	N	21.9	26.1	N	24.5	25.2	N
Cobalt	100.0%	26.6	30	0	N	6.1 J	10.2	25.9	21.7	N	10.9	11 J	N	8.8 J	11.9 J	N
Copper	100.0%	1680	25	72	N	16	15.7	37.3	74.5	N	26.5	91.3	N	37.8	77.8	N
Iron	100.0%	39700	32698.0	23	N	19700	26900	39700	36800	N	25100	32200	N	27900	32000	N
Lead	94.5%	6230	30	48	N	12.4	12.4	22	110	N	18.1	184	N	182	31.7	N
Magnesium	100.0%	16000	9071.1	10	N	9360	4360	7720	8270	N	13300	5380	N	6950	5500	N
Manganese	100.0%	1650	1065.8	6	N	263	242	1110	1650	N	404	533	N	471	663	N
Mercury	71.4%	1.1	0.1	18	N	0.04 U	0.05 U	0.05 U	0.07 J	N	0.05 U	0.32	N	0.11 J	0.96	N
Nickel	100.0%	76	41.3	38	N	28.3	49.6	69.3	47.3	N	36.2	37.4	N	37.2	37.9	N
Potassium	100.0%	3170	1529.6	35	N	1450	1510	1560	1540	N	1460	1900	N	2400	2050	N
Selenium	40.7%	1.5	2	0	N	0.2 J	0.15 U J	0.13 U J	0.15 U J	N	0.12 U J	0.38 J	N	0.1 U J	0.2 J	N
Silver	7.7%	3.7	0.6	3	N	2 U	1.1 U	2 U	2.1 U	N	1.8 U	2.1 U	N	1.8 U	2.2 U	N
Sodium	72.5%	227	76	36	N	142 J	54.5 J	69.5 U	76 U	N	99.4 J	75.7 U	N	92 J	77.1 U	N
Thallium	9.9%	0.8	0.3	9	N	0.52 U	0.46 U	0.41 U	0.49 U	N	0.37 U	0.68 U	N	0.32 U	0.43 U	N
Vanadium	100.0%	38.6	150	0	N	18.8	32.3	19.3	26.2	N	21	28.4	N	25	26.8	N
Zinc	100.0%	1200	89.1	58	N	56	69.9	90.8	99.4	N	71.2	404	N	123	397	N
Cyanide	1.1%	2.6	NA	NA	N	0.69 U	0.63 U	0.7 U	0.7 U	N	0.65 U	0.67 U	N	0.66 U	0.74 U	N

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TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB-09 2-4' 12/10/91 GB-09-3	GB-10 0-6" 12/11/91 GB-10-1	GB-10 2-4' 12/11/91 GB-10-3	GB-11 0-6" 12/10/91 GB-11-1	GB-11 0-6" 12/10/91 GB-11-1RE	GB-11 2-4' 12/10/91 GB-11-3	GB-12 0-6" 12/16/91 GB-12-1	GB-12 0-6" 12/16/91 GB-12-1A	GB-12 0-2' 12/16/91 GB-12-2	GB-12 0-2' 12/16/91 GB-12-2RE	GB-12 0-2' 12/16/91 GB-12-2A	GB-13 0-6" 01/23/92 GB-13-1
VOCs (ug/kg)																
Methylene Chloride	2.1%	4	100	0	6 U	6 U	6 U	6 U	N	5 U	6 U	6 U	6 U	N	6 U	9 U
Acetone	0.0%	0	200	0	11 U	12 U	12 U	13 U	N	11 U	12 U	12 U	12 U	N	13 U	18 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	6 U	6 U	6 U	N	5 U	6 U	6 U	6 U	N	6 U	9 U
Chloroform	5.3%	13	300	0	6 U	6 U	6 U	6 U	N	5 U	6 U	8	6 U	N	6 U	9 U
2-Butanone	0.0%	0	300	0	11 U	12 U	12 U	13 U	N	11 U	12 U	12 U	12 U	N	13 U	18 U
1,1,1-Trichloroethane	0.0%	0	800	0	6 U	6 U	6 U	6 U	N	5 U	6 U	6 U	6 U	N	6 U	9 U
Carbon Tetrachloride	0.0%	0	600	0	6 U	6 U	6 U	6 U	N	5 U	6 U	6 U	6 U	N	6 U	9 U
Trichloroethene	3.2%	100	700	0	6 U	6 U	6 U	6 U	N	5 U	6 U	3 J	6 U	N	6 U	9 U
Benzene	0.0%	0	60	0	6 U	6 U	6 U	6 U	N	5 U	6 U	6 U	6 U	N	6 U	9 U
Tetrachloroethene	5.3%	15	1400	0	6 U	6 U	6 U	6 U	N	5 U	6 U	3 J	6 U	N	6 U	9 U
Toluene	3.2%	3	1500	0	6 U	6 U	6 U	6 U	N	5 U	6 U	6 U	6 U	N	6 U	9 U
Chlorobenzene	0.0%	0	1700	0	6 U	6 U	6 U	6 U	N	5 U	6 U	6 U	6 U	N	6 U	9 U
Xylene (total)	0.0%	0	1200	0	6 U	6 U	6 U	6 U	N	5 U	6 U	6 U	6 U	N	6 U	9 U
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
2-Methylphenol	0.0%	0	100 or MDL	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
4-Methylphenol	0.0%	0	900	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
Benzoic acid	0.0%	0	2700	0	3600 U	3800 U	3500 U	4100 U J	2000 U R	3400 U	3800 U	4000 U	3900 U J	3900 U R	3900 U	5000 U
Naphthalene	0.0%	0	13,000	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
2-Methylnaphthalene	0.0%	0	36,400	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
2-Chloronaphthalene	0.0%	0	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
2-Nitroaniline	0.0%	0	430 or MDL	0	3600 U	3800 U	3500 U	4100 U J	2000 U R	3400 U	3800 U	4000 U	3900 U J	3900 U R	3900 U	5000 U
Acenaphthylene	0.0%	0	41,000	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
2,6-Dinitrotoluene	6.1%	340	1000	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U J	810 U R	790 U	1000 U
3-Nitroaniline	0.0%	0	500 or MDL	0	3600 U	3800 U	3500 U	4100 U J	2000 U R	3400 U	3800 U	4000 U	3900 U	3900 U R	3900 U	5000 U
Acenaphthene	0.0%	0	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Dibenzofuran	0.0%	0	6200	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
2,4-Dinitrotoluene	13.1%	4200	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	130 J	820 U	810 U	810 U R	790 U	260 J
Diethylphthalate	11.1%	94	7100	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Fluorene	0.0%	0	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
N-Nitrosodiphenylamine	10.1%	1000	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	130 J
Hexachlorobenzene	3.0%	90	410	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Pentachlorophenol	1.0%	140	1000 or MDL	0	3600 U	3800 U	3500 U	4100 U J	2000 U R	3400 U	3800 U	4000 U	3900 U	3900 U R	3900 U	5000 U
Phenanthrene	1.0%	290	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Anthracene	1.0%	18	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	N	N	N	N	N	N	N
Di-n-butylphthalate	32.3%	1500	8100	0	730 U	790 U	730 U	850 U J	420 U R	700 U	490 J	460 J	86 J	810 U R	180 J	1000 U
Fluoranthene	3.0%	480	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Pyrene	3.0%	300	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Butylbenzylphthalate	1.0%	64	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Benzo(a)anthracene	1.0%	200	220 or MDL	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Chrysene	1.0%	250	400	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
bis(2-Ethylhexyl)phthalate	37.4%	1400	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	260 J	820 U	810 U	810 U R	790 U	520 J
Di-n-octylphthalate	1.0%	19	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Benzo(b)fluoranthene	1.0%	180	1100	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
benzo(k)fluoranthene	1.0%	190	1100	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Benzo(a)pyrene	1.0%	150	61 or MDL	1	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	730 U	790 U	730 U	850 U J	420 U R	700 U	790 U	820 U	810 U	810 U R	790 U	1000 U

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TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB-09 2-4' 12/10/91 GB-09-3	GB-10 0-6" 12/11/91 GB-10-1	GB-10 2-4' 12/11/91 GB-10-3	GB-11 0-6" 12/10/91 GB-11-1	GB-11 0-6" 12/10/91 GB-11-1RE	GB-11 2-4' 12/10/91 GB-11-3	GB-12 0-6" 12/16/91 GB-12-1	GB-12 0-6" 12/16/91 GB-12-1A	GB-12 0-2' 12/16/91 GB-12-2	GB-12 0-2' 12/16/91 GB-12-2RE	GB-12 0-2' 12/16/91 GB-12-2A	GB-13 0-6" 01/23/92 GB-13-1
Pesticides/PCBs (ug/kg)																
beta-BHC	0.0%	0	200	0	18 U	19 U	18 U	21 U	N	17 U	19 U	20 U	20 U	N	19 U	25 U J
delta-BHC	0.0%	0	300	0	18 U	19 U	18 U	21 U	N	17 U	19 U	20 U	20 U	N	19 U	25 U J
gamma-BHC (Lindane)	0.0%	0	60	0	18 U	19 U	18 U	21 U	N	17 U	19 U	20 U	20 U	N	19 U	25 U J
Heptachlor	0.0%	0	100	0	18 U	19 U	18 U	21 U	N	17 U	19 U	20 U	20 U	N	19 U	25 U J
Aldrin	1.1%	2.5	41	0	18 U	19 U	18 U	21 U	N	17 U	19 U	20 U	20 U	N	19 U	25 U J
Heptachlor epoxide	0.0%	0	20	0	18 U	19 U	18 U	21 U	N	17 U	19 U	20 U	20 U	N	19 U	25 U J
Endosulfan I	1.1%	1.3	900	0	18 U	19 U	18 U	21 U	N	17 U	19 U	20 U	20 U	N	19 U	25 U J
Dieldrin	0.0%	0	44	0	36 U	38 U	35 U	41 U	N	34 U	38 U	40 U	39 U	N	39 U	50 U J
4,4'-DDE	5.4%	32	2100	0	36 U	38 U	35 U	41 U	N	34 U	38 U	40 U	39 U	N	39 U	50 U J
Endrin	0.0%	0	100	0	36 U	38 U	35 U	41 U	N	34 U	38 U	40 U	39 U	N	39 U	50 U J
Endosulfan II	0.0%	0	900	0	36 U	38 U	35 U	41 U	N	34 U	38 U	40 U	39 U	N	39 U	50 U J
4,4'-DDD	1.1%	4.2	2900	0	36 U	38 U	35 U	41 U	N	34 U	38 U	40 U	39 U	N	39 U	50 U J
Endosulfan sulfate	0.0%	0	1000	0	36 U	38 U	35 U	41 U	N	34 U	38 U	40 U	39 U	N	39 U	50 U J
4,4'-DDT	2.2%	5.3	2100	0	36 U	38 U	35 U	41 U	N	34 U	38 U	40 U	39 U	N	39 U	50 U J
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	N	N	N	N	N	N	N
alpha-Chlordane	0.0%	0	540	0	180 U	190 U	180 U	210 U	N	170 U	190 U	200 U	200 U	N	190 U	250 U J
Aroclor-1254	1.1%	430	1000	0	360 U	380 U	350 U	410 U	N	340 U	380 U	400 U	390 U	N	390 U	500 U J
Aroclor-1260	1.1%	240	1000	0	360 U	380 U	350 U	410 U	N	340 U	380 U	400 U	390 U	N	390 U	500 U J
Explosives (ug/kg)																
HMX	1.1%	75		NA	N	1000 U	1000 U	1000 U	N	1000 U	1000 U	1000 U	1000 U	N	1000 U	1000 U J
RDX	4.4%	240		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U J
1,3,5-Trinitrobenzene	7.8%	280		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U J
1,3-Dinitrobenzene	0.0%	0		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U J
Tetryl	0.0%	0		NA	N	400 U	400 U	400 U	N	400 U	400 U	400 U	400 U	N	400 U	400 U J
2,4,6-Trinitrotoluene	5.6%	350		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U J
4-amino-2,6-Dinitrotoluene	10.0%	430		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U J
2-amino-4,6-Dinitrotoluene	13.3%	370		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U J
2,6-Dinitrotoluene	1.1%	67	1000	0	N	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	N	120 U	120 U J
2,4-Dinitrotoluene	13.3%	2400		NA	N	120 U	120 U	120 U	N	120 J	120 U	64 J	120 U	N	120 U	100 J
Metals (mg/kg)																
Aluminum	100.0%	25300	17503.0	33	14000	25300	16700	24600	N	18000	13200	15200	19100	N	19700	20300 J
Antimony	13.2%	26.6	5	12	11.6 U R	12.2 U R	5.4 U R	10.8 U R	N	5.4 U R	40 R	6.4 R	6 U R	N	6 U R	8.3 U J
Arsenic	98.9%	18.5	7.5	8	3.7	6.8 J	3.5 J	5.5 J	N	7.1 J	4.8 J	4.7 J	4.6 J	N	4.2 J	5.8
Barium	91.2%	4520	300	15	166	208 J	81.3 J	154 J	N	77.1 J	397 J	365 J	249 J	N	168 J	622 R
Beryllium	61.5%	1.1	1	1	0.94 R	1.1 R	0.79 R	1.3 R	N	0.97 R	0.74 R	0.87 R	0.79 R	N	0.84 R	0.97
Cadmium	56.0%	7	1.8	44	2.3	3.4	3.4	3.6	N	4	3	2.5	2.9	N	3.5	7
Calcium	100.0%	99000	46825.0	14	74700	4480 J	60300 J	3630 J	N	37800 J	3990 J	4450 J	2840 J	N	2850 J	8000 J
Chromium	100.0%	35.4	26.6	38	23.7	30.2	25.6	32.3	N	29.1	23.1	23.4	23.3	N	26.5	29.9 J
Cobalt	100.0%	26.6	30	0	26.6	10.3 J	16.1	17.4	N	23.4	12.9	11.5	14.1	N	12.4	14.1
Copper	100.0%	1680	25	72	30.9	29.6 J	23 J	24.8	N	26.5	345	233	79.9	N	89.8	863
Iron	100.0%	39700	32698.0	23	30000	30800 J	31600 J	36900 J	N	35400 J	30700 J	25600 J	26900 J	N	29900 J	35600
Lead	94.5%	6230	30	48	14.4	35.2	18	14.1	N	13.5	6230 J	672 J	171 J	N	185 J	2440
Magnesium	100.0%	16000	9071.1	10	9370	6870	8660	5730	N	7830	4420	5230	4700	N	5540	6140 J
Manganese	100.0%	1650	1065.8	6	1550	561	545	841	N	674	562	565	359	N	423	745
Mercury	71.4%	1.1	0.1	18	0.04 U	0.05 J	0.04 U	0.05 U	N	0.04 U	0.06 J	0.08	0.05 J	N	0.05 J	0.15
Nickel	100.0%	76	41.3	38	58.7	34.8	46.1	46.6	N	55.3	30.1	36.1	26.6	N	33.9	62.1
Potassium	100.0%	3170	1529.6	35	1880	3140	1470	2480	N	1410	1000	1200	1580	N	1750	1980
Selenium	40.7%	1.5	2	0	0.11 U J	0.16 U J	0.11 U J	0.2 U J	N	0.11 U J	0.19 J	0.13 J	0.22 J	N	0.16 J	0.33 J
Silver	7.7%	3.7	0.6	3	1.9 U	2 U	0.88 U	1.8 U	N	0.88 U	0.95 U	1 U	0.97 U	N	0.98 U	1.4 U
Sodium	72.5%	227	76	36	133 J	101 J	110 J	62.6 U	N	62.1 J	34 U	37.1 U	48.2 J	N	43.1 J	48.2 U
Thallium	9.9%	0.8	0.3	9	0.34 U	0.5 U	0.34 U	0.64 U	N	0.36 U	0.37 U	0.37 U	0.38 U	N	0.34 U	0.65 J
Vanadium	100.0%	38.6	150	0	21.6	38.6	20.3	36.3	N	21.4	19.7	22.6	29.5	N	27.4	28.2
Zinc	100.0%	1200	89.1	58	120	79.2 J	65.6 J	96.1 J	N	102 J	284 J	232 J	112 J	N	138 J	900 J
Cyanide	1.1%	2.6	NA	NA	0.63 U	0.73 U	0.63 U	0.7 U	N	0.53 U	0.67 U	0.66 U	0.53 U	N	0.67 U	0.95 U

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB-13 0-6" 01/23/92 GB-13-1RE	GB-13 0-2' 01/23/92 GB-13-2	GB-14 0-6" 12/16/91 GB-14-1	GB-14 0-6" 12/16/91 GB-14-1A	GB-14 0-6" 12/17/91 GB-14-1AR	GB-14 0-2' 12/16/91 GB-14-2	GB-14 0-2' 12/16/91 GB-14-2A	GB-15 0-6" 01/23/92 GB-15-1	GB-15 0-2' 01/23/92 GB-15-2	GB-16 0-6" 01/23/92 GB-16-1	GB-16 0-2' 01/23/92 GB-16-2	GB-17/MW21 0-6" 01/14/92 GB-17-1
VOCs (ug/kg)																
Methylene Chloride	2.1%	4	100	0	N	7 U	6 U	6 U	N	6 U	6 U	7 U	6 U	7 U	10 U	6 U
Acetone	0.0%	0	200	0	N	12 U	14 U	12 U	N	12 U	12 U	14 U	12 U	12 U	12 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Chloroform	5.3%	13	300	0	N	6 U	6 U	6 U	N	6 U	6 U	2 J	6 U	6 U	6 U	6 U
2-Butanone	0.0%	0	300	0	N	12 U	11 U	12 U	N	12 U	12 U	14 U	12 U	12 U	12 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Carbon Tetrachloride	0.0%	0	600	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Trichloroethene	3.2%	100	700	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Benzene	0.0%	0	60	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Tetrachloroethene	5.3%	15	1400	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Toluene	3.2%	3	1500	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Chlorobenzene	0.0%	0	1700	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Xylene (total)	0.0%	0	1200	0	N	6 U	6 U	6 U	N	6 U	6 U	7 U	6 U	6 U	6 U	6 U
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	N	810 U	740 U	730 U	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
2-Methylphenol	0.0%	0	100 or MDL	0	N	810 U	740 U	730 U	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
4-Methylphenol	0.0%	0	900	0	N	810 U	740 U	730 U	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	N	810 U	740 U	730 U	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Benzoic acid	0.0%	0	2700	0	N	3900 U	3600 U	3500 U J	3500 U R	3800 U	3700 U	4300 U	3700 U	4200 U	3800 U	3900 U
Naphthalene	0.0%	0	13,000	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
2-Methylnaphthalene	0.0%	0	36,400	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
2-Chloronaphthalene	0.0%	0	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
2-Nitroaniline	0.0%	0	430 or MDL	0	N	3900 U	3600 U	3500 U J	3500 U R	3800 U	3700 U	4300 U	3700 U	4200 U	3800 U	3900 U
Acenaphthylene	0.0%	0	41,000	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
2,6-Dinitrotoluene	6.1%	340	1000	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
3-Nitroaniline	0.0%	0	500 or MDL	0	N	3900 U	3600 U	3500 U J	3500 U R	3800 U	3700 U	4300 U	3700 U	4200 U	3800 U	3900 U
Acenaphthene	0.0%	0	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Dibenzofuran	0.0%	0	6200	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
2,4-Dinitrotoluene	13.1%	4200	50,000*	0	N	810 U	150 J	730 U J	260 R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Diethylphthalate	11.1%	94	7100	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Fluorene	0.0%	0	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
N-Nitrosodiphenylamine	10.1%	1000	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Hexachlorobenzene	3.0%	90	410	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Pentachlorophenol	1.0%	140	1000 or MDL	0	N	3900 U	3600 U	3500 U	3500 U R	3800 U	3700 U	4300 U	3700 U	4200 U	3800 U	3900 U
Phenanthrene	1.0%	290	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Anthracene	1.0%	18	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	N	N	N	N	N	N	N
Di-n-butylphthalate	32.3%	1500	8100	0	N	110 J	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Fluoranthene	3.0%	480	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Pyrene	3.0%	300	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Butylbenzylphthalate	1.0%	64	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Benzo(a)anthracene	1.0%	200	220 or MDL	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Chrysene	1.0%	250	400	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
bis(2-Ethylhexyl)phthalate	37.4%	1400	50,000*	0	N	290 J	740 U	730 U J	730 U R	770 U	760 U	620 J	970	430 J	860	810 U
Di-n-octylphthalate	1.0%	19	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Benzo(b)fluoranthene	1.0%	180	1100	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
benzo(k)fluoranthene	1.0%	190	1100	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Benzo(a)pyrene	1.0%	150	61 or MDL	1	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	N	810 U	740 U	730 U J	730 U R	770 U	760 U	880 U	770 U	870 U	790 U	810 U

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TABLE 4–13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB–13 0–6" 01/23/92 GB–13–1RE	GB–13 0–2' 01/23/92 GB–13–2	GB–14 0–6" 12/16/91 GB–14–1	GB–14 0–6" 12/16/91 GB–14–1A	GB–14 0–6" 12/17/91 GB–14–1AR	GB–14 0–2' 12/16/91 GB–14–2	GB–14 0–2' 12/16/91 GB–14–2A	GB–15 0–6" 01/23/92 GB–15–1	GB–15 0–2' 01/23/92 GB–15–2	GB–16 0–6" 01/23/92 GB–16–1	GB–16 0–2' 01/23/92 GB–16–2	GB–17/MW21 0–6" 01/14/92 GB–17–1
Pesticides/PCBs (ug/kg)																
beta–BHC	0.0%	0	200	0	25 U J	20 U	18 U	18 U	N	19 U	18 U	21 U	19 U	21 U	19 U	20 U
delta–BHC	0.0%	0	300	0	25 U J	20 U	18 U	18 U	N	19 U	18 U	21 U	19 U	21 U	19 U	20 U
gamma–BHC (Lindane)	0.0%	0	60	0	25 U J	20 U	18 U	18 U	N	19 U	18 U	21 U	19 U	21 U	19 U	20 U
Heptachlor	0.0%	0	100	0	25 U J	20 U	18 U	18 U	N	19 U	18 U	21 U	19 U	21 U	19 U	20 U
Aldrin	1.1%	2.5	41	0	25 U J	20 U	18 U	18 U	N	19 U	18 U	21 U	19 U	21 U	19 U	20 U
Heptachlor epoxide	0.0%	0	20	0	25 U J	20 U	18 U	18 U	N	19 U	18 U	21 U	19 U	21 U	19 U	20 U
Endosulfan I	1.1%	1.3	900	0	25 U J	20 U	18 U	18 U	N	19 U	18 U	21 U	19 U	21 U	19 U	20 U
Dieldrin	0.0%	0	44	0	51 U J	39 U	36 U	35 U	N	38 U	37 U	43 U	37 U	42 U	38 U	39 U
4,4'–DDE	5.4%	32	2100	0	51 U J	39 U	36 U	35 U	N	38 U	37 U	43 U	37 U	42 U	38 U	39 U
Endrin	0.0%	0	100	0	51 U J	39 U	36 U	35 U	N	38 U	37 U	43 U	37 U	42 U	38 U	39 U
Endosulfan II	0.0%	0	900	0	51 U J	39 U	36 U	35 U	N	38 U	37 U	43 U	37 U	42 U	38 U	39 U
4,4'–DDD	1.1%	4.2	2900	0	51 U J	39 U	36 U	35 U	N	38 U	37 U	43 U	37 U	42 U	38 U	39 U
Endosulfan sulfate	0.0%	0	1000	0	51 U J	39 U	36 U	35 U	N	38 U	37 U	43 U	37 U	42 U	38 U	39 U
4,4'–DDT	2.2%	5.3	2100	0	51 U J	39 U	36 U	35 U	N	38 U	37 U	43 U	37 U	42 U	38 U	39 U
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	N	N	N	N	N	N	N
alpha–Chlordane	0.0%	0	540	0	250 U J	200 U	180 U	180 U	N	190 U	180 U	210 U	190 U	210 U	190 U	200 U
Aroclor–1254	1.1%	430	1000	0	510 U J	390 U	360 U	350 U	N	380 U	370 U	430 U	370 U	420 U	380 U	390 U
Aroclor–1260	1.1%	240	1000	0	510 U J	390 U	360 U	350 U	N	380 U	370 U	430 U	370 U	420 U	380 U	390 U
Explosives (ug/kg)																
HMX	1.1%	75		NA	N	1000 U	1000 U	1000 U	N	1000 U	1000 U	1000 U J	1000 U	1000 U J	1000 U	1000 U
RDX	4.4%	240		NA	N	120 U	120 U	120 U	N	120 U	120 U	90 J	120 U	120 U J	120 U	120 U
1,3,5–Trinitrobenzene	7.8%	280		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U J	120 U	120 U J	120 U	120 U
1,3–Dinitrobenzene	0.0%	0		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U J	120 U	120 U J	120 U	120 U
Tetryl	0.0%	0		NA	N	400 U	400 U	400 U	N	400 U	400 U	400 U J	400 U	400 U J	400 U	400 U
2,4,6–Trinitrotoluene	5.6%	350		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U J	120 U	120 U J	120 U	120 U
4–amino–2,6–Dinitrotoluene	10.0%	430		NA	N	120 U	120 U	120 U	N	120 U	120 U	99 J	120 U	120 U J	120 U	120 U
2–amino–4,6–Dinitrotoluene	13.3%	370		NA	N	120 U	120 U	120 U	N	120 U	120 U	130 J	120 U	120 U J	120 U	120 U
2,6–Dinitrotoluene	1.1%	67	1000	0	N	120 U	120 U	120 U	N	120 U	120 U	120 U J	120 U	120 U J	120 U	120 U
2,4–Dinitrotoluene	13.3%	2400		NA	N	120 U	120 U	120 U	N	120 U	120 U	120 U J	120 U	120 U J	120 U	120 U
Metals (mg/kg)																
Aluminum	100.0%	25300	17503.0	33	N	18600 J	13000	10800	N	21000	17600	18900 J	16600 J	18500 J	13600 J	19000
Antimony	13.2%	26.6	5	12	N	6.8 U J	6 U R	5.9 U R	N	5.7 U R	6 U R	7 U J	9.2 J	6.8 U J	6.2 U J	6.4 U J
Arsenic	98.9%	18.5	7.5	8	N	5.8	3.9 J	3.9 J	N	4.3 J	5.1 J	5.9	3	4.4	4.1	5.3
Barium	91.2%	4520	300	15	N	325 R	78.5 J	51.5 J	N	148 J	92.7 J	384 R	255 R	929 R	127 R	551 R
Beryllium	61.5%	1.1	1	1	N	0.93	0.78 R	0.68 R	N	0.97 R	0.73 R	0.97	0.84	0.91	0.72	1.6 R
Cadmium	56.0%	7	1.8	44	N	3.8	2.5	2.2	N	3.4	3	2.4	2	2.7	1.8	3.9 J
Calcium	100.0%	99000	46825.0	14	N	6130 J	12300 J	12100 J	N	5790 J	8130 J	3820 J	18600 J	10200 J	43600 J	4040
Chromium	100.0%	35.4	26.6	38	N	27.9 J	23.5	19.8	N	27.6	25.9	24.6 J	22.3 J	25.5 J	17.1 J	25.9 J
Cobalt	100.0%	26.6	30	0	N	14.7	13.3	10.9	N	12.9	13.9	12.4	9	9.7	9.1	18.9
Copper	100.0%	1680	25	72	N	234	65.3	49.8	N	57.8	42	345	81.6 J	51.6 J	21.4 J	39.1
Iron	100.0%	39700	32698.0	23	N	32600	25200 J	22000 J	N	29900 J	28000 J	28300	26800	27200	20800	31700
Lead	94.5%	6230	30	48	N	1060	49.8	68.5	N	137	77.5	2340	985	30.5 R	10.8 R	98.4
Magnesium	100.0%	16000	9071.1	10	N	6210 J	5990	5270	N	5510	5620	5470 J	5890 J	6190 J	9610 J	6490
Manganese	100.0%	1650	1065.8	6	N	620	349	317	N	419	490	624	476	510	448	620
Mercury	71.4%	1.1	0.1	18	N	0.11	0.06 J	0.08 J	N	0.07 J	0.06 J	0.1 J	0.04 J	0.35	0.02 U	0.17 R
Nickel	100.0%	76	41.3	38	N	40.7	43.4	37.5	N	40.2	37.9	33.8	34.8	31.1	24.7	39.2
Potassium	100.0%	3170	1529.6	35	N	1710	1110	872	N	2130	1620	1900	1820	1670	1500	1430 J
Selenium	40.7%	1.5	2	0	N	0.28 J	0.46 J	0.39 J	N	0.14 J	0.19 J	0.33 J	0.15 J	12 U J	0.86 U J	0.19 U J
Silver	7.7%	3.7	0.6	3	N	1.1 U	0.98 U	0.96 U	N	0.92 U	0.97 U	1.1 U	0.98 U	1.1 U	1 U	0.41 U
Sodium	72.5%	227	76	36	N	39.4 U	34.8 U	34.3 U	N	43.1 J	52.4 J	40.7 U	34.9 U	39.4 U	36 U	86.2 J
Thallium	9.9%	0.8	0.3	9	N	0.5 J	0.37	0.39	N	0.33 U	0.32 U	0.53 U	0.31 J	0.67 J	0.41 U	0.46 U
Vanadium	100.0%	38.6	150	0	N	27.7	21.8	16.2	N	30.7	24.3	28.7	23.6	28.9	22.2	26.2 J
Zinc	100.0%	1200	89.1	58	N	491 J	251 J	173 J	N	113 J	102 J	150 J	123 J	308 J	72.1 J	149
Cyanide	1.1%	2.6	NA	NA	N	0.73 U	0.66 U	0.66 U	N	0.55 U	0.64 U	0.7 U	0.56 U	0.72 U	0.54 U	0.57 U

TABLE 4–13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB–17/MW21 0–2' 11/01/91 S110105	GB–18/MW19 0–6" 01/14/92 GB–18–1	GB–18/MW19 5–5.5' 10/31/91 S103104	GB–19 0–6" 01/14/92 GB–19–1	GB–20/MW29 0–6" 01/14/92 GB–20–1	GB20/MW29 2–4' 11/13/91 S1311106	GB21/MW30 0–2' 11/14/91 S1411110MW30	MW–31 0–2' 11/15/92 S1511115MW31	MW–32 0–2' 11/19/91 S1911118MW32	MW–34 0–2' 11/20/91 S2011121MW34	MW–34 0–2' 11/20/91 S2011121MW34RE
VOCs (ug/kg)															
Methylene Chloride	2.1%	4	100	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Acetone	0.0%	0	200	0	11 U	13 U	11 U J	13 U	13 U	11 U	18 U	17 U	12 U	12 U	N
1,2–Dichloroethene (total)	0.0%	0	300 (b)	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Chloroform	5.3%	13	300	0	6 U	7 U	5 U J	6 U	5 J	6 U	6 U	6 U	6 U	6 U	N
2–Butanone	0.0%	0	300	0	11 U	13 U	11 U J	13 U	13 U	11 U	12 U	12 U	12 U	12 U	N
1,1,1–Trichloroethane	0.0%	0	800	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Carbon Tetrachloride	0.0%	0	600	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Trichloroethene	3.2%	100	700	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Benzene	0.0%	0	60	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Tetrachloroethene	5.3%	15	1400	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Toluene	3.2%	3	1500	0	2 J	7 U	2 J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Chlorobenzene	0.0%	0	1700	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Xylene (total)	0.0%	0	1200	0	6 U	7 U	5 U J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	N
Semivolatiles (ug/kg)															
Phenol	0.0%	0	30 or MDL	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
2–Methylphenol	0.0%	0	100 or MDL	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
4–Methylphenol	0.0%	0	900	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
2,4–Dimethylphenol	0.0%	0	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Benzoic acid	0.0%	0	2700	0	3600 U	4700 U	3400 U	4400 U	4400 U	3600 U	3900 U	N	N	3500 U	N
Naphthalene	0.0%	0	13,000	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
2–Methylnaphthalene	0.0%	0	36,400	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
2–Chloronaphthalene	0.0%	0	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
2–Nitroaniline	0.0%	0	430 or MDL	0	3600 U	4700 U	3400 U	4400 U	4400 U	3600 U	3900 U	N	N	3500 U	N
Acenaphthylene	0.0%	0	41,000	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
2,6–Dinitrotoluene	6.1%	340	1000	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
3–Nitroaniline	0.0%	0	500 or MDL	0	3600 U	4700 U	3400 U	4400 U	4400 U	3600 U	3900 U	N	N	3500 U	N
Acenaphthene	0.0%	0	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Dibenzofuran	0.0%	0	6200	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
2,4–Dinitrotoluene	13.1%	4200	50,000*	0	730 U	960 U	710 U	280 J	900 U	750 U	790 U	N	N	730 U	N
Diethylphthalate	11.1%	94	7100	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Fluorene	0.0%	0	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
N–Nitrosodiphenylamine	10.1%	1000	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Hexachlorobenzene	3.0%	90	410	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Pentachlorophenol	1.0%	140	1000 or MDL	0	3600 U	4700 U	3400 U	4400 U	4400 U	3600 U	3900 U	N	N	3500 U	N
Phenanthrene	1.0%	290	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Anthracene	1.0%	18	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Carbazole	0.0%	0	50,000*	0	N	N	N	N	N	N	N	N	N	N	N
Di–n–butylphthalate	32.3%	1500	8100	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Fluoranthene	3.0%	480	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	78 J	N	N	730 U	N
Pyrene	3.0%	300	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	120 J	N	N	730 U	N
Butylbenzylphthalate	1.0%	64	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Benzo(a)anthracene	1.0%	200	220 or MDL	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Chrysene	1.0%	250	400	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
bis(2–Ethylhexyl)phthalate	37.4%	1400	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Di–n–octylphthalate	1.0%	19	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Benzo(b)fluoranthene	1.0%	180	1100	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
benzo(k)fluoranthene	1.0%	190	1100	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Benzo(a)pyrene	1.0%	150	61 or MDL	1	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Indeno(1,2,3–cd)pyrene	0.0%	0	3200	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	730 U	960 U	710 U	900 U	900 U	750 U	790 U	N	N	730 U	N

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	GB-17/MW21 0-2' 11/01/91 S110105	GB-18/MW19 0-6" 01/14/92 GB-18-1	GB-18/MW19 5-5.5' 10/31/91 S103104	GB-19 0-6" 01/14/92 GB-19-1	GB-20/MW29 0-6" 01/14/92 GB-20-1	GB20/MW29 2-4' 11/13/91 S1311106	GB21/MW30 0-2' 11/14/91 S1411110MW30	MW-31 0-2' 11/15/92 S1511115MW31	MW-32 0-2' 11/19/91 S1911118MW32	MW-34 0-2' 11/20/91 S2011121MW34	MW-34 0-2' 11/20/91 S2011121MW34RE
Pesticides/PCBs (ug/kg)															
beta-BHC	0.0%	0	200	0	18 U	23 U	17 U	22 U	22 U	18 U	19 U	N	N	18 U	18 U R
delta-BHC	0.0%	0	300	0	18 U	23 U	17 U	22 U	22 U	18 U	19 U	N	N	18 U	18 U R
gamma-BHC (Lindane)	0.0%	0	60	0	18 U	23 U	17 U	22 U	22 U	18 U	19 U	N	N	18 U	18 U R
Heptachlor	0.0%	0	100	0	18 U	23 U	17 U	22 U	22 U	18 U	19 U	N	N	18 U	18 U R
Aldrin	1.1%	2.5	41	0	18 U	23 U	17 U	22 U	22 U	18 U	19 U	N	N	18 U	18 U R
Heptachlor epoxide	0.0%	0	20	0	18 U	23 U	17 U	22 U	22 U	18 U	19 U	N	N	18 U	18 U R
Endosulfan I	1.1%	1.3	900	0	18 U	23 U	17 U	22 U	22 U	18 U	19 U	N	N	18 U	18 U R
Dieldrin	0.0%	0	44	0	36 U	47 U	34 U	44 U	44 U	36 U	39 U	N	N	35 U	36 U R
4,4'-DDE	5.4%	32	2100	0	36 U	47 U	34 U	44 U	44 U	36 U	20 J	N	N	35 U	36 U R
Endrin	0.0%	0	100	0	36 U	47 U	34 U	44 U	44 U	36 U	39 U	N	N	35 U	36 U R
Endosulfan 11	0.0%	0	900	0	36 U	47 U	34 U	44 U	44 U	36 U	39 U	N	N	35 U	36 U R
4,4'-DDD	1.1%	4.2	2900	0	36 U	47 U	34 U	44 U	44 U	36 U	39 U	N	N	35 U	36 U R
Endosulfan sulfate	0.0%	0	1000	0	36 U	47 U	34 U	44 U	44 U	36 U	39 U	N	N	35 U	36 U R
4,4'-DDT	2.2%	5.3	2100	0	36 U	47 U	34 U	44 U	44 U	36 U	39 U	N	N	35 U	36 U R
Endrin aldehyde	0.0%	0		NA	N	N	N	N	N	N	N	N	N	N	N
alpha-Chlordane	0.0%	0	540	0	180 U	230 U	170 U	220 U	220 U	180 U	190 U	N	N	180 U	180 U R
Aroclor-1254	1.1%	430	1000	0	360 U	470 U	340 U	440 U	440 U	360 U	390 U	N	N	350 U	360 U R
Aroclor-1260	1.1%	240	1000	0	360 U	470 U	340 U	440 U	440 U	360 U	390 U	N	N	350 U	360 U R
Explosives (ug/kg)															
HMX	1.1%	75		NA	120 U	1000 U	120 U	1000 U	1000 U	120 U	120 U	N	N	120 U	N
RDX	4.4%	240		NA	120 U	120 U	120 U	120 U	120 U	120 U	240	N	N	120 U	N
1,3,5-Trinitrobenzene	7.8%	280		NA	120 U	120 U	120 U	120 U	66 J	120 U	120 U	N	N	120 U	N
1,3-Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	N	N	120 U	N
Tetryl	0.0%	0		NA	120 U	400 U	120 U	400 U	400 U	120 U	120 U	N	N	120 U	N
2,4,6-Trinitrotoluene	5.6%	350		NA	120 U	120 U	120 U	120 U	350	120 U	120 U	N	N	120 U	N
4-amino-2,6-Dinitrotoluene	10.0%	430		NA	120 U	120 U	120 U	120 U	120 U	120 U	130	N	N	120 U	N
2-amino-4,6-Dinitrotoluene	13.3%	370		NA	120 U	120 U	120 U	120 U	120 U	120 U	110 J	N	N	120 U	N
2,6-Dinitrotoluene	1.1%	67	1000	0	120 U	120 U	120 U	120 U	120 U	120 U	120 U	N	N	120 U	N
2,4-Dinitrotoluene	13.3%	2400		NA	120 U	120 U	120 U	160	120 U	120 U	120 U	N	N	120 U	N
Metals (mg/kg)															
Aluminum	100.0%	25300	17503.0	33	18300	19100	17500	19200	21200	16900	16000	N	N	16100	N
Antimony	13.2%	26.6	5	12	9.7 U J	7.3 U J	8.1 U J	8.2 J	7 U J	11.4 U J	6.4 U J	N	N	5.7 J	N
Arsenic	98.9%	18.5	7.5	8	6.2	5	9.1	12.5	5.1	8.5	4	N	N	6.3 U	N
Barium	91.2%	4520	300	15	77.1	1740	96.9	1190	211 R	95.2	253	N	N	67.5	N
Beryllium	61.5%	1.1	1	1	0.84 J	1.1 R	0.88	1.1 R	1.2 R	1.1	0.94	N	N	0.86	N
Cadmium	56.0%	7	1.8	44	2.3	5.2 J	2.5	3.9 J	3.9 J	2.5	2.7	N	N	2.3	N
Calcium	100.0%	99000	46825.0	14	7540	8680	59100	6020	9770	86100	9150	N	N	28600	N
Chromium	100.0%	35.4	26.6	38	30	25.6 J	28.5	27 J	29.3 J	25.1	23.1	N	N	26.6	N
Cobalt	100.0%	26.6	30	0	17.2	13.1	15.8	11.2	14.2	10.9	11.5	N	N	17	N
Copper	100.0%	1680	25	72	28.1	82.4	27	619	50	28.7	74.7	N	N	32.7	N
Iron	100.0%	39700	32698.0	23	39700	29800	34900	28800	31600	26600	27900	N	N	35000	N
Lead	94.5%	6230	30	48	18.5	173	22.3	2370	82.6	16.1	316	N	N	11.9	N
Magnesium	100.0%	16000	9071.1	10	7930	5710	9870	6170	7010	8590	4790	N	N	6850	N
Manganese	100.0%	1650	1065.8	6	617	1100	546	796	695	498	620	N	N	803	N
Mercury	71.4%	1.1	0.1	18	0.06 R	1.1	0.04 U	0.19 R	0.13 R	0.04 U	0.16 R	N	N	0.07 R	N
Nickel	100.0%	76	41.3	38	50.7 J	26.8	52.9 J	31.3	40.4	59 J	30.9 J	N	N	49.3 J	N
Potassium	100.0%	3170	1529.6	35	1490	1950 J	2650	2460 J	2660 J	3170	2040	N	N	1290	N
Selenium	40.7%	1.5	2	0	0.13 U J	0.32 J	0.19 U J	0.64 J	0.36 J	0.16 U J	0.23 U J	N	N	0.18 U J	N
Silver	7.7%	3.7	0.6	3	1.4 U	0.46 U	1.2 U	0.44 U	0.45 U	1.7 U	0.96 U	N	N	0.87 J	N
Sodium	72.5%	227	76	36	74 U	59 J	147 J	66.5 J	64 J	196 J	52.8 J	N	N	55.2 J	N
Thallium	9.9%	0.8	0.3	9	0.35 U	0.69 U	0.53 U	0.8 J	0.57 J	0.46 U	0.64 U	N	N	0.51 U	N
Vanadium	100.0%	38.6	150	0	25.7	30.1 J	26.8	29.6 J	30.2 J	27.4	25.7	N	N	22.3	N
Zinc	100.0%	1200	89.1	58	71.2	62.1	100	399	175	86.3	220	N	N	95.7	N
Cyanide	1.1%	2.6	NA	NA	0.66 U	0.84 U	0.6 U	0.75 U	0.8 U	0.68 U	0.7 U	N	N	0.54 U	N

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-2 01/18/93 GB23-1	OB 2-4 01/18/93 GB23-2	OB 0-2 01/18/93 GB23-6	OB 0-2 01/18/93 GB24-1	OB 2-4 01/18/93 GB24-2	OB 0-2 01/18/93 GB25-1	OB 2-4 01/18/93 GB25-2	OB 0-2 01/19/93 GB26-1	OB 2-4 01/19/93 GB26-2	OB 0-2 01/19/93 GB26-4	OB 0-2 01/19/93 GB27-1	OB 4-6 01/19/93 GB27-3
VOCs (ug/kg)																
Methylene Chloride	2.1%	4	100	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Acetone	0.0%	0	200	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Chloroform	5.3%	13	300	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
2-Butanone	0.0%	0	300	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Carbon Tetrachloride	0.0%	0	600	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Trichloroethene	3.2%	100	700	0	12 U	12 U	13 U	12 U	12 U	100	78	13 U	12 U	12 U	12 U	12 U
Benzene	0.0%	0	60	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Tetrachloroethene	5.3%	15	1400	0	2 J	12 U	15 J	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Toluene	3.2%	3	1500	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Chlorobenzene	0.0%	0	1700	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Xylene (total)	0.0%	0	1200	0	12 U	12 U	13 U	12 U	12 U	12 U	12 U	13 U	12 U	12 U	12 U	12 U
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
2-Methylphenol	0.0%	0	100 or MDL	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
4-Methylphenol	0.0%	0	900	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Benzoic acid	0.0%	0	2700	0	N	N	N	N	N	N	N	N	N	N	N	N
Naphthalene	0.0%	0	13,000	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
2-Methylnaphthalene	0.0%	0	36,400	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
2-Chloronaphthalene	0.0%	0	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
2-Nitroaniline	0.0%	0	430 or MDL	0	1000 U	990 U	1000 U	950 U	880 U	970 U	890 U	980 U	980 U	990 U	950 U	940 U
Acenaphthylene	0.0%	0	41,000	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
2,6-Dinitrotoluene	6.1%	340	1000	0	41 J	410 U	290 J	210 J	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
3-Nitroaniline	0.0%	0	500 or MDL	0	1000 U	990 U	1000 U	950 U	880 U	970 U	890 U	980 U	980 U	990 U	950 U	940 U
Acenaphthene	0.0%	0	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Dibenzofuran	0.0%	0	6200	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
2,4-Dinitrotoluene	13.1%	4200	50,000*	0	330 J	410 U	3400	2300	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Diethylphthalate	11.1%	94	7100	0	420 U	410 U	67 J	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Fluorene	0.0%	0	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
N-Nitrosodiphenylamine	10.1%	1000	50,000*	0	190 J	410 U	380 J	260 J	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Hexachlorobenzene	3.0%	90	410	0	22 J	410 U	20 J	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Pentachlorophenol	1.0%	140	1000 or MDL	0	1000 U	990 U	1000 U	950 U	880 U	970 U	890 U	980 U	140 J	990 U	950 U	940 U
Phenanthrene	1.0%	290	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Anthracene	1.0%	18	50,000*	0	420 U	410 U	420 U	18 J	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Carbazole	0.0%	0	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Di-n-butylphthalate	32.3%	1500	8100	0	1000	66 J	1500	380 J	34 J	260 J	76 J	400 U	400 U	410 U	390 U	390 U
Fluoranthene	3.0%	480	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Pyrene	3.0%	300	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Butylbenzylphthalate	1.0%	64	50,000*	0	420 U	64 J	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Benzo(a)anthracene	1.0%	200	220 or MDL	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Chrysene	1.0%	250	400	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
bis(2-Ethylhexyl)phthalate	37.4%	1400	50,000*	0	400 J	360 J	460	290 J	120 J	420	190 J	870	400 U	1400	870	700
Di-n-octylphthalate	1.0%	19	50,000*	0	420 U	19 J	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Benzo(b)fluoranthene	1.0%	180	1100	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
benzo(k)fluoranthene	1.0%	190	1100	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Benzo(a)pyrene	1.0%	150	61 or MDL	1	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	420 U	410 U	420 U	390 U	360 U	400 U	370 U	400 U	400 U	410 U	390 U	390 U

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-2 01/18/93 GB23-1	OB 2-4 01/18/93 GB23-2	OB 0-2 01/18/93 GB23-6	OB 0-2 01/18/93 GB24-1	OB 2-4 01/18/93 GB24-2	OB 0-2 01/18/93 GB25-1	OB 2-4 01/18/93 GB25-2	OB 0-2 01/19/93 GB26-1	OB 2-4 01/19/93 GB26-2	OB 0-2 01/19/93 GB26-4	OB 0-2 01/19/93 GB27-1	OB 4-6 01/19/93 GB27-3
Pesticides/PCBs (ug/kg)																
beta-BHC	0.0%	0	200	0	2.2 U	2.1 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	2 U	2 U
delta-BHC	0.0%	0	300	0	2.2 U	2.1 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	2 U	2 U
gamma-BHC (Lindane)	0.0%	0	60	0	2.2 U	2.1 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Heptachlor	0.0%	0	100	0	2.2 U	2.1 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Aldrin	1.1%	2.5	41	0	2.2 U	2.1 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Heptachlor epoxide	0.0%	0	20	0	2.2 U	2.1 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Endosulfan I	1.1%	1.3	900	0	2.2 U	2.1 U	1.3 J	2 U	1.8 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Dieldrin	0.0%	0	44	0	4.2 U	4 U	4.2 U	3.9 U	3.6 U	4 U	3.6 U	4 U	4.1 U	4.1 U	3.9 U	3.9 U
4,4'-DDE	5.4%	32	2100	0	4.2 U	4 U	4.2 U	5.8	3.6 U	4 U	3.6 U	4 U	4.1 U	4.1 U	3.9 U	3.9 U
Endrin	0.0%	0	100	0	4.2 U	4 U	4.2 U	3.9 U	3.6 U	4 U	3.6 U	4 U	4.1 U	4.1 U	3.9 U	3.9 U
Endosulfan II	0.0%	0	900	0	4.2 U	4 U	4.2 U	3.9 U	3.6 U	4 U	3.6 U	4 U	4.1 U	4.1 U	3.9 U	3.9 U
4,4'-DDD	1.1%	4.2	2900	0	4.2 U	4 U	4.2 U	4.2	3.6 U	4 U	3.6 U	4 U	4.1 U	4.1 U	3.9 U	3.9 U
Endosulfan sulfate	0.0%	0	1000	0	4.2 U	4 U	4.2 U	3.9 U	3.6 U	4 U	3.6 U	4 U	4.1 U	4.1 U	3.9 U	3.9 U
4,4'-DDT	2.2%	5.3	2100	0	4.2 U	4 U	4.2 U	3.9 J	3.6 U	4 U	3.6 U	4 U	4.1 U	4.1 U	3.9 U	3.9 U
Endrin aldehyde	0.0%	0		NA	4.2 U	4 U	4.2 U	3.9 U	3.6 U	4 U	3.6 U	4 U	4.1 U	4.1 U	3.9 U	3.9 U
alpha-Chlordane	0.0%	0	540	0	2.2 U	2.1 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Aroclor-1254	1.1%	430	1000	0	42 U	40 U	430 J	39 U	36 U	40 U	36 U	40 U	41 U	41 U	39 U	39 U
Aroclor-1260	1.1%	240	1000	0	42 U	40 U	42 U	39 U	36 U	40 U	36 U	40 U	41 U	41 U	39 U	39 U
Explosives (ug/kg)																
HMX	1.1%	75		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
RDX	4.4%	240		NA	120 U	100 J	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3,5-Trinitrobenzene	7.8%	280		NA	260	120 U	200	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3-Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	5.6%	350		NA	100 J	120 U	57 J	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	10.0%	430		NA	430	120 U	280 J	64 J	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2-amino-4,6-Dinitrotoluene	13.3%	370		NA	370	120 U	270	140	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,6-Dinitrotoluene	1.1%	67	1000	0	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4-Dinitrotoluene	13.3%	2400		NA	2400 J	120 U	1200 J	260	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)																
Aluminum	100.0%	25300	17503.0	33	20500	17100	17700	19100	7440	15000	14900	16500	11900	17400	14500	13800
Antimony	13.2%	26.6	5	12	26.6 J	6.3 UJ	18.5 J	7.3 J	5.8 UJ	6.5 UJ	5.4 UJ	6.5 UJ	5.9 UJ	6.1 UJ	5.6 UJ	6.2 UJ
Arsenic	98.9%	18.5	7.5	8	7.7 J	4.1 J	5.9 J	4.2 J	1.5 J	4.1 J	2.2 J	6.5	5.2	5.4	5.9	4.6
Barium	91.2%	4520	300	15	4520	175 J	3070	1480	42.5 J	103 J	75.9 J	120	73.3	176	90.9	71.5
Beryllium	61.5%	1.1	1	1	0.74	0.77	0.69	0.9	0.4 J	0.7	0.66	0.91	0.57	0.89	0.71	0.64
Cadmium	56.0%	7	1.8	44	5.5	0.38 J	5.9	1	0.33 U	0.37 U	0.31 U	0.37 U	0.34 U	0.35 U	0.32 U	0.35 U
Calcium	100.0%	99000	46825.0	14	8600	9950	9120	5780	1060	38100	22900	4010	4070	4370	5680	41700
Chromium	100.0%	35.4	26.6	38	35.4	30.7	31.4	34.3	14.1	25.4	27.1	26.4	21.8	28.7	24.5	24.7
Cobalt	100.0%	26.6	30	0	12.9	14.8	10.5	13.1	13.6	10.6	15.8	13.2	11.4	16.5	12.4	11.8
Copper	100.0%	1680	25	72	1680	74.2	869	1400	27.4	39.1	41.7	30.1	40.8	41.2	32.3	33.1
Iron	100.0%	39700	32698.0	23	36100	33000	30400	32700	16100	29100	31400	31900	27600	34400	28200	26400
Lead	94.5%	6230	30	48	5200	163	3200	1310	17.9	57.2	22.1	67.5	21.5	32.7	16.8	17.7
Magnesium	100.0%	16000	9071.1	10	7510	7290	6290	7190	3460	7800	6830	5490	4800	6100	5790	8600
Manganese	100.0%	1650	1065.8	6	365	434	385	655	346	416	362	422 J	498	1270 J	659	421
Mercury	71.4%	1.1	0.1	18	0.41	0.11 J	0.27	0.2	0.03 J	0.04 J	0.04 J	0.06 J	0.03 U	0.06 J	0.06 J	0.03 U
Nickel	100.0%	76	41.3	38	39.5	55.1	39.7	49.1	32.7	45.4	54.7	40.9	41.2	49	45.6	41.3
Potassium	100.0%	3170	1529.6	35	1770	1360	1340	2060	592	1440	1300	1580	948	1740	1320	1640
Selenium	40.7%	1.5	2	0	1.5 J	0.9 J	0.45 J	0.88 J	0.3 J	0.75 J	0.58 J	0.15 UJ	0.16 UJ	0.27 UJ	0.22 UJ	0.16 UJ
Silver	7.7%	3.7	0.6	3	1 R	0.39 R	0.71 R	3.7	0.34 U	0.38 U	0.32 U	0.38 U	0.35 U	0.36 U	0.33 U	0.36 U
Sodium	72.5%	227	76	36	227 J	106 J	158 J	89.5 J	32.2 U	93.5 J	82.6 J	55.2 J	53.6 J	71.7 J	60.2 J	113 J
Thallium	9.9%	0.8	0.3	9	0.48 U	0.61 U	0.45 U	0.53 U	0.57 U	0.54 U	0.51 U	0.34 U	0.38 U	0.65 U	0.52 U	0.38 U
Vanadium	100.0%	38.6	150	0	28.3	24.7	26.5	30.4	10	22.6	20.2	27.5	20.3	29.3	22.9	20.7
Zinc	100.0%	1200	89.1	58	1200	123	992	375	45.4	103	56.7	90.3	87.9	93.4	99.4	93.9
Cyanide	1.1%	2.6	NA	NA	0.77 U	0.73 U	0.78 U	0.7 U	0.63 U	0.73 U	0.62 U	0.75 U	0.77 U	0.81 U	0.7 U	0.71 U

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-2 01/14/93 GB28-1	OB 2-4 01/14/93 GB28-2	OB 0-2 01/19/93 GB29-1	OB 2-4 01/19/93 GB29-2	OB 0-2 01/19/93 GB29-4	OB 0-2 01/18/93 GB30-1	OB 4-6 01/18/93 GB30-3	OB 0-2 01/15/93 GB31-1	OB 2-4 01/15/93 GB31-2	OB 0-2 01/15/93 GB32-1	OB 4-5 01/15/93 GB32-3	OB 0-2 01/18/93 GB33-1
VOCs (ug/kg)																
Methylene Chloride	2.1%	4	100	0	4 J	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	2 J	12 U
Acetone	0.0%	0	200	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Chloroform	5.3%	13	300	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
2-Butanone	0.0%	0	300	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Carbon Tetrachloride	0.0%	0	600	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Trichloroethene	3.2%	100	700	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Benzene	0.0%	0	60	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Tetrachloroethene	5.3%	15	1400	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Toluene	3.2%	3	1500	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Chlorobenzene	0.0%	0	1700	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Xylene (total)	0.0%	0	1200	0	11 U	12 U	12 U	11 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U	12 U
Semivolatiles (ug/kg)																
Phenol	0.0%	0	30 or MDL	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
2-Methylphenol	0.0%	0	100 or MDL	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
4-Methylphenol	0.0%	0	900	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Benzoic acid	0.0%	0	2700	0	N	N	N	N	N	N	N	N	N	N	N	N
Naphthalene	0.0%	0	13,000	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
2-Methylnaphthalene	0.0%	0	36,400	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
2-Chloronaphthalene	0.0%	0	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
2-Nitroaniline	0.0%	0	430 or MDL	0	920 U	890 U	1000 U	920 U	950 U	950 U	870 U	960 U	990 U	980 U	880 U	930 U
Acenaphthylene	0.0%	0	41,000	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
2,6-Dinitrotoluene	6.1%	340	1000	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
3-Nitroaniline	0.0%	0	500 or MDL	0	920 U	890 U	1000 U	920 U	950 U	950 U	870 U	960 U	990 U	980 U	880 U	930 U
Acenaphthene	0.0%	0	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Dibenzofuran	0.0%	0	6200	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
2,4-Dinitrotoluene	13.1%	4200	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	410	410 U	410 U	360 U	380 U
Diethylphthalate	11.1%	94	7100	0	380 U	370 U	420 U	380 U	30 J	26 J	23 J	400 U	410 U	410 U	360 U	21 J
Fluorene	0.0%	0	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
N-Nitrosodiphenylamine	10.1%	1000	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	100 J	410 U	410 U	360 U	380 U
Hexachlorobenzene	3.0%	90	410	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Pentachlorophenol	1.0%	140	1000 or MDL	0	920 U	890 U	1000 U	920 U	950 U	950 U	870 U	960 U	990 U	980 U	880 U	930 U
Phenanthrene	1.0%	290	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Anthracene	1.0%	18	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Carbazole	0.0%	0	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Di-n-butylphthalate	32.3%	1500	8100	0	380 U	25 J	30 J	61 J	22 J	37 J	60 J	23 J	120 J	410 U	24 J	22 J
Fluoranthene	3.0%	480	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Pyrene	3.0%	300	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Butylbenzylphthalate	1.0%	64	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Benzo(a)anthracene	1.0%	200	220 or MDL	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Chrysene	1.0%	250	400	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
bis(2-Ethylhexyl)phthalate	37.4%	1400	50,000*	0	380 U	370 U	280 J	230 J	140 J	150 J	200 J	400 U	610	410 U	360 U	360 J
Di-n-octylphthalate	1.0%	19	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Benzo(b)fluoranthene	1.0%	180	1100	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
benzo(k)fluoranthene	1.0%	190	1100	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Benzo(a)pyrene	1.0%	150	61 or MDL	1	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	380 U	370 U	420 U	380 U	390 U	390 U	360 U	400 U	410 U	410 U	360 U	380 U

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TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-2 01/14/93 GB28-1	OB 2-4 01/14/93 GB28-2	OB 0-2 01/19/93 GB29-1	OB 2-4 01/19/93 GB29-2	OB 0-2 01/19/93 GB29-4	OB 0-2 01/18/93 GB30-1	OB 4-6 01/18/93 GB30-3	OB 0-2 01/15/93 GB31-1	OB 2-4 01/15/93 GB31-2	OB 0-2 01/15/93 GB32-1	OB 4-5 01/15/93 GB32-3	OB 0-2 01/18/93 GB33-1
Pesticides/PCBs (ug/kg)																
beta-BHC	0.0%	0	200	0	1.9 U	1.9 U	2.2 U	1.9 U	2 U	2 U	1.8 U	2.1 U	2.1 U	2.1 U	1.9 U	2 U
delta-BHC	0.0%	0	300	0	1.9 U	1.9 U	2.2 U	1.9 U	2 U	2 U	1.8 U	2.1 U	2.1 U	2.1 U	1.9 U	2 U
gamma-BHC (Lindane)	0.0%	0	60	0	1.9 U	1.9 U	2.2 U	1.9 U	2 U	2 U	1.8 U	2.1 U	2.1 U	2.1 U	1.9 U	2 U
Heptachlor	0.0%	0	100	0	1.9 U	1.9 U	2.2 U	1.9 U	2 U	2 U	1.8 U	2.1 U	2.1 U	2.1 U	1.9 U	2 U
Aldrin	1.1%	2.5	41	0	1.9 U	1.9 U	2.2 U	1.9 U	2 U	2 U	1.8 U	2.1 U	2.1 U	2.1 U	1.9 U	2 U
Heptachlor epoxide	0.0%	0	20	0	1.9 U	1.9 U	2.2 U	1.9 U	2 U	2 U	1.8 U	2.1 U	2.1 U	2.1 U	1.9 U	2 U
Endosulfan I	1.1%	1.3	900	0	1.9 U	1.9 U	2.2 U	1.9 U	2 U	2 U	1.8 U	2.1 U	2.1 U	2.1 U	1.9 U	2 U
Dieldrin	0.0%	0	44	0	3.7 U	3.7 U	4.2 U	3.8 U	3.9 U	3.9 U	3.6 U	4 U	4.1 U	4 U	3.7 U	3.9 U
4,4'-DDE	5.4%	32	2100	0	3.7 U	3.7 U	4.2 U	3.8 U	3.9 U	3.9 U	3.6 U	2.4 J	4.1 U	4 U	3.7 U	3.9 U
Endrin	0.0%	0	100	0	3.7 U	3.7 U	4.2 U	3.8 U	3.9 U	3.9 U	3.6 U	4 U	4.1 U	4 U	3.7 U	3.9 U
Endosulfan II	0.0%	0	900	0	3.7 U	3.7 U	4.2 U	3.8 U	3.9 U	3.9 U	3.6 U	4 U	4.1 U	4 U	3.7 U	3.9 U
4,4'-DDD	1.1%	4.2	2900	0	3.7 U	3.7 U	4.2 U	3.8 U	3.9 U	3.9 U	3.6 U	4 U	4.1 U	4 U	3.7 U	3.9 U
Endosulfan sulfate	0.0%	0	1000	0	3.7 U	3.7 U	4.2 U	3.8 U	3.9 U	3.9 U	3.6 U	4 U	4.1 U	4 U	3.7 U	3.9 U
4,4'-DDT	2.2%	5.3	2100	0	3.7 U	3.7 U	4.2 U	3.8 U	3.9 U	3.9 U	3.6 U	4 U	4.1 U	4 U	3.7 U	3.9 U
Endrin aldehyde	0.0%	0		NA	3.7 U	3.7 U	4.2 U	3.8 U	3.9 U	3.9 U	3.6 U	4 U	4.1 U	4 U	3.7 U	3.9 U
alpha-Chlordane	0.0%	0	540	0	1.9 U	1.9 U	2.2 U	1.9 U	2 U	2 U	1.8 U	2.1 U	2.1 U	2.1 U	1.9 U	2 U
Aroclor-1254	1.1%	430	1000	0	37 U	37 U	42 U	38 U	39 U	39 U	36 U	40 U	41 U	40 U	37 U	39 U
Aroclor-1260	1.1%	240	1000	0	37 U	37 U	42 U	38 U	39 U	39 U	36 U	40 U	41 U	40 U	37 U	39 U
Explosives (ug/kg)																
HMX	1.1%	75		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
RDX	4.4%	240		NA	120 U	120 U	98 J	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3,5-Trinitrobenzene	7.8%	280		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3-Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	5.6%	350		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	10.0%	430		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2-amino-4,6-Dinitrotoluene	13.3%	370		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,6-Dinitrotoluene	1.1%	67	1000	0	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4-Dinitrotoluene	13.3%	2400		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)																
Aluminum	100.0%	25300	17503.0	33	11000	11600	14200	11400	13000	10900	15000	9880	16400	15200	9750	10700
Antimony	13.2%	26.6	5	12	5.9 UJ	5.3 UJ	6.6 J	6.1 UJ	6.4 UJ	5.8 UJ	5.4 UJ	6.4 UJ	5.7 J	6.2 UJ	6.1 UJ	5.9 UJ
Arsenic	98.9%	18.5	7.5	8	2.2 J	3.3 J	6.4 J	5 J	5.3 J	5.2 J	4 J	7.3 J	2.5 J	6.5 J	4.6 J	4.9 J
Barium	91.2%	4520	300	15	73.4 J	72.9 J	395 J	44.6 J	293 J	100 J	56 J	97.6 J	83.2 J	196 J	65.7 J	70.4 J
Beryllium	61.5%	1.1	1	1	0.55	0.55	0.71	0.49 J	0.56 J	0.55	0.67	0.6	0.79	0.74	0.44 J	0.51 J
Cadmium	56.0%	7	1.8	44	0.34 U	0.31 U	0.35 U	0.35 U	0.37 U	0.33 U	0.31 U	0.37 U	0.32 U	0.35 U	0.35 U	0.34 U
Calcium	100.0%	99000	46825.0	14	75600	54300	23500	1480	25200	99000	6610	1960	10400	60900	61600	82600
Chromium	100.0%	35.4	26.6	38	17.4	20.4	23.6	21	20.6	17.6	27.2	14.4	30.2	21.3	17.4	17.1
Cobalt	100.0%	26.6	30	0	10.3	9.6	13	12.8	9.8	8.4	16	10.1	16.7	10.8	7.3	9.1
Copper	100.0%	1680	25	72	24.6	30.3	179	27.5	104	19.5	36.5	20.2	33.4	33.7	22.2	23.1
Iron	100.0%	39700	32698.0	23	21200	24700	28100	24400	23500	21100	31600	20600	34100	27000	19400	21400
Lead	94.5%	6230	30	48	12.9	15.2	457	26.2	209	11.4	23.1	33.6 R	36.5 R	54.6	26.1 R	17.1
Magnesium	100.0%	16000	9071.1	10	11300	8030	7920	5250	6780	12300	7400	3050	7040	16000	8670	7820
Manganese	100.0%	1650	1065.8	6	440	363	721	233	476	475	381	511	630	737	304	455
Mercury	71.4%	1.1	0.1	18	0.05 J	0.04 J	0.04 J	0.04 J	0.06 J	0.03 U	0.04 J	0.06 J	0.03 J	0.04 J	0.04 J	0.03 J
Nickel	100.0%	76	41.3	38	34.4	37.9	41.6	45	32.6	28.9	61.8	20.1	54.1	32.6	30.3	32.5
Potassium	100.0%	3170	1529.6	35	1270	1050	1440	909	1280	1230	1230	646	1100	1250	1050	1260
Selenium	40.7%	1.5	2	0	0.63 J	0.73 J	0.52 J	0.22 UJ	0.22 UJ	0.23 UJ	0.19 UJ	0.7 J	0.69 J	0.66 J	0.77 J	0.19 UJ
Silver	7.7%	3.7	0.6	3	0.35 U	0.32 U	0.36 U	0.36 U	0.44 R	0.35 R	0.33 R	0.44 R	0.33 U	0.36 U	0.48 R	0.35 U
Sodium	72.5%	227	76	36	165 J	120 J	87 J	38.6 J	85 J	188 J	66.9 J	35.2 U	52.5 J	149 J	139 J	160 J
Thallium	9.9%	0.8	0.3	9	0.38 U	0.46 U	0.51 U	0.52 U	0.51 U	0.54 U	0.45 U	0.4 U	0.62 U	0.42 U	0.53 U	0.45 U
Vanadium	100.0%	38.6	150	0	17.5	17.7	24.5	15.8	21.9	17.5	20.8	18.2	22	26.7	14.4	17.1
Zinc	100.0%	1200	89.1	58	70.3	84.9	162 J	83.8	684 J	68.9	171	44.4	75.6	89.4	52.7	68.9
Cyanide	1.1%	2.6	NA	NA	0.65 U	0.59 U	0.75 U	0.69 U	0.72 U	0.71 U	0.62 U	0.72 U	0.72 U	0.72 U	0.64 U	0.7 U

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 2-4 01/18/93 GB33-2	OB 0-2 01/19/93 GB34-1	OB 6-8 01/19/93 GB34-4	OB 0-2 01/20/93 GB35-1	OB 2-4 01/20/93 GB35-2	OB 0-2 01/20/93 GB35-6	OB 0-2 01/20/93 GB36-1	OB 2-4 01/20/93 GB36-2	OB 0-2 01/11/93 MW36-1	OB 4-5.5 01/11/93 MW36-3	OB 0-2 01/11/93 MW36-6
VOCs (ug/kg)															
Methylene Chloride	2.1%	4	100	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Acetone	0.0%	0	200	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Chloroform	5.3%	13	300	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
2-Butanone	0.0%	0	300	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Carbon Tetrachloride	0.0%	0	600	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Trichloroethene	3.2%	100	700	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Benzene	0.0%	0	60	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Tetrachloroethene	5.3%	15	1400	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Toluene	3.2%	3	1500	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Chlorobenzene	0.0%	0	1700	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Xylene (total)	0.0%	0	1200	0	11 U	12 U	11 U	12 U	11 U	13 U	12 U	11 U	12 U	11 U	12 U
Semivolatiles (ug/kg)															
Phenol	0.0%	0	30 or MDL	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
2-Methylphenol	0.0%	0	100 or MDL	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
4-Methylphenol	0.0%	0	900	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Benzoic acid	0.0%	0	2700	0	N	N	N	N	N	N	N	N	N	N	N
Naphthalene	0.0%	0	13,000	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
2-Methylnaphthalene	0.0%	0	36,400	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
2-Chloronaphthalene	0.0%	0	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
2-Nitroaniline	0.0%	0	430 or MDL	0	880 U	950 U	880 U	1000 U	880 U	1000 U	940 U	840 U	880 U	860 U	970 U
Acenaphthylene	0.0%	0	41,000	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
2,6-Dinitrotoluene	6.1%	340	1000	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
3-Nitroaniline	0.0%	0	500 or MDL	0	880 U	950 U	880 U	1000 U	880 U	1000 U	940 U	840 U	880 U	860 U	970 U
Acenaphthene	0.0%	0	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Dibenzofuran	0.0%	0	6200	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
2,4-Dinitrotoluene	13.1%	4200	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Diethylphthalate	11.1%	94	7100	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Fluorene	0.0%	0	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
N-Nitrosodiphenylamine	10.1%	1000	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Hexachlorobenzene	3.0%	90	410	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Pentachlorophenol	1.0%	140	1000 or MDL	0	880 U	950 U	880 U	1000 U	880 U	1000 U	940 U	840 U	880 U	860 U	970 U
Phenanthrene	1.0%	290	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Anthracene	1.0%	18	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Carbazole	0.0%	0	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Di-n-butylphthalate	32.3%	1500	8100	0	33 J	33 J	63 J	420 U	12 J	15 J	390 U	350 U	360 U	350 U	400 U
Fluoranthene	3.0%	480	50,000*	0	360 U	390 U	360 U	420 U	360 U	24 J	390 U	350 U	360 U	350 U	400 U
Pyrene	3.0%	300	50,000*	0	360 U	390 U	360 U	420 U	360 U	16 J	390 U	350 U	360 U	350 U	400 U
Butylbenzylphthalate	1.0%	64	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Benzo(a)anthracene	1.0%	200	220 or MDL	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Chrysene	1.0%	250	400	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
bis(2-Ethylhexyl)phthalate	37.4%	1400	50,000*	0	180 J	500	440	400 J	360 U	420 U	390 U	350 U	290 J	220 J	520
Di-n-octylphthalate	1.0%	19	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Benzo(b)fluoranthene	1.0%	180	1100	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
benzo(k)fluoranthene	1.0%	190	1100	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Benzo(a)pyrene	1.0%	150	61 or MDL	1	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	360 U	390 U	360 U	420 U	360 U	420 U	390 U	350 U	360 U	350 U	400 U

TABLE 4–13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 2–4 01/18/93 GB33–2	OB 0–2 01/19/93 GB34–1	OB 6–8 01/19/93 GB34–4	OB 0–2 01/20/93 GB35–1	OB 2–4 01/20/93 GB35–2	OB 0–2 01/20/93 GB35–6	OB 0–2 01/20/93 GB36–1	OB 2–4 01/20/93 GB36–2	OB 0–2 01/11/93 MW36–1	OB 4–5.5 01/11/93 MW36–3	OB 0–2 01/11/93 MW36–6
Pesticides/PCBs (ug/kg)															
beta–BHC	0.0%	0	200	0	1.9 U	2 U	1.9 U	2.1 U	1.9 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2 U
delta–BHC	0.0%	0	300	0	1.9 U	2 U	1.9 U	2.1 U	1.9 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2 U
gamma–BHC (Lindane)	0.0%	0	60	0	1.9 U	2 U	1.9 U	2.1 U	1.9 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2 U
Heptachlor	0.0%	0	100	0	1.9 U	2 U	1.9 U	2.1 U	1.9 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2 U
Aldrin	1.1%	2.5	41	0	1.9 U	2 U	2.5 J	2.1 U	1.9 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2 U
Heptachlor epoxide	0.0%	0	20	0	1.9 U	2 U	1.9 U	2.1 U	1.9 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2 U
Endosulfan I	1.1%	1.3	900	0	1.9 U	2 U	1.9 U	2.1 U	1.9 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2 U
Dieldrin	0.0%	0	44	0	3.6 U	3.9 U	3.6 U	4.2 U	3.6 U	4.2 U	3.9 U	3.5 U	3.8 U	3.6 U	4 U
4,4'–DDE	5.4%	32	2100	0	3.6 U	12	3.6 U	4.2 U	3.6 U	4.2 U	3.9 U	3.5 U	3.8 U	3.6 U	4 U
Endrin	0.0%	0	100	0	3.6 U	3.9 U	3.6 U	4.2 U	3.6 U	4.2 U	3.9 U	3.5 U	3.8 U	3.6 U	4 U
Endosulfan II	0.0%	0	900	0	3.6 U	3.9 U	3.6 U	4.2 U	3.6 U	4.2 U	3.9 U	3.5 U	3.8 U	3.6 U	4 U
4,4'–DDD	1.1%	4.2	2900	0	3.6 U	3.9 U	3.6 U	4.2 U	3.6 U	4.2 U	3.9 U	3.5 U	3.8 U	3.6 U	4 U
Endosulfan sulfate	0.0%	0	1000	0	3.6 U	3.9 U	3.6 U	4.2 U	3.6 U	4.2 U	3.9 U	3.5 U	3.8 U	3.6 U	4 U
4,4'–DDT	2.2%	5.3	2100	0	3.6 U	5.3	3.6 U	4.2 U	3.6 U	4.2 U	3.9 U	3.5 U	3.8 U	3.6 U	4 U
Endrin aldehyde	0.0%	0		NA	3.6 U	3.9 U	3.6 U	4.2 U	3.6 U	4.2 U	3.9 U	3.5 U	3.8 U	3.6 U	4 U
alpha–Chlordane	0.0%	0	540	0	1.9 U	2 U	1.9 U	2.1 U	1.9 U	2.2 U	2 U	1.8 U	2 U	1.9 U	2 U
Aroclor–1254	1.1%	430	1000	0	36 U	39 U	36 U	42 U	36 U	42 U	39 U	35 U	38 U	36 U	40 U
Aroclor–1260	1.1%	240	1000	0	36 U	39 U	36 U	42 U	36 U	42 U	39 U	35 U	38 U	36 U	40 U
Explosives (ug/kg)															
HMX	1.1%	75		NA	120 U	120 U	120 U	75 J	120 U	120 U	120 U	120 U	120 U	120 U	120 U
RDX	4.4%	240		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3,5–Trinitrobenzene	7.8%	280		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3–Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4,6–Trinitrotoluene	5.6%	350		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
4–amino–2,6–Dinitrotoluene	10.0%	430		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2–amino–4,6–Dinitrotoluene	13.3%	370		NA	120 U	68 J	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,6–Dinitrotoluene	1.1%	67	1000	0	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4–Dinitrotoluene	13.3%	2400		NA	120 U	82 J	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)															
Aluminum	100.0%	25300	17503.0	33	8670	16100	11300	18000	17600	16200	18100	16200	17900	12700	17900
Antimony	13.2%	26.6	5	12	6 UJ	10.1 J	5.8 UJ	5.8 UJ	6.8 J	6.3 J	5.9 J	5.8 UJ	6.4 UJ	5.7 UJ	6.4 UJ
Arsenic	98.9%	18.5	7.5	8	4.7 J	11.6	5.5	6.2	7.7	5.3	4.6	9.7	5.2 J	2.9 J	5.4 J
Barium	91.2%	4520	300	15	75.4 J	1050	87.3	93.6	61.7	61.7	74.8	50.8	118 J	46.9 J	95.6 J
Beryllium	61.5%	1.1	1	1	0.42 J	0.71	0.52 J	0.85	0.74	0.77	0.77	0.65	0.94	0.59	0.81
Cadmium	56.0%	7	1.8	44	0.34 U	1.3	0.33 U	0.33 U	0.31 U	0.35 U	0.3 U	0.33 U	0.36 U	0.33 U	0.37 U
Calcium	100.0%	99000	46825.0	14	77900	9790	68200	1590	17700	1370	1660	22900	19800	4170	9720
Chromium	100.0%	35.4	26.6	38	14.1	25.4	19.2	23.5	29.3	25.1	24.8	27.4	27.5 J	23.3 J	24.9 J
Cobalt	100.0%	26.6	30	0	7.1	11.2	11	9.4	16.3	10.3	20.4	13.2	13.6	18.6	8.2
Copper	100.0%	1680	25	72	20.7	482	29	17.5	24.5	17.2	17.7	17.5	30.3 J	19.2 J	26.8 J
Iron	100.0%	39700	32698.0	23	18300	26900	22100	25200	34200	30800	26100	30700	33700	27500	32800
Lead	94.5%	6230	30	48	8.7	1350	22.8	14.4	5.4	19.1	12.7	6.2	14.5	20.2	15.9
Magnesium	100.0%	16000	9071.1	10	13200	5810	8990	3850	7790	4490	4490	7150	6820	5750	5040
Manganese	100.0%	1650	1065.8	6	355	501	415	701	646	775	426	507	608	540	311
Mercury	71.4%	1.1	0.1	18	0.04 J	0.24 J	0.02 J	0.06 J	0.03 U	0.07 J	0.02 J	0.02 J	0.04 J	0.02 J	0.07 J
Nickel	100.0%	76	41.3	38	29.1	32.4	37.6	26.3	48.7	28.3	28.3	42.8	46.1 J	43.3 J	28.2 J
Potassium	100.0%	3170	1529.6	35	1190	1710	1580	1110	1110	975	1400	1100	1350	754	1220
Selenium	40.7%	1.5	2	0	0.17 UJ	0.26 UJ	0.24 UJ	0.23 UJ	0.23 UJ	0.21 UJ	0.2 UJ	0.18 UJ	0.19 UJ	0.19 UJ	0.22 UJ
Silver	7.7%	3.7	0.6	3	0.35 U	0.38 U	0.34 U	0.34 U	0.32 U	0.36 U	0.31 U	0.34 U	0.38 J	0.34 U	0.38 U
Sodium	72.5%	227	76	36	154 J	89.5 J	154 J	35.6 J	77.5 J	34.6 J	46.6 J	97.6 J	56.2 J	31.6 U	35.2 U
Thallium	9.9%	0.8	0.3	9	0.41 U	0.62 U	0.56 U	0.55 U	0.54 U	0.5 U	0.46 U	0.43 U	0.45 U	0.45 U	0.53 U
Vanadium	100.0%	38.6	150	0	14.3	25.4	17	27.1	22.3	26.1	27.8	19.7	29.2 J	16.2 J	30.8 J
Zinc	100.0%	1200	89.1	58	75.2	312	75.5	55	83.4	53.1	59.2	74.1	97.6 J	34.7 J	56 J
Cyanide	1.1%	2.6	NA	NA	0.66 U	0.72 U	0.71 U	0.78 U	0.71 U	0.82 U	0.7 U	0.68 U	0.56 U	0.56 U	0.6 U

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-2 01/11/93 MW37-1	OB 2-4 01/11/93 MW37-2	OB 0-2 01/08/93 MW38-1	OB 4-6 01/08/93 MW38-3	OB 0-2 01/07/93 MW39-1	OB 4-6 01/07/93 MW39-3	OB 0-2 01/07/93 MW40-1	OB 2-4 01/07/93 MW40-2	OB 0-2 01/12/93 MW41-1	OB 2-4 01/12/93 MW41-2
VOCs (ug/kg)														
Methylene Chloride	2.1%	4	100	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Acetone	0.0%	0	200	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Chloroform	5.3%	13	300	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
2-Butanone	0.0%	0	300	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Carbon Tetrachloride	0.0%	0	600	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Trichloroethene	3.2%	100	700	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Benzene	0.0%	0	60	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Tetrachloroethene	5.3%	15	1400	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Toluene	3.2%	3	1500	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	3 J
Chlorobenzene	0.0%	0	1700	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Xylene (total)	0.0%	0	1200	0	12 U	12 U	12 U	11 U	13 U	12 U	12 U	12 U	13 U	12 U
Semivolatiles (ug/kg)														
Phenol	0.0%	0	30 or MDL	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
2-Methylphenol	0.0%	0	100 or MDL	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
4-Methylphenol	0.0%	0	900	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Benzoic acid	0.0%	0	2700	0	N	N	N	N	N	N	N	N	N	N
Naphthalene	0.0%	0	13,000	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
2-Methylnaphthalene	0.0%	0	36,400	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
2-Chloronaphthalene	0.0%	0	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
2-Nitroaniline	0.0%	0	430 or MDL	0	910 U	940 U	980 U	930 U	1000 U	900 U	990 U	1000 U	1100 U	940 U
Acenaphthylene	0.0%	0	41,000	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
2,6-Dinitrotoluene	6.1%	340	1000	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
3-Nitroaniline	0.0%	0	500 or MDL	0	910 U	940 U	980 U	930 U	1000 U	900 U	990 U	1000 U	1100 U	940 U
Acenaphthene	0.0%	0	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Dibenzofuran	0.0%	0	6200	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
2,4-Dinitrotoluene	13.1%	4200	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Diethylphthalate	11.1%	94	7100	0	370 U	390 U	400 U	55 J	50 J	370 U	18 J	16 J	440 U	20 J
Fluorene	0.0%	0	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
N-Nitrosodiphenylamine	10.1%	1000	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Hexachlorobenzene	3.0%	90	410	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Pentachlorophenol	1.0%	140	1000 or MDL	0	910 U	940 U	980 U	930 U	1000 U	900 U	990 U	1000 U	1100 U	940 U
Phenanthrene	1.0%	290	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Anthracene	1.0%	18	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Carbazole	0.0%	0	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Di-n-butylphthalate	32.3%	1500	8100	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Fluoranthene	3.0%	480	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Pyrene	3.0%	300	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Butylbenzylphthalate	1.0%	64	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Benzo(a)anthracene	1.0%	200	220 or MDL	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Chrysene	1.0%	250	400	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
bis(2-Ethylhexyl)phthalate	37.4%	1400	50,000*	0	340 J	540	420 U	600 U	850 U	380 U	640 U	560 U	440 U	240 J
Di-n-octylphthalate	1.0%	19	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Benzo(b)fluoranthene	1.0%	180	1100	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
benzo(k)fluoranthene	1.0%	190	1100	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Benzo(a)pyrene	1.0%	150	61 or MDL	1	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	370 U	390 U	400 U	380 U	420 U	370 U	410 U	410 U	440 U	390 U

TABLE 4-13

GRID BORINGS
SUMMARY OF COMPOUNDS DETECTED

OPEN BURNING GROUNDS
SENECA ARMY DEPOT

COMPOUND	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-2 01/11/93 MW37-1	OB 2-4 01/11/93 MW37-2	OB 0-2 01/08/93 MW38-1	OB 4-6 01/08/93 MW38-3	OB 0-2 01/07/93 MW39-1	OB 4-6 01/07/93 MW39-3	OB 0-2 01/07/93 MW40-1	OB 2-4 01/07/93 MW40-2	OB 0-2 01/12/93 MW41-1	OB 2-4 01/12/93 MW41-2
Pesticides/PCBs (ug/kg)														
beta-BHC	0.0%	0	200	0	1.9 U	2 U	2.1 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U
delta-BHC	0.0%	0	300	0	1.9 U	2 U	2.1 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U
gamma-BHC (Lindane)	0.0%	0	60	0	1.9 U	2 U	2.1 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U
Heptachlor	0.0%	0	100	0	1.9 U	2 U	2.1 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U
Aldrin	1.1%	2.5	41	0	1.9 U	2 U	2.1 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U
Heptachlor epoxide	0.0%	0	20	0	1.9 U	2 U	2.1 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U
Endosulfan I	1.1%	1.3	900	0	1.9 U	2 U	2.1 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U
Dieldrin	0.0%	0	44	0	3.8 U	3.9 U	4.1 U	3.8 U	4.3 U	3.7 U	4.2 U	4.2 U	4.4 U	3.9 U
4,4'-DDE	5.4%	32	2100	0	3.8 U	3.9 U	4.1 U	3.8 U	4.3 U	3.7 U	4.2 U	4.2 U	4.4 U	3.9 U
Endrin	0.0%	0	100	0	3.8 U	3.9 U	4.1 U	3.8 U	4.3 U	3.7 U	4.2 U	4.2 U	4.4 U	3.9 U
Endosulfan II	0.0%	0	900	0	3.8 U	3.9 U	4.1 U	3.8 U	4.3 U	3.7 U	4.2 U	4.2 U	4.4 U	3.9 U
4,4'-DDD	1.1%	4.2	2900	0	3.8 U	3.9 U	4.1 U	3.8 U	4.3 U	3.7 U	4.2 U	4.2 U	4.4 U	3.9 U
Endosulfan sulfate	0.0%	0	1000	0	3.8 U	3.9 U	4.1 U	3.8 U	4.3 U	3.7 U	4.2 U	4.2 U	4.4 U	3.9 U
4,4'-DDT	2.2%	5.3	2100	0	3.8 U	3.9 U	4.1 U	3.8 U	4.3 U	3.7 U	4.2 U	4.2 U	4.4 U	3.9 U
Endrin aldehyde	0.0%	0		NA	3.8 U	3.9 U	4.1 U	3.8 U	4.3 U	3.7 U	4.2 U	4.2 U	4.4 U	3.9 U
alpha-Chlordane	0.0%	0	540	0	1.9 U	2 U	2.1 U	2 U	2.2 U	1.9 U	2.2 U	2.2 U	2.2 U	2 U
Aroclor-1254	1.1%	430	1000	0	38 U	39 U	41 U	38 U	43 U	37 U	42 U	42 U	44 U	39 U
Aroclor-1260	1.1%	240	1000	0	38 U	39 U	41 U	38 U	43 U	37 U	42 U	42 U	44 U	39 U
Explosives (ug/kg)														
HMX	1.1%	75		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
RDX	4.4%	240		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3,5-Trinitrobenzene	7.8%	280		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3-Dinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	5.6%	350		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	10.0%	430		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2-amino-4,6-Dinitrotoluene	13.3%	370		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,6-Dinitrotoluene	1.1%	67	1000	0	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4-Dinitrotoluene	13.3%	2400		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)														
Aluminum	100.0%	25300	17503.0	33	12600	15400	25100	16700	20200	14400	20200	17700	13700	16500
Antimony	13.2%	26.6	5	12	5.5 UJ	5.9 UJ	6.2 UJ	6.2 UJ	6 UJ	5.2 UJ	6.3 UJ	6.2 UJ	6.7 UJ	6.4 UJ
Arsenic	98.9%	18.5	7.5	8	4.9 J	6 J	4.1 J	4 J	4.6 J	4.7 J	5.1 J	5.1 J	3.5 J	5 J
Barium	91.2%	4520	300	15	58.6 J	115 J	118 J	65.9 J	147 J	60.2 J	152 J	78 J	53 J	79.2 J
Beryllium	61.5%	1.1	1	1	0.58	0.83	1.5	0.85	1	0.66	0.99	0.89	0.76	0.81
Cadmium	56.0%	7	1.8	44	0.32 U	0.34 U	0.35 U	0.35 U	0.34 U	0.3 U	0.36 U	0.35 U	0.38 U	0.36 U
Calcium	100.0%	99000	46825.0	14	6080	11100	2690	10000	4700	2330	3650	3420	1170	9540
Chromium	100.0%	35.4	26.6	38	17.8 J	25.1 J	34.6 J	27.7 J	28.4 J	26.8 J	32.6 J	33.1 J	20.7 J	29.1 J
Cobalt	100.0%	26.6	30	0	12.3	11.2	15.9	16.3	12.8	13.9	18.2	15.6	15.7	15.2
Copper	100.0%	1680	25	72	20.1 J	32 J	40.8 J	42 J	35.3 J	54.7 J	57.1 J	72.1 J	24.2 J	42.1 J
Iron	100.0%	39700	32698.0	23	23300	28900	32800	31100	31400	30600	38000	37700	27000	34800
Lead	94.5%	6230	30	48	15.7	17.8	18.9	38.6	39	34.1	42	42	30.8	32.2
Magnesium	100.0%	16000	9071.1	10	3770	7480	6450	6240	5260	6170	6620	7400	3990	7000
Manganese	100.0%	1650	1065.8	6	437	647	297	379	574	395	1480	611	497	423
Mercury	71.4%	1.1	0.1	18	0.08 J	0.03 J	0.06 J	0.04 J	0.36	0.03 U	0.44	0.05 J	0.13	0.07 J
Nickel	100.0%	76	41.3	38	23.2 J	42.7 J	49.8 J	50.4 J	36.9 J	57 J	76 J	73.9 J	26.4 J	59.5 J
Potassium	100.0%	3170	1529.6	35	827	1180	2950	1800	1920	1580	2130	1810	770	1020
Selenium	40.7%	1.5	2	0	0.22 UJ	0.23 UJ	0.21 UJ	0.21 UJ	0.52 J	0.94 J	0.27 J	0.25 UJ	0.23 UJ	0.19 UJ
Silver	7.7%	3.7	0.6	3	0.33 U	0.49 J	0.36 U	0.37 U	0.35 U	0.31 U	0.39 J	0.4 J	0.4 U	0.38 U
Sodium	72.5%	227	76	36	30.6 U	44.4 J	64.3 J	67.4 J	48.4 J	52.1 J	44 J	67.7 J	37 U	35.7 J
Thallium	9.9%	0.8	0.3	9	0.52 U	0.54 U	0.49 U	0.5 U	0.55 U	0.56 U	0.56 J	0.6 U	0.55 U	0.46 U
Vanadium	100.0%	38.6	150	0	20.9 J	24.3 J	38.1 J	24.8 J	33.4 J	23.4 J	35.2 J	32.7 J	22.7 J	24.3 J
Zinc	100.0%	1200	89.1	58	63.3 J	87 J	90.6 J	120 J	91.6 J	74.8 J	99.3 J	114 J	54.5 J	78.7 J
Cyanide	1.1%	2.6	NA	NA	0.58 U	2.6	0.62 U	0.58 U	0.67 U	0.57 U	0.63 U	0.65 U	0.78 U	0.71 U

NOTES:
a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

150. The highest individual VOC concentration was for acetone which was reported at 34 ug/kg in sample SD-240. No other VOCs were reported at concentrations above 10 ug/kg.

4.4.2 Distribution of Semivolatile Organic Compounds

Table 4-13 summarizes the analytical results for the grid boring samples analyzed using Level IV methods. For the grid boring and monitoring well soil samples, a total of 59 samples were found to have SVOCs present. No semivolatile organic compounds were identified in grid boring soil samples at concentrations above the associated TAGM limits.

Within the 59 grid boring soil samples where SVOCs were detected, a total of 19 separate SVOCs were identified. Of these, 10 compounds were identified only once. The most commonly detected compounds were bis(2-ethylhexyl)phthalate (found in 37 percent of samples), di-n-butylphthalate (32 percent), and 2,4-dinitrotoluene (13 percent). Maximum concentrations for these compounds were 1,400 ug/kg, 1,500 ug/kg, and 7,000 ug/kg, respectively. The grid boring soil samples with the highest total SVOCs were GB03-1 (9,180 ug/kg), GB23-6 (duplicate of GB23-1, 5,760 ug/kg), GB02-4RE (6,800 ug/kg), GB03-2RE (4,220 ug/kg), and GB24-1 (3,458 ug/kg). It should be noted that for all of these samples the explosive compounds 2,4-dinitrotoluene and/or 2,6-dinitrotoluene make up a large percentage of the total SVOCs detected. A comparison of the concentrations of these two compounds as determined from the NYSDEC CLP Method versus 8330 methods suggests that the concentrations from NYSDEC CLP Method are significantly higher than those determined by method 8330.

Table 4-14 summarizes the analytical results for the low hill samples analyzed using Level IV methods. For the 22 low hill soil samples analyzed, SVOCs were detected in the parts per billion range in 15 samples. No semivolatile organic compounds were identified in the low hill soil samples at concentrations above the associated TAGM limits. A total of five SVOCs were identified. The three most common SVOCs were di-n-butylphthalate (36 percent), pyrene (20 percent), and bis(2-ethylhexyl)phthalate (16 percent). For di-n-butylphthalate the highest concentration determined was 460 ug/kg in sample LH-32. For pyrene, the highest estimated concentration was 17 ug/kg in sample LH-21. For bis(2-ethylhexyl)phthalate the highest individual concentration was reported at 460 ug/kg in sample LH-26. While SVOCs were identified in a little more than half of the low-hill samples, the higher concentrations of SVOCs appear to be concentrated in the vicinity of samples LH-26 through LH-33. Based upon the compounds identified, it is believed that the distribution of SVOCs is strongly

TABLE 4-14

SUMMARY OF COMPOUNDS DETECTED
LOW HILL SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 2.0 12/10/92 LH-01	OB 2.0 12/10/92 LH-02	OB 2.0 12/10/92 LH-02RE	OB 2.0 12/10/92 LH-04	OB 2.0 12/10/92 LH-06	OB 2.0 12/10/92 LH-07	OB 2.0 12/10/92 LH-09	OB 2.0 12/09/92 LH-14	OB 2.0 12/09/92 LH-16
VOCs (ug/kg)													
Methylene Chloride	0.0%	0	100	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Acetone	0.0%	0	200	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Chloroform	0.0%	0	300	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
2-Butanone	0.0%	0	300	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
1,1,1-Trichloroethane	0.0%	0	800	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Carbon Tetrachloride	0.0%	0	600	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Trichloroethene	0.0%	0	700	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Benzene	0.0%	0	60	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Tetrachloroethene	0.0%	0	1400	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Toluene	0.0%	0	1500	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Chlorobenzene	0.0%	0	1700	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Xylene (total)	0.0%	0	1200	0	12 U	12 U	N	N	12 U	12 U	12 U	12 U	13 U
Semivolatiles (ug/kg)													
Phenol	0.0%	0	30 or MDL	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
2-Methylphenol	0.0%	0	100 or MDL	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
4-Methylphenol	0.0%	0	900	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Benzoic Acid	NA	NA	2700	0	N	N	N	N	N	N	N	N	N
Naphthalene	0.0%	0	13,000	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
2-Methylnaphthalene	0.0%	0	36,400	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
2-Chloronaphthalene	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
2-Nitroaniline	0.0%	0	430 or MDL	0	990 U	990 U	980 U	N	980 U	1000 U	980 U	990 U	1000 U
Acenaphthylene	0.0%	0	41,000	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
2,6-Dinitrotoluene	0.0%	0	1000	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
3-Nitroaniline	0.0%	0	500 or MDL	0	990 U	990 U	980 U	N	980 U	1000 U	980 U	990 U	1000 U
Acenaphthene	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Dibenzofuran	0.0%	0	6200	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
2,4-Dinitrotoluene	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Diethylphthalate	0.0%	0	7100	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Fluorene	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
N-Nitrosodiphenylamine	8.0%	110	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Hexachlorobenzene	0.0%	0	410	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	990 U	990 U	980 U	N	980 U	1000 U	980 U	990 U	1000 U
Phenanthrene	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Anthracene	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Carbazole	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Di-n-butylphthalate	36.0%	460	8100	0	15 J	410 U	400 U	N	24 J	410 U	410 U	16 J	15 J
Fluoranthene	12.0%	21	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Pyrene	20.0%	17	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Butylbenzylphthalate	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Benzo(a)anthracene	0.0%	0	220 or MDL	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Chrysene	0.0%	0	400	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
bis(2-Ethylhexyl)phthalate	16.0%	460	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Di-n-octylphthalate	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Benzo(b)fluoranthene	0.0%	0	1100	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Benzo(k)fluoranthene	0.0%	0	1100	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Benzo(a)pyrene	0.0%	0	61 or MDL	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	410 U	410 U	400 U	N	410 U	410 U	410 U	410 U	410 U

TABLE 4-14

SUMMARY OF COMPOUNDS DETECTED
LOW HILL SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 2.0 12/10/92 LH-01	OB 2.0 12/10/92 LH-02	OB 2.0 12/10/92 LH-02RE	OB 2.0 12/10/92 LH-04	OB 2.0 12/10/92 LH-06	OB 2.0 12/10/92 LH-07	OB 2.0 12/10/92 LH-09	OB 2.0 12/09/92 LH-14	OB 2.0 12/09/92 LH-16
Pesticides/PCBs (ug/kg)													
beta-BHC	0.0%	0	200	0	2.1 U	2.1 U	N	N	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
delta-BHC	8.3%	1.2	300	0	2.1 U	2.1 U	N	N	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
gamma-BHC (Lindane)	0.0%	0	60	0	2.1 U	2.1 U	N	N	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
Heptachlor	0.0%	0	100	0	2.1 U	2.1 U	N	N	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
Aldrin	0.0%	0	41	0	2.1 U	2.1 U	N	N	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
Heptachlor epoxide	0.0%	0	20	0	2.1 U	2.1 U	N	N	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
Endosulfan I	0.0%	0	900	0	2.1 U	2.1 U	N	N	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
Dieldrin	4.2%	5.8	44	0	4 U	4.1 U	N	N	4.1 U	4.1 U	4 U	4.1 U	4.1 U
4,4'-DDE	12.5%	6.4	2100	0	1.8 J	4.1 U	N	N	4.1 U	4.1 U	4 U	4.1 U	4.1 U
Endrin	0.0%	0	100	0	4 U	4.1 U	N	N	4.1 U	4.1 U	4 U	4.1 U	4.1 U
Endosulfan II	0.0%	0	900	0	4 U	4.1 U	N	N	4.1 U	4.1 U	4 U	4.1 U	4.1 U
4,4'-DDD	0.0%	0	2900	0	4 U	4.1 U	N	N	4.1 U	4.1 U	4 U	4.1 U	4.1 U
Endosulfan sulfate	0.0%	0	1000	0	4 U	4.1 U	N	N	4.1 U	4.1 U	4 U	4.1 U	4.1 U
4,4'-DDT	12.5%	5	2100	0	1.8 J	4.1 U	N	N	4.1 U	4.1 U	4 U	4.1 U	4.1 U
Endrin aldehyde	0.0%	0		NA	4 U	4.1 U	N	N	4.1 U	4.1 U	4 U	4.1 U	4.1 U
alpha-Chlordane	0.0%	0	540	0	2.1 U	2.1 U	N	N	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
Aroclor-1254	0.0%	0	1000	0	40 U	41 U	N	N	41 U	41 U	40 U	41 U	41 U
Aroclor-1260	0.0%	0	1000	0	40 U	41 U	N	N	41 U	41 U	40 U	41 U	41 U
Explosives (ug/kg)													
HMX	4.2%	68		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
RDX	16.7%	140		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
1,3,5-Trinitrobenzene	4.2%	66		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
1,3-Dinitrotoluene	0.0%	0		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	0.0%	0		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
4-amino-4,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
2,4-Dinitrotoluene	4.2%	520		NA	120 U	120 U	N	N	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)													
Aluminum	100.0%	20000.00	17503.0	7	18100	15600	N	16000	N	14900	14200	19700	20000
Antimony	12.5%	8.20	5	3	5.9 UJ	5.2 UJ	N	7.7 UJ	N	5.4 UJ	6.3 UJ	6.7 UJ	6.7 UJ
Arsenic	100.0%	6.90	7.5	0	4.8	6.9	N	5.2	N	4.5	4.6	4.4	4.7
Barium	100.0%	656.00	300	2	100	74.6	N	107	N	126	127	150	160
Beryllium	100.0%	1.10	1	2	0.87	0.79	N	0.8	N	0.83	0.78	0.98	1.1
Cadmium	54.2%	2.70	1.8	1	0.34 U	0.3 U	N	0.47 J	N	0.44 J	0.57 J	0.45 J	0.38 U
Calcium	100.0%	6780.00	46825.0	0	3680	1810	N	2090	N	2370	5800	4370	5330
Chromium	100.0%	28.40	26.6	3	22.7	27.6	N	21.4	N	19.1	22	26.7	25.9
Cobalt	100.0%	13.80	30	0	9.9	11.5	N	11.1	N	11.8	10.8	11.4	11.2
Copper	100.0%	427.00	25	19	23	31.7	N	24.5	N	20.3	26.7	30.3	27.2
Iron	100.0%	30100.00	32698.0	0	25900	27300	N	30100	N	23300	23400	27000	26800
Lead	100.0%	1530.00	30	24	94.1	42.8	N	45.8	N	37.8	51.2	41.3	42
Magnesium	100.0%	5750.00	9071.1	0	3680	3540	N	3540	N	3430	3770	4660	4380
Manganese	100.0%	1280.00	1065.8	1	783	944	N	811	N	1280	605	696	857
Mercury	50.0%	0.14	0.1	2	0.15 R	0.11 R	N	0.14 R	N	0.14 R	0.12 R	0.08 R	0.11 R
Nickel	100.0%	32.70	41.3	0	23.9	20.4	N	21.8	N	20.7	24.3	31.9	31.3
Potassium	100.0%	2140.00	1529.6	7	1400	1060	N	858	N	946	1230	2460	2390
Selenium	58.3%	1.10	2	0	0.84	0.59 J	N	0.61 J	N	0.5 J	0.57 J	0.64 J	1.1
Silver	12.5%	0.80	0.6	2	0.35 U	0.31 U	N	0.46 U	N	0.32 U	0.37 U	0.4 U	0.68 J
Sodium	87.5%	67.70	76	0	45 J	29.4 J	N	42.8 U	N	29.7 U	37.5 J	41.6 J	54.6 J
Thallium	0.0%	0.00	0.3	0	0.42 U	0.48 U	N	0.71 U	N	0.49 U	0.58 U	0.47 U	0.38 U
Vanadium	100.0%	33.40	150	0	32.7	27.3	N	29.9	N	26.2	24.9	32.8	33.4
Zinc	100.0%	443.00	89.1	14	110	172	N	74.9	N	80.8	93.8	97.2	88.1
Cyanide	0.0%	0	NA	NA	0.67 U	0.73 U	N	0.88 U	N	0.72 U	0.74 U	0.73 U	0.73 U

TABLE 4-14

SUMMARY OF COMPOUNDS DETECTED
LOW HILL SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 2.0 12/09/92 LH-17	OB 2.0 12/09/92 LH-18	OB 2.5 12/08/92 LH-21	OB 2.5 12/08/92 LH-210	OB 2.5 12/08/92 LH-23	OB 2.0 03/08/93 LH-26	OB 2.0 03/08/93 LH-27	OB 2.0 03/08/93 LH-28	OB 2.0 03/08/93 LH-29
VOCs (ug/kg)													
Methylene Chloride	0.0%	0	100	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Acetone	0.0%	0	200	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Chloroform	0.0%	0	300	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
2-Butanone	0.0%	0	300	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
1,1,1-Trichloroethane	0.0%	0	800	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Carbon Tetrachloride	0.0%	0	600	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Trichloroethene	0.0%	0	700	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Benzene	0.0%	0	60	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Tetrachloroethene	0.0%	0	1400	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Toluene	0.0%	0	1500	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Chlorobenzene	0.0%	0	1700	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Xylene (total)	0.0%	0	1200	0	13 U	12 U	13 U	13 U	12 U	12 U	12 U	12 U	13 U
Semivolatiles (ug/kg)													
Phenol	0.0%	0	30 or MDL	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
2-Methylphenol	0.0%	0	100 or MDL	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
4-Methylphenol	0.0%	0	900	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Benzoic Acid	NA	NA	2700	0	N	N	N	N	N	N	N	N	N
Naphthalene	0.0%	0	13,000	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
2-Methylnaphthalene	0.0%	0	36,400	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
2-Chloronaphthalene	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
2-Nitroaniline	0.0%	0	430 or MDL	0	1000 U	990 U	1000 U	1000 U	990 U	950 U	950 U	990 U	1000 U
Acenaphthylene	0.0%	0	41,000	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
2,6-Dinitrotoluene	0.0%	0	1000	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
3-Nitroaniline	0.0%	0	500 or MDL	0	1000 U	990 U	1000 U	1000 U	990 U	950 U	950 U	990 U	1000 U
Acenaphthene	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Dibenzofuran	0.0%	0	6200	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
2,4-Dinitrotoluene	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Diethylphthalate	0.0%	0	7100	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Fluorene	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
N-Nitrosodiphenylamine	8.0%	110	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Hexachlorobenzene	0.0%	0	410	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	1000 U	990 U	1000 U	1000 U	990 U	950 U	950 U	990 U	1000 U
Phenanthrene	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Anthracene	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Carbazole	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Di-n-butylphthalate	36.0%	460	8100	0	27 J	12 J	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Fluoranthene	12.0%	21	50,000*	0	420 U	410 U	16 J	16 J	410 U	390 U	390 U	410 U	420 U
Pyrene	20.0%	17	50,000*	0	420 U	410 U	17 J	15 J	410 U	390 U	390 U	410 U	420 U
Butylbenzylphthalate	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Benzo(a)anthracene	0.0%	0	220 or MDL	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Chrysene	0.0%	0	400	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
bis(2-Ethylhexyl)phthalate	16.0%	460	50,000*	0	420 U	410 U	410 U	420 U	410 U	460	390 U	270 J	120 J
Di-n-octylphthalate	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Benzo(b)fluoranthene	0.0%	0	1100	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Benzo(k)fluoranthene	0.0%	0	1100	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Benzo(a)pyrene	0.0%	0	61 or MDL	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	420 U	410 U	410 U	420 U	410 U	390 U	390 U	410 U	420 U

TABLE 4-14

SUMMARY OF COMPOUNDS DETECTED
LOW HILL SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 2.0 12/09/92 LH-17	OB 2.0 12/09/92 LH-18	OB 2.5 12/08/92 LH-21	OB 2.5 12/08/92 LH-210	OB 2.5 12/08/92 LH-23	OB 2.0 03/08/93 LH-26	OB 2.0 03/08/93 LH-27	OB 2.0 03/08/93 LH-28	OB 2.0 03/08/93 LH-29
Pesticides/PCBs (ug/kg)													
beta-BHC	0.0%	0	200	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U	2.1 U	2.2 U
delta-BHC	8.3%	1.2	300	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U	2.1 U	2.2 U
gamma-BHC (Lindane)	0.0%	0	60	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U	2.1 U	2.2 U
Heptachlor	0.0%	0	100	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U	2.1 U	2.2 U
Aldrin	0.0%	0	41	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U	2.1 U	2.2 U
Heptachlor epoxide	0.0%	0	20	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U	2.1 U	2.2 U
Endosulfan I	0.0%	0	900	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U	2.1 U	2.2 U
Dieldrin	4.2%	5.8	44	0	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	3.9 U	3.9 U	4.1 U	4.2 U
4,4'-DDE	12.5%	6.4	2100	0	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	3.9 U	3.9 U	4.1 U	4.2 U
Endrin	0.0%	0	100	0	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	3.9 U	3.9 U	4.1 U	4.2 U
Endosulfan II	0.0%	0	900	0	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	3.9 U	3.9 U	4.1 U	4.2 U
4,4'-DDD	0.0%	0	2900	0	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	3.9 U	3.9 U	4.1 U	4.2 U
Endosulfan sulfate	0.0%	0	1000	0	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	3.9 U	3.9 U	4.1 U	4.2 U
4,4'-DDT	12.5%	5	2100	0	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	3.9 U	3.9 U	4.1 U	4.2 U
Endrin aldehyde	0.0%	0		NA	4.2 U	4.1 U	4.1 U	4.2 U	4.1 U	3.9 U	3.9 U	4.1 U	4.2 U
alpha-Chlordane	0.0%	0	540	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U	2.1 U	2.2 U
Aroclor-1254	0.0%	0	1000	0	42 U	41 U	41 U	42 U	41 U	39 U	39 U	41 U	42 U
Aroclor-1260	0.0%	0	1000	0	42 U	41 U	41 U	42 U	41 U	39 U	39 U	41 U	42 U
Explosives (ug/kg)													
HMX	4.2%	68		NA	120 U	120 U	120 U	120 U	120 U	120 U	68 J	120 U	120 U
RDX	16.7%	140		NA	120 U	120 U	120 U	120 U	120 U	140	85 J	89 J	93 J
1,3,5-Trinitrobenzene	4.2%	66		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-4,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4-Dinitrotoluene	4.2%	520		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)													
Aluminum	100.0%	20000.00	17503.0	7	16700	15900	21800	19100	18600	15800	17400	18700	16200
Antimony	12.5%	8.20	5	3	6.5 UJ	6.5 UJ	6.7 UJ	6.3 UJ	6 UJ	6 UJ	6.1 UJ	6.8 J	5.9 UJ
Arsenic	100.0%	6.90	7.5	0	5	4.9	4.8	5.3	4.8	6.2	5.8	5.8	5.5
Barium	100.0%	656.00	300	2	152	135	136	123	143	165	151	269	149
Beryllium	100.0%	1.10	1	2	0.96	0.9	1.1	1	0.94	0.83	0.78	0.84	0.82
Cadmium	54.2%	2.70	1.8	1	0.44 J	0.39 J	0.38 U	0.36 U	0.91	0.41 J	0.37 J	0.51 J	0.34 U
Calcium	100.0%	6780.00	46825.0	0	3850	3370	2820	2650	2690	6780	2360	3410	2640
Chromium	100.0%	28.40	26.6	3	23.3	22.6	28.4	25.2	26.3	23.6	22.6	25	20.6
Cobalt	100.0%	13.80	30	0	10.9	11.8	12.7	13.8	12.1	11	12.8	10.9	10.6
Copper	100.0%	427.00	25	19	32.2	31.4	27.4	24.4	49.7	98.4	89.2	127	42.6
Iron	100.0%	30100.00	32698.0	0	26400	26400	30000	28700	29100	27400	24900	27900	22700
Lead	100.0%	1530.00	30	24	60.2	46.6	39.1	39.3	64.3	162 J	177 J	415	228 J
Magnesium	100.0%	5750.00	9071.1	0	4080	3960	4740	4270	4700	4690	4020	4690	3710
Manganese	100.0%	1280.00	1065.8	1	775	863	805	1030	765	560	655	542	784
Mercury	50.0%	0.14	0.1	2	0.14 R	0.13 R	0.12 R	0.17 R	0.18 R	0.05 J	0.05 J	0.05 J	0.1 J
Nickel	100.0%	32.70	41.3	0	28.3	28	32.5	28.1	32.7	32.3	26.5	29	25.6
Potassium	100.0%	2140.00	1529.6	7	1740	1350	2140	1590	1860	1360	1680	1870	1270
Selenium	58.3%	1.10	2	0	0.94 J	0.8 J	0.94	0.8 J	0.79 J	0.24 UJ	0.23 UJ	0.23 UJ	0.22 UJ
Silver	12.5%	0.80	0.6	2	0.47 J	0.8 J	0.39 U	0.37 U	0.35 U	0.36 U	0.36 U	0.38 U	0.35 U
Sodium	87.5%	67.70	76	0	45.6 J	41.8 J	54 J	34.6 U	47.7 J	60.8 J	54.5 J	63.8 J	46.4 J
Thallium	0.0%	0.00	0.3	0	0.57 U	0.62 U	0.43 U	0.44 U	0.5 U	0.57 U	0.54 U	0.55 U	0.51 U
Vanadium	100.0%	33.40	150	0	28.5	28	35.4	31.8	30.4	25.9	28.5	30.5	25.3
Zinc	100.0%	443.00	89.1	14	91.3	85.9	98.2	84.8	106	115 J	91.3 J	135 J	79.1 J
Cyanide	0.0%	0	NA	NA	0.73 U	0.71 U	0.6 U	0.76 U	0.73 U	0.71 U	0.72 U	0.73 U	0.75 U

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TABLE 4-14

SUMMARY OF COMPOUNDS DETECTED
LOW HILL SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 2.0 03/09/93 LH-31	OB 2.0 03/09/93 LH-32	OB 2.0 03/09/93 LH-33	OB 2.0 03/09/93 LH-35	OB 2.0 03/09/93 LH-35D	OB 2.0 03/09/93 LH-36	OB 2.0 03/09/93 LH-37	OB 2.0 03/09/93 LH-40
VOCs (ug/kg)												
Methylene Chloride	0.0%	0	100	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Acetone	0.0%	0	200	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Chloroform	0.0%	0	300	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
2-Butanone	0.0%	0	300	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
1,1,1-Trichloroethane	0.0%	0	800	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Carbon Tetrachloride	0.0%	0	600	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Trichloroethene	0.0%	0	700	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Benzene	0.0%	0	60	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Tetrachloroethene	0.0%	0	1400	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Toluene	0.0%	0	1500	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Chlorobenzene	0.0%	0	1700	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Xylene (total)	0.0%	0	1200	0	13 U	13 U	12 U	12 U	12 U	13 U	12 U	13 U
Semivolatiles (ug/kg)												
Phenol	0.0%	0	30 or MDL	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
2-Methylphenol	0.0%	0	100 or MDL	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
4-Methylphenol	0.0%	0	900	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Benzoic Acid	NA	NA	2700	0	N	N	N	N	N	N	N	N
Naphthalene	0.0%	0	13,000	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
2-Methylnaphthalene	0.0%	0	36,400	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
2-Chloronaphthalene	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
2-Nitroaniline	0.0%	0	430 or MDL	0	980 U	1000 U	990 U	980 U	970 U	1000 U	940 U	1000 U
Acenaphthylene	0.0%	0	41,000	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
2,6-Dinitrotoluene	0.0%	0	1000	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
3-Nitroaniline	0.0%	0	500 or MDL	0	980 U	1000 U	990 U	980 U	970 U	1000 U	940 U	1000 U
Acenaphthene	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Dibenzofuran	0.0%	0	6200	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
2,4-Dinitrotoluene	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Diethylphthalate	0.0%	0	7100	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Fluorene	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
N-Nitrosodiphenylamine	8.0%	110	50,000*	0	62 J	110 J	410 U	400 U	400 U	420 U	390 U	420 U
Hexachlorobenzene	0.0%	0	410	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	980 U	1000 U	990 U	980 U	970 U	1000 U	940 U	1000 U
Phenanthrene	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Anthracene	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Carbazole	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Di-n-butylphthalate	36.0%	460	8100	0	340 J	460	410 U	400 U	400 U	420 U	390 U	83 J
Fluoranthene	12.0%	21	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	21 J
Pyrene	20.0%	17	50,000*	0	13 J	410 U	15 J	400 U	400 U	420 U	390 U	16 J
Butylbenzylphthalate	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Benzo(a)anthracene	0.0%	0	220 or MDL	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Chrysene	0.0%	0	400	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
bis(2-Ethylhexyl)phthalate	16.0%	460	50,000*	0	400 U	410 U	150 J	400 U	400 U	420 U	390 U	420 U
Di-n-octylphthalate	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Benzo(b)fluoranthene	0.0%	0	1100	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Benzo(k)fluoranthene	0.0%	0	1100	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Benzo(a)pyrene	0.0%	0	61 or MDL	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	400 U	410 U	410 U	400 U	400 U	420 U	390 U	420 U

TABLE 4-14

SUMMARY OF COMPOUNDS DETECTED
LOW HILL SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 2.0 03/09/93 LH-31	OB 2.0 03/09/93 LH-32	OB 2.0 03/09/93 LH-33	OB 2.0 03/09/93 LH-35	OB 2.0 03/09/93 LH-35D	OB 2.0 03/09/93 LH-36	OB 2.0 03/09/93 LH-37	OB 2.0 03/09/93 LH-40
Pesticides/PCBs (ug/kg)												
beta-BHC	0.0%	0	200	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2.2 U
delta-BHC	8.3%	1.2	300	0	0.95 J	1.2 J	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2.2 U
gamma-BHC (Lindane)	0.0%	0	60	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2.2 U
Heptachlor	0.0%	0	100	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2.2 U
Aldrin	0.0%	0	41	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2.2 U
Heptachlor epoxide	0.0%	0	20	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2.2 U
Endosulfan I	0.0%	0	900	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2.2 U
Dieldrin	4.2%	5.8	44	0	4.1 U	4 U	4.1 U	5.8 J	4 U	4.2 U	3.9 U	4.2 U
4,4'-DDE	12.5%	6.4	2100	0	4.1 U	4 U	4.1 U	4.1 U	4 U	4.2 U	2.4 J	6.4
Endrin	0.0%	0	100	0	4.1 U	4 U	4.1 U	4.1 U	4 U	4.2 U	3.9 U	4.2 U
Endosulfan II	0.0%	0	900	0	4.1 U	4 U	4.1 U	4.1 U	4 U	4.2 U	3.9 U	4.2 U
4,4'-DDD	0.0%	0	2900	0	4.1 U	4 U	4.1 U	4.1 U	4 U	4.2 U	3.9 U	4.2 U
Endosulfan sulfate	0.0%	0	1000	0	4.1 U	4 U	4.1 U	4.1 U	4 U	4.2 U	3.9 U	4.2 U
4,4'-DDT	12.5%	5	2100	0	4.1 U	2.2 J	4.1 U	4.1 U	4 U	4.2 U	3.9 U	5
Endrin aldehyde	0.0%	0		NA	4.1 U	4 U	4.1 U	4.1 U	4 U	4.2 U	3.9 U	4.2 U
alpha-Chlordane	0.0%	0	540	0	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.2 U	2 U	2.2 U
Aroclor-1254	0.0%	0	1000	0	41 U	40 U	41 U	41 U	40 U	42 U	39 U	42 U
Aroclor-1260	0.0%	0	1000	0	41 U	40 U	41 U	41 U	40 U	42 U	39 U	42 U
Explosives (ug/kg)												
HMX	4.2%	68		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
RDX	16.7%	140		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3,5-Trinitrobenzene	4.2%	66		NA	66 J	120 U	120 U	120 U	120 U	120 U	120 U	120 U
1,3-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-4,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	120 U	120 U	120 U	120 U	120 U	120 U
2,4-Dinitrotoluene	4.2%	520		NA	520	120 U	120 U	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)												
Aluminum	100.0%	20000.00	17503.0	7	15400	17900	16500	15100	15100	16700	14300	16000
Antimony	12.5%	8.20	5	3	6 UJ	8.2 J	6.6 UJ	6.3 UJ	6.5 UJ	6.6 UJ	7.1 J	6.3 UJ
Arsenic	100.0%	6.90	7.5	0	5.5	5.7	5.5	4.3	4.6	5	4.8	5
Barium	100.0%	656.00	300	2	374	656	297	118	114	163	140	151
Beryllium	100.0%	1.10	1	2	0.83	0.87	0.77	0.72	0.75	0.76	0.63	0.77
Cadmium	54.2%	2.70	1.8	1	2.7	1.4	0.54 J	0.36 U	0.37 U	0.38 U	0.35 U	0.36 U
Calcium	100.0%	6780.00	46825.0	0	3670	5290	3540	1720	1620	2100	2500	3020
Chromium	100.0%	28.40	26.6	3	23.4	27.1	23.3	19.1	19.3	20.3	17.1	21.1
Cobalt	100.0%	13.80	30	0	13.7	15.5	10.6	8.6	8.5	8.4	7	10.5
Copper	100.0%	427.00	25	19	239	427	375	46.4	49.8	71.1	72.4	60.3
Iron	100.0%	30100.00	32698.0	0	27600	29700	26400	23500	23100	23000	22400	26700
Lead	100.0%	1530.00	30	24	1530	1250	533	106 J	90.9 J	372	115 J	112 J
Magnesium	100.0%	5750.00	9071.1	0	4580	5750	4470	3310	3290	3490	3070	3600
Manganese	100.0%	1280.00	1065.8	1	933	900	561	516	483	559	396	625
Mercury	50.0%	0.14	0.1	2	0.1 J	0.08 J	0.14 J	0.06 J	0.06 J	0.09 J	0.07 J	0.11 J
Nickel	100.0%	32.70	41.3	0	31.7	36.8	27.2	19.9	19.8	19.9	16.9	21.7
Potassium	100.0%	2140.00	1529.6	7	1240	1490	1310	925	878	1450	1010	1330
Selenium	58.3%	1.10	2	0	0.18 J	0.21 UJ	0.25 UJ	0.19 UJ	0.26 UJ	0.27 UJ	0.23 J	0.23 UJ
Silver	12.5%	0.80	0.6	2	0.36 U	0.35 U	0.39 U	0.37 U	0.38 U	0.39 U	0.36 U	0.37 U
Sodium	87.5%	67.70	76	0	49.1 J	67.7 J	61.1 J	48.2 J	50.8 J	51.1 J	49.5 J	51.1 J
Thallium	0.0%	0.00	0.3	0	0.41 U	0.5 U	0.6 U	0.46 U	0.61 U	0.65 U	0.44 U	0.55 U
Vanadium	100.0%	33.40	150	0	25.7	27.8	26.6	25.2	25.5	27.4	24.4	26.6
Zinc	100.0%	443.00	89.1	14	245	443	194 J	66.2 J	64.7 J	74.4 J	92.4 J	78 J
Cyanide	0.0%	0	NA	NA	0.75 U	0.75 U	0.73 U	0.74 U	0.7 U	0.78 U	0.71 U	0.76 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

controlled by the presence of explosive compounds present in the soils. Thus there appears to be a strong correlation between areas of elevated SVOC concentrations and areas where explosive compounds have been identified in site soils.

Table 4-15 summarizes the analytical results for the 33 sediment samples analyzed using Level IV methods. Semivolatile compounds were detected at generally low concentrations in 18 of the 33 samples analyzed. No semivolatile organic compounds were identified in the sediment samples at concentrations above the associated sediment criteria. For sediments, the compound bis(2-ethylhexyl)phthalate was the most commonly identified SVOC, being found in approximately 47 percent of the sediment samples. This compound was found at an estimated maximum concentration of 96 ug/kg in the sample SD-220. The highest individual SVOC concentration detected on-site was for 2,4-dinitrotoluene which was reported at 1,600 ug/kg in the sample SD-220. It should be noted that for the method 8330 explosives analysis of this sample the compound 2,4-dinitrotoluene was reported at an estimated concentration of only 86 ug/kg. The second most commonly identified SVOC was di-n-butylphthalate which was found in approximately 19 percent of the sediment samples at an estimated maximum concentration of 730 ug/kg in sample SD-200.

To provide some additional insight into the presence and distribution of semivolatile organic compounds identified within the grid boring/monitoring well, low hill, and sediment samples collected on-site, a map showing the distribution of total SVOCs has been developed. Figure 4-23 shows a contour map of the total SVOCs for the surface soil samples. This contour map has been generated using the geostatistical modelling program KRIGRID as described in Section 4.2. Total SVOCs have been calculated for the surface soil and sediment samples where SVOCs were identified. The samples where SVOCS were detected have to total posted on the map beneath each sample point. A contour interval of 500 ug/kg has been used to present these data.

Based upon the data presented in Figure 4-23, there appear to be two main areas of elevated SVOC concentration. The first area is found directly opposite of Pad G where a total SVOC concentration of 9,180 ug/kg has been detected in the Phase I grid boring sample GB03-1. This total SVOC value is primarily controlled by the compound 2,4-dinitrotoluene which was found at a concentration of 7,000 ug/kg in this sample. The subsequent Phase II grid borings GB-29, GB-30, and GB-31, which were installed around GB-03 to evaluate the extent of

TABLE 4-15

SUMMARY OF COMPOUNDS DETECTED
SEDIMENTS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	NYSDEC SEDIMENT CRITERIA FOR AQUATIC LIFE (a)	NUMBER OF SAMPLES ABOVE NYSDEC SEDIMENT CRITERIA	SW-120 12/10/91	SW-120 12/10/91	SW-120 11/07/91	SW-130 11/07/91	SW-140 11/08/91	SW-150 11/15/91	SW-150 11/08/91	SW-150 11/08/91	SW-160 11/12/91	SW-170 11/12/91	SW-180 11/08/91	SW-180 12/12/91
VOCs (ug/kg)																
Acetone	5.9%	34	–	NA	10 J	N	19 U	19 U	23 U	17 U	21 U	20 U	16 U	18 U	13 U	25 U
Carbon Disulfide	5.9%	6	–	NA	6 U	N	9 U	9 U	11 U	9 U	10 U	10 U	8 U	9 U	7 U	10 U
Chloroform	17.6%	20	–	NA	2 J	N	9 U	9 U	11 U	9 J	20 J	9 J	2 J	9 U	3 J	10 U
Trichloroethene	2.9%	18	–	NA	6 U	N	9 U	9 U	11 U	9 U	10 U	10 U	8 U	9 U	7 U	10 U
Semivolatiles (ug/kg)																
4-Methylphenol	9.4%	350	6 (b)	3	350 J	350 J	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	N
Naphthalene	6.3%	24	–	NA	800 U	800 U	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	N
2-Methylnaphthalene	3.1%	12	–	NA	800 U	800 U	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	N
2,6-Dinitrotoluene	3.1%	120	–	NA	800 U	800 U	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	N
2,4-Dinitrotoluene	12.5%	1600	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
N-Nitrosodiphenylamine (1)	12.5%	120	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Phenanthrene	15.6%	76	1390	0	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Anthracene	3.1%	77	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Carbazole	6.7%	27	–	NA	N	N	N	N	N	N	N	N	N	N	N	N
Di-n-butylphthalate	18.8%	730	1197(c)	0	250 J	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Fluoranthene	9.4%	140	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Pyrene	12.5%	110	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Benzo(a)anthracene	3.1%	48	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Chrysene	6.3%	62	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
bis(2-Ethylhexyl)phthalate	46.9%	96	1197(c)	0	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Benzo(b)fluoranthene	3.1%	52	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
benzo(k)fluoranthene	3.1%	54	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Benzo(a)pyrene	3.1%	38	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Indeno(1,2,3-cd)pyrene	3.1%	37	–	NA	800 U	N	810 U	3100 U	790 U	980 U	N	N	1000 U	1000 U	900 U	960 U
Pesticides/PCBs (ug/kg)																
4,4'-DDE	9.4%	10	500	0	39 U	N	39 U	38 U	38 U	43 U	N	N	49 U	49 U	44 U	47 U
4,4'-DDT	6.3%	13	500	0	39 U	N	39 U	38 U	38 U	43 U	N	N	49 U	49 U	44 U	47 U
Explosives (ug/kg)																
HMX	6.5%	130	–	NA	1000 U	N	120 U	1000 U	120 U	1000 U	N	N	1000 U	1000 U	120 U	1000 U
RDX	3.2%	500	–	NA	120 U	N	120 U	120 U	120 U	120 U	N	N	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	3.2%	100	–	NA	120 U	N	120 U	120 U	120 U	120 U	N	N	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	3.2%	160	–	NA	120 U	N	120 U	120 U	120 U	120 U	N	N	120 U	120 U	120 U	120 U
2-amino-4,6-Dinitrotoluene	6.5%	180	–	NA	120 U	N	120 U	120 U	120 U	120 U	N	N	120 U	120 U	120 U	120 U
2,4-Dinitrotoluene	9.7%	98	–	NA	120 U	N	120 U	120 U	120 U	120 U	N	N	120 U	120 U	120 U	120 U
Metals (mg/kg)																
Aluminum	93.8%	25800	–	NA	10700 J	N	10600	6450 U	15600	N	11900 U	13700	17300	19000	25800	17500 J
Antimony	6.3%	28.3	–	NA	6.4 U J	N	8 U R	7.5 U R	7 U R	N	8.8 U R	13.7 U R	10.7 U R	15 U R	10.4 U R	8.3 J
Arsenic	75.0%	9.5	5	11	7.4 J	N	3.9 R	5 U	3.9 R	N	3.4 U R	3.7 R	4.8	7.1	5.1 R	2.5 J
Barium	78.1%	1780	--	NA	53.9 J	N	39.3 R	23.6 J	55.3 R	N	35.6 R	47 R	158	245	385 R	149 J
Beryllium	68.8%	1.6	--	NA	0.68 R	N	0.64 R	0.45 U	0.81 R	N	0.67 U R	0.94 R	1	1.1 J	1.2 R	0.9 R
Cadmium	71.9%	9.7	2.5	10	2.3 J	N	2.7 J	1.8 U	3.4 J	N	2.7 U J	2.4 J	4.1	4.2	3.3 J	2 J
Calcium	100.0%	104000	–	NA	24200 J	N	27700	31100	28900	N	28200	17800	9500	12100	2420	2020 J
Chromium	75.0%	41.8	26	6	21.5 J	N	20.2 R	14.4 U	28.1 R	N	21.7 U R	26.5 R	27.1	28.5	35.5 R	24.3 J
Cobalt	75.0%	17.8	–	NA	10.2 J	N	8 R	6.5 U	11 R	N	10 U R	10.8 R	14.6	11 J	11.6 R	10.9 J
Copper	93.8%	3790	19	30	49.7 J	N	25.3 J	18.7 U	31.6 J	N	31.4 U J	32.6 J	88 J	158 J	105 J	84.5 J
Iron	100.0%	40900	24,000	28	24400 J	N	27500	24200	38500	N	28300	32800	32900	31300	37100	24100 J
Lead	96.9%	7400	27	23	311 J	N	28.3	21 U	20.3	N	49.9 J	24.6	66	131	274	36.5 J
Magnesium	100.0%	12000	–	NA	6030 J	N	5660	3720	7930	N	6260	7020	6260	6270	7010	4690 J
Manganese	100.0%	1520	428	15	339 J	N	540	346 J	596	N	373 J	367	1520 J	362 J	468	383 J
Mercury	68.8%	2	0.11	10	0.69 J	N	0.12 R	0.04 U	0.04 R	N	0.15 U	0.07 R	1.1	0.91	0.13 R	0.09 J
Nickel	75.0%	64.4	22	24	35.7 J	N	33.5 R	22.1 U	44 R	N	39.9 U R	43 R	43	45.3	41.6 R	29.8 J
Potassium	100.0%	3530	–	NA	1010 J	N	1030	574 J	1510	N	1120 J	1750	2000	2660	3340	1460 J
Selenium	43.8%	1.8	–	NA	0.22 U J	N	0.22 R	0.37 U J	0.16 U R	N	0.23 U R	0.29 R	3 U J	0.4 U J	0.22 U R	0.13 U J
Silver	15.6%	1.9	–	NA	1 U J	N	1.2 U R	1.2 U	1 U R	N	1.3 U R	2 U R	1.7 U	2.4 U	1.6 U R	1.2 U J
Sodium	59.4%	191	–	NA	63.9 J	N	64.5 J	70.4	96 J	N	67.8 J	105 U	97.9 J	107 J	79.8 U	43.9 U J
Vanadium	75.0%	37.9	–	NA	17.1 J	N	17.3 R	10.4 U	23.4 R	N	19.7 R	23.4 R	24	30.8	39.8 R	26.3 J
Zinc	81.3%	1200	85	19	122 J	N	90.3 R	39.6 U	108 R	N	60.2 U R	87.1 R	233	272	131 R	107 J
Cyanide	6.3%	0.77	–	NA	0.66 U J	N	0.72 U	0.62	0.66 U	N	0.77	0.79 U	0.91 U	0.88 U	0.77 U	0.81 U J

NOTES: a) NYSDEC Sediment Criteria – 1989.
b) NYSDEC 1989 guidelines for total phenols
c) Used NYSDEC 1989 guideline for phthalates (bis(2-Ethylhexyl) phthalate.
d) NA = not applicable
e) N = Compound was not analyzed.
f) U = Compound was not detected.
g) J = The reported value is an estimated concentration.
h) R = The data was rejected in the data validation process.

TABLE 4– 15

SUMMARY OF COMPOUNDS DETECTED
SEDIMENTS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	NYSDEC SEDIMENT CRITERIA FOR AQUATIC LIFE (a)	NUMBER OF SAMPLES ABOVE NYSDEC SEDIMENT CRITERIA	SW–190 11/06/91	SW–191 11/06/91	SW–192 11/13/91	SW–192 11/13/91	SW–193 11/13/91	SW–194 11/13/91	SW–195 11/13/91	SW–196 11/12/91	SW–197 11/15/91	SD–200 12/03/92	SD–200RE 12/03/92	SD–210 12/03/92
VOCs (ug/kg)																
Acetone	5.9%	34	–	NA	11 U	25 R	28 U	20 U	16 U	14 U	19 U	12 U	17 U	14 U	N	13 U
Carbon Disulfide	5.9%	6	–	NA	6 U	10 U	10 U	10 U	8 U	7 U	9 U	6 U	8 U	14 U	N	13 U
Chloroform	17.6%	20	–	NA	6 U	10 U	10 U	10 U	8 U	7 U	9 U	6 U	8 U	14 U	N	13 U
Trichloroethene	2.9%	18	–	NA	6 U	10 U	10 U	10 U	8 U	7 U	9 U	6 U	8 U	14 U	N	13 U
Semivolatiles (ug/kg)																
4–Methylphenol	9.4%	350	6 (b)	3	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	470 U	440 U
Naphthalene	6.3%	24	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	470 U	440 U
2–Methylnaphthalene	3.1%	12	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	470 U	440 U
2,6–Dinitrotoluene	3.1%	120	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	470 U	440 U
2,4–Dinitrotoluene	12.5%	1600	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	130 J	140 J	440 U
N–Nitrosodiphenylamine (1)	12.5%	120	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	87 J	80 J	440 U
Phenanthrene	15.6%	76	1390	0	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	76 J	440 U
Anthracene	3.1%	77	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	77 J	440 U
Carbazole	6.7%	27	–	NA	N	N	N	N	N	N	N	N	N	470 U	27 J	440 U
Di–n–butylphthalate	18.8%	730	1197(c)	0	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	730 J	460 J	210 J
Fluoranthene	9.4%	140	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	140 J	440 U
Pyrene	12.5%	110	–	NA	100 J	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	110 J	440 U
Benzo(a)anthracene	3.1%	48	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	48 J	440 U
Chrysene	6.3%	62	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	62 J	440 U
bis(2–Ethylhexyl)phthalate	46.9%	96	1197(c)	0	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	54 J	61 J	57 J
Benzo(b)fluoranthene	3.1%	52	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	52 J	440 U
benzo(k)fluoranthene	3.1%	54	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	54 J	440 U
Benzo(a)pyrene	3.1%	38	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	38 J	440 U
Indeno(1,2,3–cd)pyrene	3.1%	37	–	NA	740 U	2600 U	1700 U	N	960 U	1000 U	1200 U	780 U	1200 U	470 U	37 J	440 U
Pesticides/PCBs (ug/kg)																
4,4'–DDE	9.4%	10	500	0	36 U	130 U	80 U	N	46 U	51 U	59 U	38 U	57 U	2.8 J	N	2.8 J
4,4'–DDT	6.3%	13	500	0	36 U	130 U	80 U	N	46 U	51 U	59 U	38 U	57 U	4.7 U	N	13
Explosives (ug/kg)																
HMX	6.5%	130	–	NA	120 J	120 U	1000 U	N	1000 U	1000 U	1000 U	1000 U	1000 U	120 U	N	120 U
RDX	3.2%	500	–	NA	500	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U
2,4,6–Trinitrotoluene	3.2%	100	–	NA	100 J	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U
4–amino–2,6–Dinitrotoluene	3.2%	160	–	NA	160	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U
2–amino–4,6–Dinitrotoluene	6.5%	180	–	NA	180	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U
2,4–Dinitrotoluene	9.7%	98	–	NA	98 J	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U	N	93 J
Metals (mg/kg)																
Aluminum	93.8%	25800	–	NA	18700	19100	22900	N	16000	15800	14000	8310	15400	18000	N	14300
Antimony	6.3%	28.3	–	NA	9.5 U R	37.3 U R	21.2 U R	N	11.8 U R	12.9 U R	14.1 U R	10.3 U R	11.4 U R	28.3 J	N	8.8 UJ
Arsenic	75.0%	9.5	5	11	4.9 R	4.7 R	7.4	N	6	3.8	5.7	4.4	6.6	5.1	N	4.2
Barium	78.1%	1780	–	NA	183 R	701 R	313	N	106	196	170	44.1	106	1780	N	373
Beryllium	68.8%	1.6	–	NA	1 R	2.4 U R	1.6 J	N	0.97 J	0.98 J	1.1 J	0.71 J	1	0.93 J	N	0.8
Cadmium	71.9%	9.7	2.5	10	9.7 J	6.3 J	5	N	2.3	2.8	2.8	2	2	2.3	N	2.6
Calcium	100.0%	104000	–	NA	28700	11900	10100	N	5720	15100	3130	104000	2840	5640	N	12300
Chromium	75.0%	41.8	26	6	27.4 R	34.6 R	41.8	N	25.3	24.6	23.5	15.2	21.7	30.3	N	25.2
Cobalt	75.0%	17.8	–	NA	12.8 R	21.8 U R	17.7 J	N	16.1	11.3 J	9.5 J	7.5 J	11.3	14.3	N	13.6
Copper	93.8%	3790	19	30	416	259	217 J	N	21.2 J	82.4 J	69.4 J	22.4 J	24.4 J	3790	N	301
Iron	100.0%	40900	24,000	28	34300	31700	40900	N	33000	31100	23700	23900	28600	35800	N	31800
Lead	96.9%	7400	27	23	59.3	463	280	N	331.9	268	73.6	15.4	31.7	7400	N	829
Magnesium	100.0%	12000	–	NA	7860	8100	9900	N	5410	6500	4430	12000	4310	6700	N	5760
Manganese	100.0%	1520	428	15	659	586	439 J	N	555 J	532 J	322 J	468 J	338 J	530	N	598
Mercury	68.8%	2	0.11	10	2	0.29 R	0.18 J	N	0.04 U	0.54	0.1 J	0.17	0.06 U	0.14	N	0.08 J
Nickel	75.0%	64.4	22	24	39.1 R	56.8 R	64.4	N	40.8	38.2	31.6	23.3	30.2	42.2	N	43
Potassium	100.0%	3530	–	NA	2940	3350 J	3530	N	2210	1980	1920	938	1540	1990	N	1180
Selenium	43.8%	1.8	–	NA	0.12 U R	0.62 R	0.45 U J	N	0.4 U J	0.49 U J	0.57 U J	0.31 U J	0.35 U J	1.6 J	N	0.74 J
Silver	15.6%	1.9	–	NA	1.8 R	5.6 R	3.4 U	N	1.9 U	2.1 U	2.3 U	1.7 U	1.8 U	0.9 J	N	1.9
Sodium	59.4%	191	–	NA	73 U	285 U	123 U	N	68.5 U	74.5 U	81.7 U	194 U	65.8 U	159 J	N	59.3 J
Vanadium	75.0%	37.9	–	NA	30.3 R	38.1 R	37.9	N	24.6	22.6	21.9	10.9	27.2	28.7	N	23
Zinc	81.3%	1200	85	19	360	419	655	N	100	251	281	76	89	1200	N	386
Cyanide	6.3%	0.77	–	NA	0.67 U	2 U	1.3 U	N	0.81 U	0.82 U	1 U	0.71 U	0.98 U	0.51 U	N	0.59 U

NOTES: a) NYSDEC Sediment Criteria – 1989.
b) NYSDEC 1989 guidelines for total phenols
c) Used NYSDEC 1989 guideline for phthalates (bis(2–Ethylhexyl) phthalate
d) NA = not applicable
e) N = Compound was not analyzed.
f) U = Compound was not detected.
g) J = The reported value is an estimated concentration.
h) R = The data was rejected in the data validation process.

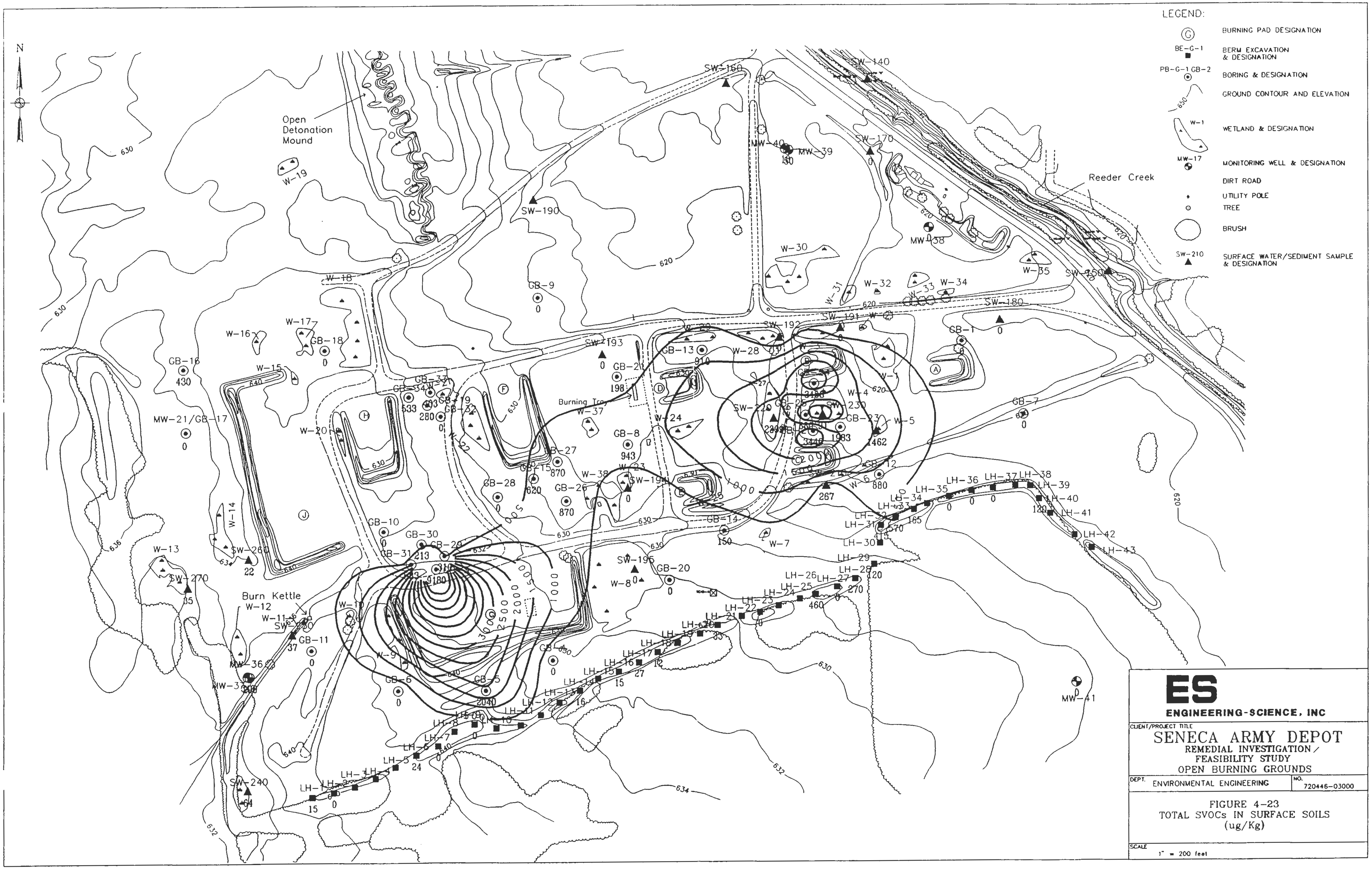
TABLE 4-15

SUMMARY OF COMPOUNDS DETECTED
SEDIMENTS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	NYSDEC SEDIMENT CRITERIA FOR AQUATIC LIFE (a)	NUMBER OF SAMPLES ABOVE NYSDEC SEDIMENT CRITERIA	SD-220 12/03/92	SD-230 12/03/92	SD-240 12/04/92	SD-250 12/04/92	SD-260 12/07/92	SD-261 12/07/92	SD-261RE 12/07/92	SD-270 12/07/92	SD-280 12/07/92	SD-290 12/07/92	SD-300 12/08/92	SD-310 12/08/92	SD-320 12/08/92
VOCs (ug/kg)																	
Acetone	5.9%	34	-	NA	14 U	13 U	34	13 U	13 U	13 U	N	14 U	13 U	14 U	13 U	11 U	22 U
Carbon Disulfide	5.9%	6	-	NA	14 U	13 U	2 J	6 J	13 U	13 U	N	14 U	13 U	14 U	13 U	11 U	13 U
Chloroform	17.6%	20	-	NA	14 U	13 U	13 U	13 U	13 U	13 U	N	14 U	13 U	14 U	13 U	11 U	13 U
Trichloroethene	2.9%	18	-	NA	14 U	18	13 U	13 U	13 U	13 U	N	14 U	13 U	14 U	13 U	11 U	13 U
Semivolatiles (ug/kg)																	
4-Methylphenol	9.4%	350	6 (b)	3	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	130 J
Naphthalene	6.3%	24	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	18 J	24 J
2-Methylnaphthalene	3.1%	12	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	12 J	400 U	450 U
2,6-Dinitrotoluene	3.1%	120	-	NA	120 J	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
2,4-Dinitrotoluene	12.5%	1600	-	NA	1600	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	42 J	400 U	450 U
N-Nitrosodiphenylamine (1)	12.5%	120	-	NA	120 J	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	100 J	400 U	450 U
Phenanthrene	15.6%	76	1390	0	26 J	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	19 J	20 J	36 J
Anthracene	3.1%	77	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
Carbazole	6.7%	27	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
Di-n-butylphthalate	18.8%	730	1197(c)	0	510	450 U	15 J	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
Fluoranthene	9.4%	140	-	NA	22 J	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	29 J
Pyrene	12.5%	110	-	NA	25 J	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	21 J
Benzo(a)anthracene	3.1%	48	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
Chrysene	6.3%	62	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	18 J
bis(2-Ethylhexyl)phthalate	46.9%	96	1197(c)	0	96 J	91 J	49 J	37 J	22 J	20 J	N	35 J	39 J	36 J	15 J	24 J	39 J
Benzo(b)fluoranthene	3.1%	52	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
benzo(k)fluoranthene	3.1%	54	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
Benzo(a)pyrene	3.1%	38	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
Indeno(1,2,3-cd)pyrene	3.1%	37	-	NA	480 U	450 U	470 U	460 U	420 U	390 U	N	540 U	410 U	490 U	370 U	400 U	450 U
Pesticides/PCBs (ug/kg)																	
4,4'-DDE	9.4%	10	500	0	10	4.5 U	4.7 U	4.6 U	4.3 U	4.5 U	4.5 U	4.6 U	4.2 U	4.9 U	3.6 U	4 U	4.4 U
4,4'-DDT	6.3%	13	500	0	2.3 J	4.5 U	4.7 U	4.6 U	4.3 U	4.5 U	4.5 U	4.6 U	4.2 U	4.9 U	3.6 U	4 U	4.4 U
Explosives (ug/kg)																	
HMX	6.5%	130	-	NA	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U	120 U	130	120 U	120 U	120 U
RDX	3.2%	500	-	NA	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U
2,4,6-Trinitrotoluene	3.2%	100	-	NA	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	3.2%	160	-	NA	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U
2-amino-4,6-Dinitrotoluene	6.5%	180	-	NA	120 U	120 U	120 U	120 U	120 U	120 U	N	120 U	120 U	85 J	120 U	120 U	120 U
2,4-Dinitrotoluene	9.7%	98	-	NA	86 J	120 U	120 U	120 U	120 U	120 U	N	120 U	120 U	120 U	120 U	120 U	120 U
Metals (mg/kg)																	
Aluminum	93.8%	25800	-	NA	17500	16000	16300	12900	10800	10500	N	15900	15900	13100	13100	12300	7560
Antimony	6.3%	28.3	-	NA	10 UJ	12 UJ	8.2 UJ	10.8 UJ	10.7 UJ	9.9 UJ	N	13.7 UJ	7.1 UJ	9.7 UJ	8.1 UJ	7.6 UJ	7.6 UJ
Arsenic	75.0%	9.5	5	11	5	9.5	4	2.5	3.4	2.1	N	7.2	3.2	2.1 J	7.2	5.7	4.5
Barium	78.1%	1780	-	NA	637	156	120	138	92.7	91	N	142	96.5	98.5	94.8	39.5	28.1 J
Beryllium	68.8%	1.6	-	NA	1.5	1.1	0.82	0.51 J	0.86 J	0.5 J	N	1.1 J	0.6 J	1.1	0.48 J	0.67	0.28 J
Cadmium	71.9%	9.7	2.5	10	2.3	0.74 J	0.47 U	0.62 U	0.61 U	0.57 U	N	0.78 U	0.41 U	2	1.3	0.55 J	0.44 U
Calcium	100.0%	104000	-	NA	8690	4330	3030	5680	85500	83000	N	3500	34500	10500	18400	30300	14300
Chromium	75.0%	41.8	26	6	28.7	22.4	22.1	18.7	17.6	16.8	N	21.5	25.6	21	24.5	23.4	16.7
Cobalt	75.0%	17.8	-	NA	13.7	7.7 J	12.5	8.6 J	9.8 J	9.3	N	10.4 J	8.2	10.6	11.2	9.9	6.1 J
Copper	93.8%	3790	19	30	445	40.5	24.2	22.9	25.7	19.3	N	23.7	31	88.7	2380	35.2	23.2
Iron	100.0%	40900	24,000	28	36400	29600	28100	26000	23300	21600	N	29200	28600	24900	36600	33100	21300
Lead	96.9%	7400	27	23	1120	62.4	38.6	32.3	11	6.6	N	22.4	12.5	24.1	332	34.7	115
Magnesium	100.0%	12000	-	NA	6240	4700	4170	4110	10800	9830	N	4110	7280	4920	6720	7150	3930
Manganese	100.0%	1520	428	15	619	196	775	313	378	410	N	365	340	357	420	477	274
Mercury	68.8%	2	0.11	10	0.07 J	0.06 J	0.04 J	0.06 J	0.03 U	0.03 J	N	0.1 J	0.07 J	0.83	0.1 J	0.07 J	0.27
Nickel	75.0%	64.4	22	24	44.6	32	28.8	24.7	32.8	29.6	N	22.9	35.7	34.9	42.3	37.3	28.1
Potassium	100.0%	3530	-	NA	1840	1840	1220	1010	1040	1140	N	1500	1390	1370	1280	1070	533 J
Selenium	43.8%	1.8	-	NA	0.76 J	1.2 J	0.84 J	0.52 J	1.2 J	1.8 J	N	1.5 J	0.96 J	0.71 J	1.4 J	1.1 J	0.76 J
Silver	15.6%	1.9	-	NA	0.59 U	0.71 U	0.49 U	0.64 U	0.63 U	0.58 U	N	0.81 U	0.42 U	1.3 J	0.68 J	0.45 U	0.49 J
Sodium	59.4%	191	-	NA	81.7 J	93.9 J	70.7 J	59.6 U	191 J	189 J	N	75.6 U	105 J	85.5 J	112 J	112 J	70.2 J
Vanadium	75.0%	37.9	-	NA	28.2	27.7	26.7	22.2	17.2	16.1	N	31.2	23.2	19.9	20.1	18.3	11.8
Zinc	81.3%	1200	85	19	647	86.3	71.9	68.9	68.3	61	N	60.2	113	208	497	106	68.5
Cyanide	6.3%	0.77	-	NA	0.72 U	0.66 U	0.7 U	0.87 U	0.78 U	0.65 U	N	0.97 U	0.7 U	0.85 U	0.5 U	0.72 U	0.88 U

NOTES: a) NYSDEC Sediment Criteria - 1989.
b) NYSDEC 1989 guidelines for total phenols
c) Used NYSDEC 1989 guideline for phthalates (bis(2-Ethylhexyl) phthalate
d) NA = not applicable
e) N = Compound was not analyzed.
f) U = Compound was not detected.
g) J = The reported value is an estimated concentration.
h) R = The data was rejected in the data validation process.



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SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING

NO. 720446-03000

FIGURE 4-23
TOTAL SVOCs IN SURFACE SOILS
(ug/Kg)

SCALE
1" = 200 feet

contamination, all had low SVOCs and total explosives thus suggesting that the extent SVOC and explosives contamination is limited to the area directly around GB-03.

The second area of SVOC contamination has been identified in the area of GB-02 where total SVOC concentrations of 3,440 ug/kg were identified during Phase I. This area of SVOC contamination appears to be more laterally extensive. Subsequent surface soil samples collected at grid borings GB-23, GB-24, and GB-25 have found total SVOCs of 1,983 ug/kg, 3,458 ug/kg, and 680 ug/kg, respectively. In addition, the sediment samples SD-200, and SD-220 had total SVOC concentrations of 1,462 ug/kg and 2,399 ug/kg, respectively. The extent of this area of SVOC contamination appears to be extended southward towards the low-hill where the sequence of low-hill samples LH-26 through LH-33 had slightly elevated SVOC concentrations. This entire area of SVOC contamination may be attributed to sediment runoff and deposition and possibly to site bulldozing activities that have been used to build the low hill.

4.4.3 Distribution of Pesticides/PCBs

Table 4-13 summarizes the analytical results for the grid boring and monitoring well soil samples analyzed using Level IV methods. For the grid boring and monitoring well soil samples, a total of 7 samples were found to have pesticides/PCBs present at very low ug/kg concentrations. No pesticides/PCBs were identified in grid boring or monitoring well soil samples at concentrations above the associated TAGM limits.

Within the 7 soil samples where pesticides/PCBs were detected, a total of 7 separate compounds were identified. The most frequently detected compound was 4,4'-DDE which was found in only 5 percent of the soil samples analyzed at a maximum estimated concentration of 32 ug/kg in sample GB03-1. The highest individual concentrations identified were for the compounds aroclor-1254 and aroclor-1260. Aroclor-1254 was found at a maximum estimated concentration of 430 ug/kg in sample GB23-6, the duplicate of GB23-1. For aroclor-1260, the maximum reported estimated concentration was 240 ug/kg found in sample GB08-1.

Table 4-14 summarizes the analytical results for the low hill soil samples analyzed using Level IV methods. For the low hill samples, a total of 6 samples were found to have pesticides/PCBs present at very low ug/kg concentrations. No pesticides/PCBs were identified in the low hill soil samples at concentrations above the associated TAGM limits. Within the

6 soil samples where pesticides/PCBs were detected, a total of 4 separate compounds were identified. The most frequently detected compounds were 4,4'-DDE and 4,4'-DDT which were found in approximately 12 percent of the soil samples analyzed. The maximum estimated concentration of 4,4'-DDE was 5.8 ug/kg identified in sample LH-35. The maximum estimated concentration of 4,4'-DDT was 5 ug/kg identified in sample LH-40.

Table 4-15 summarizes the analytical results for the sediment samples analyzed using Level IV methods. For these samples, only three samples were found to have pesticides\PCBs present, all at very low ug/kg concentrations. No pesticides/PCBs were identified in sediment samples at concentrations above the associated sediment criteria. Within the 3 sediment samples where pesticides/PCBs were detected, only the two pesticides 4,4'-DDE and 4,4'-DDT were identified. These were found in approximately 9 and 6 percent, respectively, of the samples analyzed. The maximum concentration of 4,4'-DDE was 10 ug/kg identified in sample SD-220. The maximum concentration of 4,4'-DDT was 13 ug/kg identified in sample SD-210. It should be noted that these two locations where pesticides were identified are also the wetland locations where semi-volatiles, explosives, and metals are considered to be s of interest. The runoff mechanisms present at the OB grounds appear to be concentrating or collecting s within the low and wetland areas around burning pads A, B and C.

4.4.4 Distribution of Explosives

Table 4-13 summarizes the analytical results for the grid boring and monitoring well soil samples analyzed using Level IV methods. For the grid boring and monitoring well soil samples, a total of 18 samples were found to have explosive compounds present at a wide range of concentrations.

Within the 18 soil samples where explosives were detected, a total of 8 separate explosive compounds were identified. The most frequently detected compounds were 2,4-dinitrotoluene and 2-amino-4,6-dinitrotoluene which were both found in approximately 13 percent of the soil samples analyzed. The maximum concentration of 2,4-dinitrotoluene reported as 2,400 ug/kg in sample GB23-1. The maximum concentration of 2-amino-4,6-dinitrotoluene reported was 370 ug/kg which was also found in the sample GB23-1.

While explosive compounds were identified in 18 of the 84 grid boring and monitoring well soil samples, only three samples (GB03-1, GB03-2, and GB23-1) had total explosive concentrations above 500 ug/kg. The sample GB23-1 had the maximum detected total explosives where 3,460 ug/kg were detected. The samples GB03-1 and GB03-2 had the second and third highest total explosives of 2,014 ug/kg and 1,779 ug/kg, respectively. With the exception of these 3 samples, total explosive concentrations for all of the remaining grid boring and monitoring well soil samples were below 500 ug/kg.

During the Phase I investigation four grid boring locations were identified where explosive compounds were found at elevated concentrations. These locations were GB-02, north of Pad C, GB-03 north of Pad G, GB-15 south of Pad F, and GB-19 east of Pad H. To assess the potential for explosive contamination of site soils off of the burning pads, additional grid borings were completed and soil samples were collected and analyzed around these four Phase I grid boring locations to assess this potential. Based upon the results of the Phase II grid boring investigation, explosive contamination of soils appears to be limited to the area immediately surrounding the Phase I borings GB-03, GB-15, and GB-19.

For the GB-03 location, the surrounding Phase II grid borings GB-29, GB-30, and GB-31 had no explosive compounds detected. For the GB-15 location, the surrounding Phase II grid borings GB-26, GB-27, and GB-28 also had no explosive compounds identified. The third location, around the Phase I grid boring GB-19, was investigated in Phase II through the installation of the grid borings GB-32, GB-33, and GB-34. Only the surface sample in GB-34 had explosives detected at a total estimated concentration of 150 ug/kg.

The final location where Phase II grid borings were completed was in the vicinity of GB-02. Total explosives of 437 ug/kg were reported for the surface soil sample collected during Phase I at location GB-02. During Phase II, the grid borings GB-23, GB-24 and GB-25 were installed to assess the potential for migration in this area. Based upon the results of the Phase II analyses, the surface soil sample collected at location GB-23 was found to have a total explosives concentration of 3,460 ug/kg, while the surface soil sample collected at GB-24 had total explosives of 464 ug/kg. The data for the surface soil sample collected at the adjacent grid boring GB-25 had no explosives found above the detection limits.

Thus these Phase II data have provided a refinement of the understanding of the presence and extent of the contamination present in the surface soils in the area around burning Pads A, B and C.

Table 4-14 summarizes the analytical results for the low hill soil samples analyzed using Level IV methods. A total of five samples were found to have explosive compounds present at a wide range of concentrations. Four separate explosive compounds were identified. The most frequently found explosive was RDX which was detected in approximately 16 percent of the samples. The three other explosive compounds, HMX, 1,3,5-trinitrobenzene, and 2,4-dinitrotoluene were all found with the same frequency of approximately four percent. The maximum concentration of 2,4-dinitrotoluene reported as 2,400 ug/kg in sample GB23-1. The maximum concentration of 2-amino-4,6-dinitrotoluene reported as 370 ug/kg, also in GB23-1.

As with the grid borings, the distribution of low hill soil samples where explosive compounds were detected is generally quite uniform. Only the low hill samples LH-26, LH-27, LH-28, LH-29, and LH-31 were found to contain explosive compounds. These low hill sample locations are directly opposite the area where the grid boring soils show the highest levels of explosives in the soils. Based upon the present understanding of the development of the low hill, i.e., by scraping site surface soils and piling them up onto the low hill, it might be expected that contaminated soils from the areas around Pads A, B and C would be moved to this section of the low hill.

Table 4-15 summarizes the analytical results for the sediment samples analyzed using Level IV methods. From the complete set of 33 samples, a total of four samples were found to have explosive compounds present at a wide range of concentrations. A total of six separate explosive compounds were identified. The most frequently detected compounds were 2,4-dinitrotoluene (10 percent of samples), and HMX and 2-amino-4,6-dinitrotoluene which were found in approximately 6 percent of the samples. The maximum estimated concentration of 2,4-dinitrotoluene was 98 ug/kg in sample SW-190. RDX also had the highest reported sediment concentration of 500 ug/kg in this sample. The maximum concentration of HMX was reported as 130 ug/kg which was found in the sample SD-290. Total explosive concentrations for the four sediment samples where explosives were detected were 1,158 ug/kg (SW-190), 93 ug/kg (SD-210), 86 ug/kg (SD-220), and 215 ug/kg (SD-290).

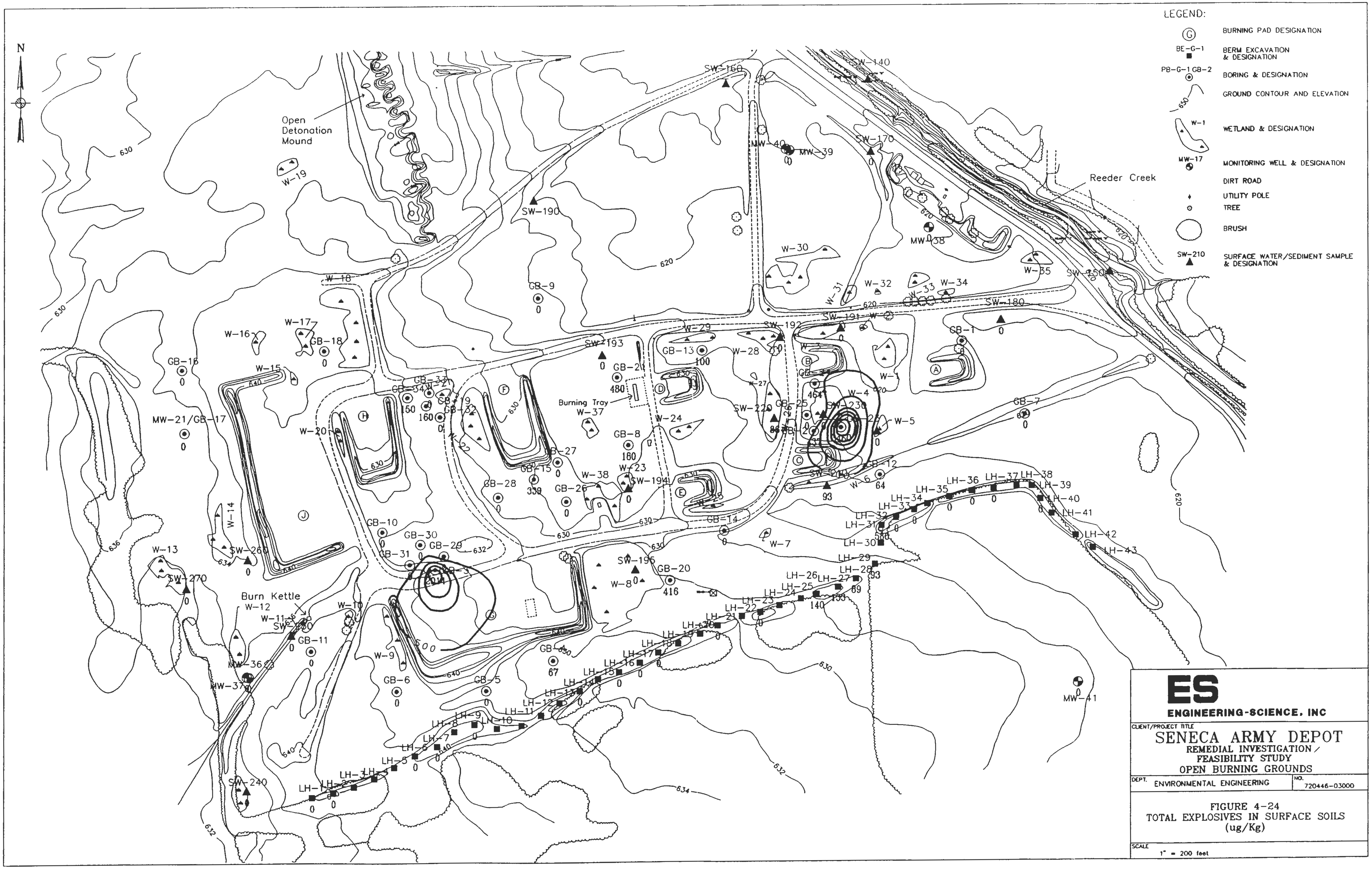
As with the grid borings and low hill samples, the distribution of sediment samples where explosive compounds were detected is generally quite uniform. The sediment samples SW-190 and SD-290 were both collected from low swales that drain the Open Detonation Mound. It appears unlikely that s found at these locations are associated with open burning activities. By comparison, the sediment samples collected at locations SD-210 and SD-220 are within the area where elevated concentrations of semivolatile organic compounds and explosives have been detected in grid boring soils. These are also the sediment sample locations where very low levels of pesticides were detected. The combination of these data suggest again that constituents are preferentially collecting within these low portions of the site.

To assist in the presentation of these data a contour map of total explosives detected is shown in Figure 4-24. This map has been generated using the geostatistical methods described in Section 4.2 and includes the sediment and low hill samples along with the near surface soil sample collected at grid boring and monitoring well locations. A contour interval of 500 ug/kg has been used to depict the distribution of total explosives. As can be seen from these data, two areas of elevated total explosives have been identified, these being at grid boring GB-03 opposite Pad J where 2,014 ug/kg of total explosives were found, and in the area between Pads A, B, and C where 3,460 ug/kg of total explosives were detected at grid boring GB-23. A broad area of elevated total explosives is present around these burning pads and may extend south towards the low-hill. These areas of elevated total explosives are consistent with the results from the total SVOC data.

4.4.5 Distribution of Metals

Table 4-13 summarizes the analytical results for the grid boring and monitoring well soil samples analyzed using Level IV methods. A total of 84 grid boring and monitoring well soil samples, 22 low hill samples, and 33 sediment samples were analyzed using Level IV methods.

Figure 4-25 shows the distribution of barium concentrations determined for the surface samples described above. The map has been developed using the geostatistical methods described in Section 4.2. A contour interval of 500 mg/kg has been used to present these data. Three areas of elevated barium concentrations have been identified. The first comprises the area Pads A, B, and C where the highest concentrations of barium is grid boring soils and sediments have been identified. Elevated levels of barium have also been identified in the low hill samples collected south of this area. The second area is in the vicinity of grid boring GB-03, adjacent to Pad G, where 924 mg/kg of barium in surface soils has been identified. These two areas are consistent with areas of elevated total SVOCs and total explosives. The third area of concern is on the north side of the site in between Pads F and H where elevated barium concentrations has been identified in the soil samples GB-19 (1,190 mg/kg), GB-34 (1,050 mg/kg), and at GB-18 (1,740 mg/kg).



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CLIENT/PROJECT TITLE

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FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING

NO. 720446-03000

FIGURE 4-24
TOTAL EXPLOSIVES IN SURFACE SOILS
(ug/Kg)

SCALE 1" = 200 feet

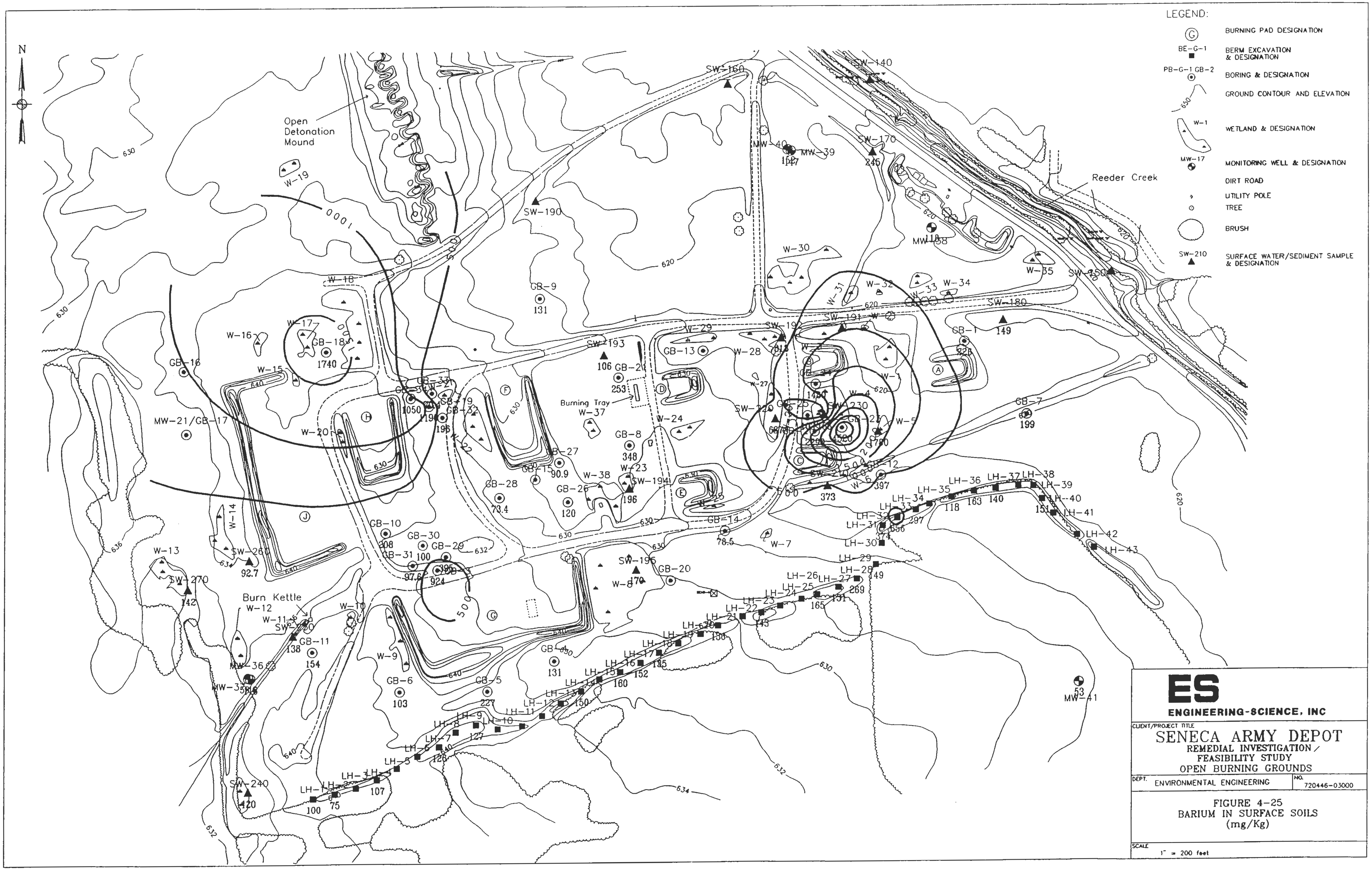

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FIGURE 4-25
BARIUM IN SURFACE SOILS
(mg/Kg)

SCALE
1" = 200 feet

Figure 4-26 shows the distribution of copper concentrations determined for the surface samples described above. The map has been developed using the geostatistical methods described in Section 4.2. A contour interval of 500 mg/kg has been used to present these data. Two areas of elevated copper concentrations have been identified. The first comprises the area Pads A, B, and C where the highest concentrations of copper is grid boring soils (1,680 mg/kg) and sediments (3,790 mg/kg) have been identified. Elevated levels of copper have also been identified in the low hill samples collected south of this area. This area is also consistent with areas of elevated total SVOCs and total explosives. The second area of concern is on the north side of the site in between Pads F and H where elevated copper concentrations has been identified in the soil sample GB-19 (619 mg/kg).

Figure 4-27 shows the distribution of lead concentrations determined for the surface samples described above. The map has been developed using the geostatistical methods described in Section 4.2. A contour interval of 500 mg/kg has been used to present these data. Four areas of elevated lead concentrations have been identified. The first comprises the area Pads A, B, and C where the highest concentrations of lead is grid boring soils (5,200 mg/kg) and sediments (7,400 mg/kg) have been identified. Elevated levels of lead have also been identified in the low hill samples collected south of this area. The second area of concern is on the north side of the site in between Pads F and H where elevated lead concentrations has been identified in the soil sample GB-19 (2,370 mg/kg), and GB-34 (1,350 mg/kg).

Figure 4-28 shows the distribution of zinc concentrations determined for the surface samples described above. The map has been developed using the geostatistical methods described in Section 4.2. A contour interval of 500 mg/kg has been used to present these data. One zone of elevated zinc concentrations has been identified in the area between Pads A, B, and C where the highest concentrations of zinc in grid boring soils (1,200 mg/kg) and sediments (1,200 mg/kg) have been identified. Slightly elevated levels of zinc have also been identified in the low hill samples collected south of this area. This area is consistent with areas of elevated total SVOCs and total explosives previously identified.

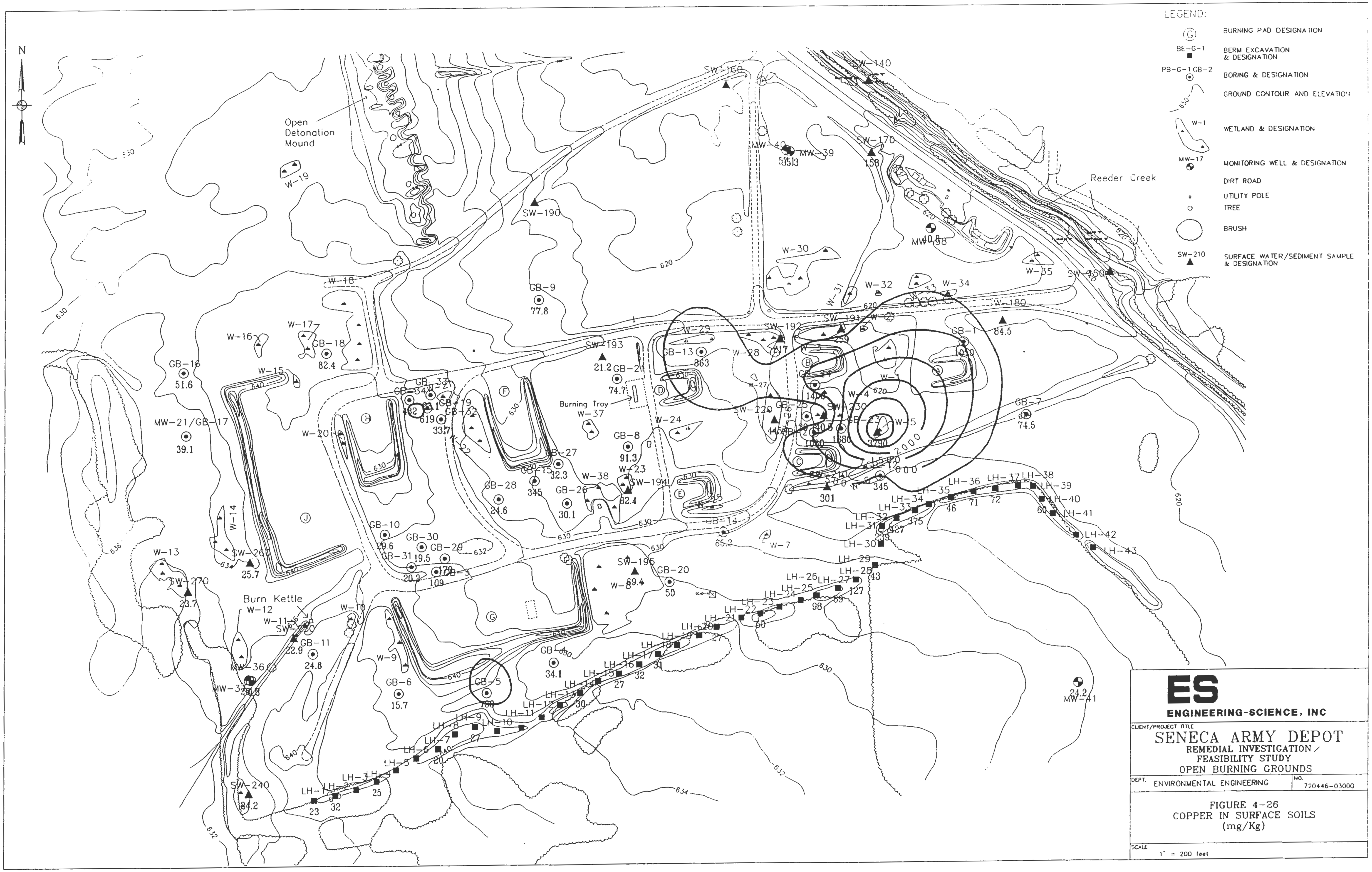

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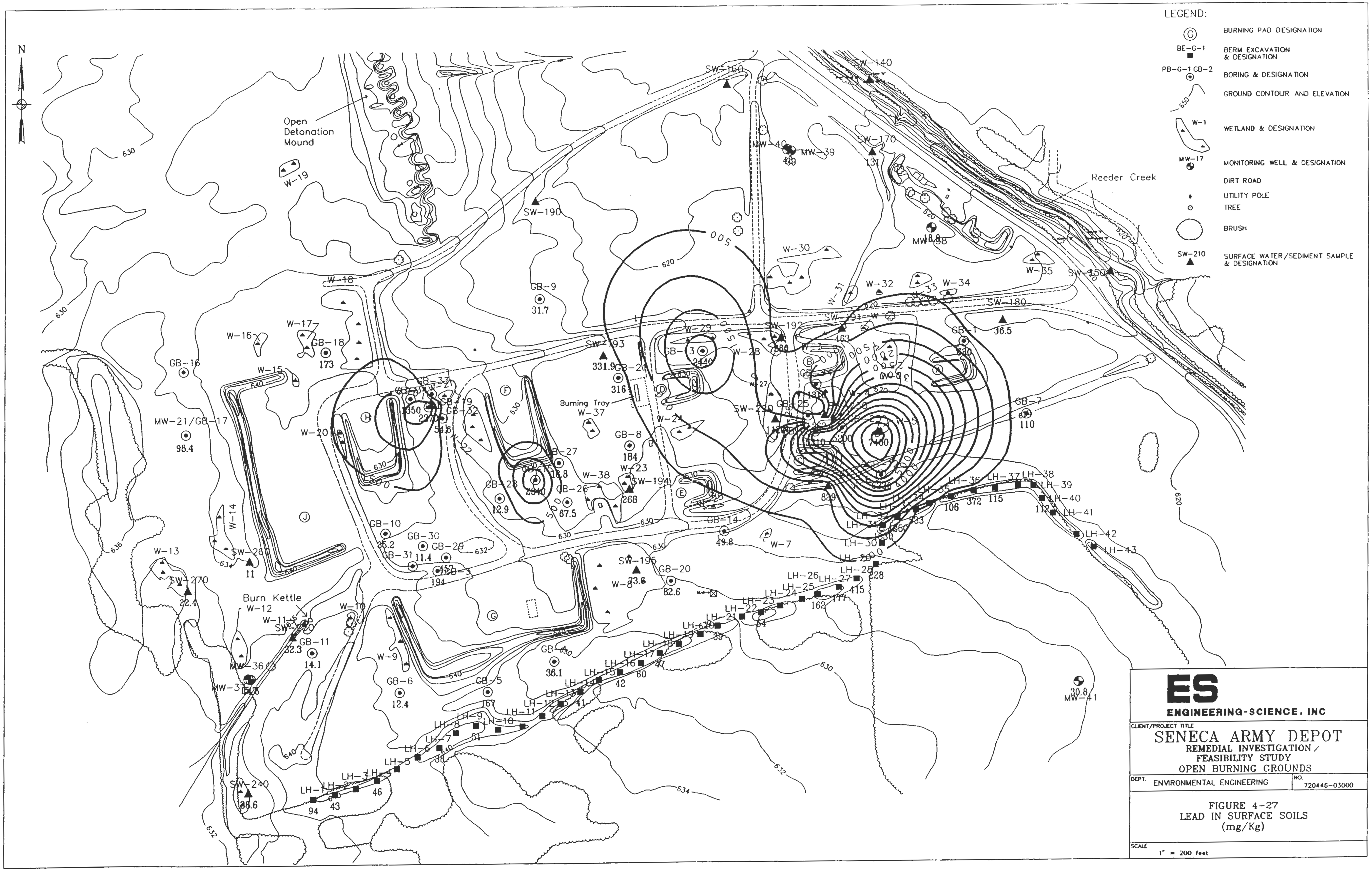
FIGURE 4-26
COPPER IN SURFACE SOILS
(mg/Kg)

SCALE 1" = 200 feet



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OPEN BURNING GROUNDS

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FIGURE 4-27
LEAD IN SURFACE SOILS
(mg/Kg)

SCALE 1" = 200 feet

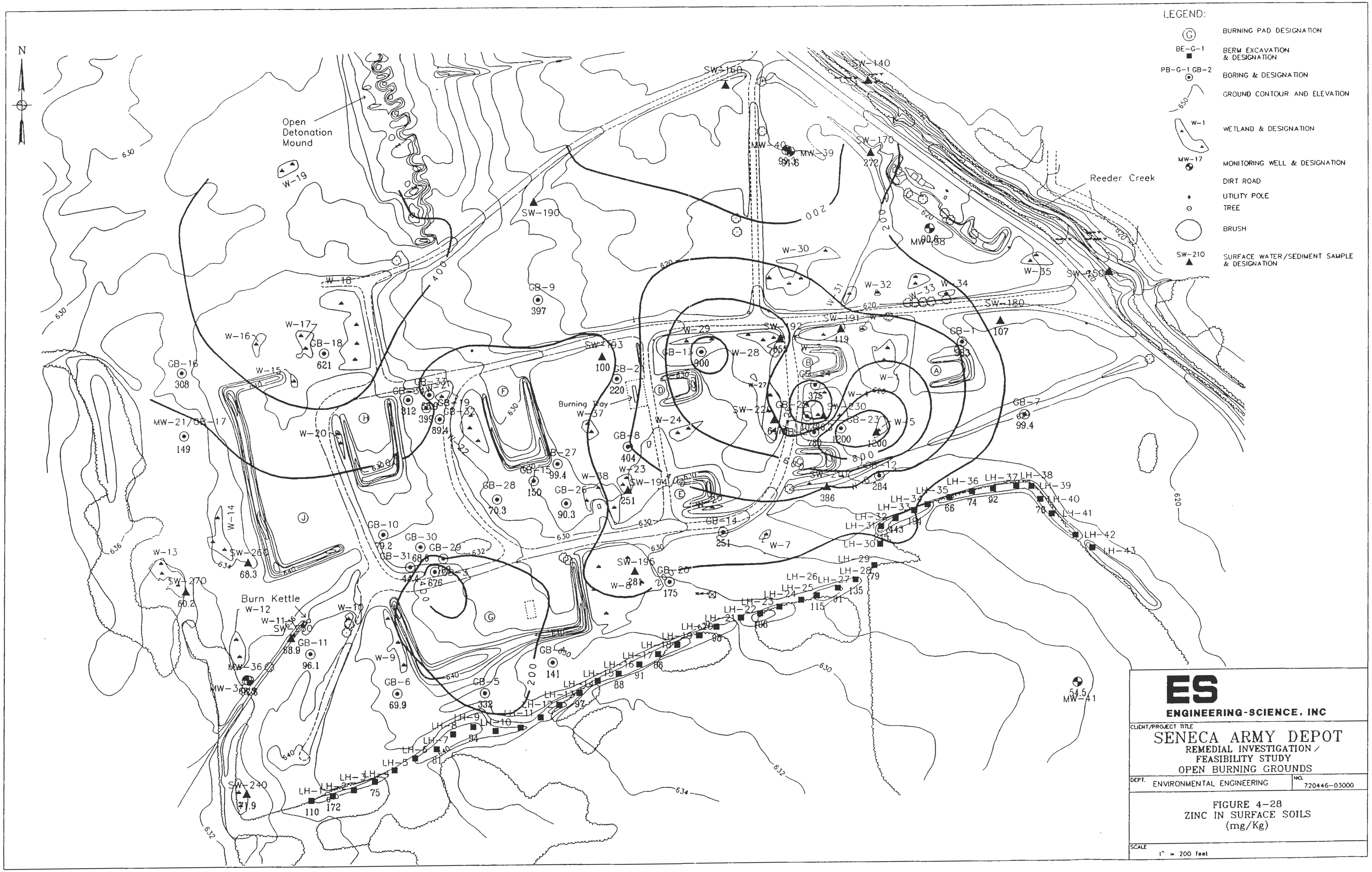

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FIGURE 4-28
ZINC IN SURFACE SOILS
(mg/Kg)

SCALE 1" = 200 feet

4.5 DOWNWIND SOILS AND BURN KETTLE SOILS

4.5.1 Burn Kettle Soils

4.5.1.1 Volatile Organic Compounds

Table 4-16 summarizes the distribution of volatile organics found within the burn kettle soils. Only one volatile organic compound was detected in one of the burn kettle soil samples (BKTL-2) collected at the Open Burning Grounds. Chloroform was detected at an estimated concentration below the sample quantitation limit. This estimated concentration (2 ug/kg) was not above the TAGM or site background.

4.5.1.2 Semivolatile Compounds

No semivolatile compounds were detected in any of the burn kettle soil samples collected on-site.

4.5.1.3 Pesticides and PCBs

No pesticides or PCBs were detected in any of the burn kettle soil samples collected on-site.

4.5.1.4 Explosives

No explosives were detected in any of the burn kettle soil samples collected on-site.

4.5.1.5 Metals

Table 4-16 summarizes the distribution of inorganic compounds found within the burn kettle soil samples collected. Only those compounds that were found above the detection limits are shown.

Barium was detected in all of the burn kettle soil samples analyzed. None of these samples were above the TAGM value for barium (300 mg/kg). The highest concentration of barium detected in burn kettle soils was 155 mg/kg in sample BKTL-5, a duplicate for BKTL-3. Copper was detected in all of the burn kettle soils. Only two of the samples had a copper concentration above the TAGM value (25 mg/kg). The highest concentration reported for

TABLE 4-16

SUMMARY OF COMPOUNDS DETECTED
BURN KETTLE SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-0.5 03/10/93 BKTL-1	OB 0-0.5 03/10/93 BKTL-1RE	OB 0-0.5 03/10/93 BKTL-2	OB 0-0.5 03/10/93 BKTL-3	OB 0-0.5 03/10/93 BKTL-4	OB 0-0.5 03/10/93 BKTL-5
VOCs (ug/kg)										
Methylene Chloride	0.0%	0	100	0	14 U	N	12 U	12 U	13 U	12 U
Acetone	0.0%	0	200	0	14 U	N	12 U	12 U	13 U	12 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	14 U	N	12 U	12 U	13 U	12 U
Chloroform	20.0%	2	300	0	14 U	N	2 J	12 U	13 U	12 U
2-Butanone	0.0%	0	300	0	14 U	N	12 U	12 U	13 U	12 U
1,1,1-Trichloroethane	0.0%	0	800	0	14 U	N	12 U	12 U	13 U	12 U
Carbon Tetrachloride	0.0%	0	600	0	14 U	N	12 U	12 U	13 U	12 U
Trichloroethene	0.0%	0	700	0	14 U	N	12 U	12 U	13 U	12 U
Benzene	0.0%	0	60	0	14 U	N	12 U	12 U	13 U	12 U
Tetrachloroethene	0.0%	0	1400	0	14 U	N	12 U	12 U	13 U	12 U
Toluene	0.0%	0	1500	0	14 U	N	12 U	12 U	13 U	12 U
Chlorobenzene	0.0%	0	1700	0	14 U	N	12 U	12 U	13 U	12 U
Xylene (total)	0.0%	0	1200	0	14 U	N	12 U	12 U	13 U	12 U
Semivolatiles (ug/kg)										
Phenol	0.0%	0	30 or MDL	0	450 U	450 U	410 U	400 U	420 U	400 U
2-Methylphenol	0.0%	0	100 or MDL	0	450 U	450 U	410 U	400 U	420 U	400 U
4-Methylphenol	0.0%	0	900	0	450 U	450 U	410 U	400 U	420 U	400 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Benzoic Acid	NA	NA	2700	0	N	N	N	N	N	N
Naphthalene	0.0%	0	13,000	0	450 U	450 U	410 U	400 U	420 U	400 U
2-Methylnaphthalene	0.0%	0	36,400	0	450 U	450 U	410 U	400 U	420 U	400 U
2-Chloronaphthalene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
2-Nitroaniline	0.0%	0	430 or MDL	0	1100 U	1100 U	1000 U	980 U	1000 U	980 U
Acenaphthylene	0.0%	0	41,000	0	450 U	450 U	410 U	400 U	420 U	400 U
2,6-Dinitrotoluene	0.0%	0	1000	0	450 U	450 U	410 U	400 U	420 U	400 U
3-Nitroaniline	0.0%	0	500 or MDL	0	1100 U	1100 U	1000 U	980 U	1000 U	980 U
Acenaphthene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Dibenzofuran	0.0%	0	6200	0	450 U	450 U	410 U	400 U	420 U	400 U
2,4-Dinitrotoluene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Diethylphthalate	0.0%	0	7100	0	450 U	450 U	410 U	400 U	420 U	400 U
Fluorene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
N-Nitrosodiphenylamine	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Hexachlorobenzene	0.0%	0	410	0	450 U	450 U	410 U	400 U	420 U	400 U
Pentachlorophenol	0.0%	0	1000 or MDL	0	540 R	1100 U	1000 U	980 U	1000 U	980 U
Phenanthrene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Anthracene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Carbazole	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Di-n-butylphthalate	0.0%	0	8100	0	450 U	450 U	410 U	400 U	420 U	400 U
Fluoranthene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Pyrene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Butylbenzylphthalate	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Benzo(a)anthracene	0.0%	0	220 or MDL	0	450 U	450 U	410 U	400 U	420 U	400 U
Chrysene	0.0%	0	400	0	450 U	450 U	410 U	400 U	420 U	400 U
bis(2-Ethylhexyl)phthalate	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Di-n-octylphthalate	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U
Benzo(b)fluoranthene	0.0%	0	1100	0	450 U	450 U	410 U	400 U	420 U	400 U
Benzo(k)fluoranthene	0.0%	0	1100	0	450 U	450 U	410 U	400 U	420 U	400 U
Benzo(a)pyrene	0.0%	0	61 or MDL	0	450 U	450 U	410 U	400 U	420 U	400 U
Indeno(1,2,3-cd)pyrene	0.0%	0	3200	0	450 U	450 U	410 U	400 U	420 U	400 U
Dibenz(a,h)anthracene	0.0%	0	14 or MDL	0	450 U	450 U	410 U	400 U	420 U	400 U
Benzo(g,h,i)perylene	0.0%	0	50,000*	0	450 U	450 U	410 U	400 U	420 U	400 U

TABLE 4–16

SUMMARY OF COMPOUNDS DETECTED
BURN KETTLE SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0–0.5 03/10/93 BKTL–1	OB 0–0.5 03/10/93 BKTL–1RE	OB 0–0.5 03/10/93 BKTL–2	OB 0–0.5 03/10/93 BKTL–3	OB 0–0.5 03/10/93 BKTL–4	OB 0–0.5 03/10/93 BKTL–5
Pesticides/PCBs (ug/kg)										
beta–BHC	0.0%	0	200	0	2.3 U	N	2.1 U	2.1 U	2.2 U	2.1 U
delta–BHC	0.0%	0	300	0	2.3 U	N	2.1 U	2.1 U	2.2 U	2.1 U
gamma–BHC (Lindane)	0.0%	0	60	0	2.3 U	N	2.1 U	2.1 U	2.2 U	2.1 U
Heptachlor	0.0%	0	100	0	2.3 U	N	2.1 U	2.1 U	2.2 U	2.1 U
Aldrin	0.0%	0	41	0	2.3 U	N	2.1 U	2.1 U	2.2 U	2.1 U
Heptachlor epoxide	0.0%	0	20	0	2.3 U	N	2.1 U	2.1 U	2.2 U	2.1 U
Endosulfan I	0.0%	0	900	0	2.3 U	N	2.1 U	2.1 U	2.2 U	2.1 U
Dieldrin	0.0%	0	44	0	4.5 U	N	4.1 U	4 U	4.2 U	4 U
4,4'–DDE	0.0%	0	2100	0	4.5 U	N	4.1 U	4 U	4.2 U	4 U
Endrin	0.0%	0	100	0	4.5 U	N	4.1 U	4 U	4.2 U	4 U
Endosulfan II	0.0%	0	900	0	4.5 U	N	4.1 U	4 U	4.2 U	4 U
4,4'–DDD	0.0%	0	2900	0	4.5 U	N	4.1 U	4 U	4.2 U	4 U
Endosulfan sulfate	0.0%	0	1000	0	4.5 U	N	4.1 U	4 U	4.2 U	4 U
4,4'–DDT	0.0%	0	2100	0	4.5 U	N	4.1 U	4 U	4.2 U	4 U
Endrin aldehyde	0.0%	0		NA	4.5 U	N	4.1 U	4 U	4.2 U	4 U
alpha–Chlordane	0.0%	0	540	0	2.3 U	N	2.1 U	2.1 U	2.2 U	2.1 U
Aroclor–1254	0.0%	0	1000	0	45 U	N	41 U	40 U	42 U	40 U
Aroclor–1260	0.0%	0	1000	0	45 U	N	41 U	40 U	42 U	40 U
Explosives (ug/kg)										
HMX	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
RDX	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
1,3,5–Trinitrobenzene	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
1,3–Dinitrobenzene	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
2,4,6–Trinitrotoluene	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
4–amino–2,6–Dinitrotoluene	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
2–amino–4,6–Dinitrotoluene	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
2,6–Dinitrotoluene	0.0%	0	1000	0	120 U	N	120 U	120 U	120 U	120 U
2,4–Dinitrotoluene	0.0%	0		NA	120 U	N	120 U	120 U	120 U	120 U
Metals (mg/kg)										
Aluminum	100.0%	19300	17503.0	2	19300	N	17300	17300	14600	18200
Antimony	20.0%	9.7	5	1	11.8 UJ	N	9.8 UJ	9.7 J	12.2 UJ	8.2 UJ
Arsenic	100.0%	6.6	7.5	0	3.7	N	4.6	6.6	5.8	6.3
Barium	100.0%	155	300	0	153	N	106	130	136	155
Beryllium	100.0%	0.99	1	0	0.99 J	N	0.97	0.85 J	0.73 J	0.99
Cadmium	0.0%	0	1.8	0	0.68 U	N	0.56 U	0.53 U	0.7 U	0.47 U
Calcium	100.0%	11300	46825.0	0	5380	N	3540	10200	11300	5440
Chromium	100.0%	54.1	26.6	1	54.1	N	21.6	24	22.2	23.4
Cobalt	100.0%	16.9	30	0	16.9	N	10.7	11.2	11.1 J	11.1
Copper	100.0%	56.2	25	2	56.2	N	15.4	24.2	32.2	23.4
Iron	100.0%	54800	32698.0	1	54800	N	28300	28000	27300	31500
Lead	100.0%	201	30	2	30.4	N	16.7 J	20.3	201	19.4
Magnesium	100.0%	6610	9071.1	0	6610	N	3310	6270	4670	4610
Manganese	100.0%	1150	1065.8	2	922	N	1150	613	688	1150
Mercury	100.0%	0.14	0.1	1	0.05 J	N	0.05 J	0.05 J	0.14 J	0.07 J
Nickel	100.0%	48.3	41.3	1	48.3	N	20.4	31.5	35.1	26.9
Potassium	100.0%	1720	1529.6	2	1720	N	993	1410	1280	1620
Selenium	60.0%	0.31	2	0	0.29 UJ	N	0.18 J	0.29 J	0.31 J	0.25 UJ
Silver	0.0%	0	0.6	0	0.7 U	N	0.58 U	0.54 U	0.72 U	0.49 U
Sodium	40.0%	54.2	76	0	65.1 U	N	54.2 J	50.8 U	67.1 U	48.1 J
Thallium	0.0%	0	0.3	0	0.67 U	N	0.37 U	0.61 U	0.58 U	0.6 U
Vanadium	100.0%	32.4	150	0	30.3	N	31.4	27.3	25.3	32.4
Zinc	100.0%	90.1	89.1	1	73.2	N	57.6	58	90.1	53.4
Cyanide	0.0%	0	NA	NA	0.68 U	N	0.63 U	0.62 U	0.63 U	0.62 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi–VOCs <500 ppm, Individual Semi–VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2–Dichloroethene (trans) was used for 1,2–Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

copper was 56.2 mg/kg found in sample BKTL-1. Lead was detected in all of the burn kettle soil samples, two of these being above the TAGM value (30 mg/kg). The highest concentration reported for lead was 201 mg/kg found in sample BKTL-4. Zinc was detected in all burn kettle soils samples, however only one was above the TAGM value of 89.1 mg/kg. In general the burn kettle samples have low metal concentrations in comparison to site background.

4.5.2 Downwind Soils

4.5.2.1 Volatile Organic Compounds

Only three volatile organic compounds were detected in the downwind soil samples collected at the OB grounds. Chloroform and 2-butanone were detected at estimated concentrations below the sample quantitation limit in samples DW-01 and DW-02. Acetone was detected in one sample (DW-02) at 230 ug/kg, above both the site background concentration and TAGM. Table 4-17 summarizes the distribution of volatile organics in downwind soil samples.

4.5.2.2 Semivolatile Organic Compounds

Overall, twenty-two (22) semivolatile compounds were detected in downwind soil samples, primarily in samples DW-03 and DW-08. Many of these compounds were also present in the background samples, DW-09, DW-10, and DW-11. The background sample locations were adjacent to Route 96A. This indicates that the semivolatile contamination is probably due to ubiquitous anthropogenic sources, such as automobiles, etc. Additionally, the concentrations were 10 to 100 times greater in the background samples that were located next to Route 96A than in the downwind samples. Table 4-17 summarizes the distribution of semivolatile organics in downwind soil samples.

4.5.2.3 Pesticides and PCBs

Six pesticides and PCBs were detected in the downwind soil samples. 4,4'-DDE was detected in only one sample at an estimated concentration below the sample quantitation limit. Endrin, Endosulfan sulfate, 4,4'-DDT, and alpha Chlordane were all detected at estimated concentrations that were below site background concentrations and TAGMs. The highest concentration detected was for Endosulfan II, detected at an estimated concentration of 480 ug/kg in DW-05.

TABLE 4-17

SUMMARY OF COMPOUNDS DETECTED
DOWNWIND SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-0.2 12/10/92 DW-01	OB 0-0.2 12/10/92 DW-02	OB 0-0.2 12/10/92 DW-02RE	OB 0-0.2 12/10/92 DW-03	OB 0-0.2 12/10/92 DW-04	OB 0-0.2 12/10/92 DW-05	OB 0-0.2 12/10/92 DW-06
VOCs (ug/kg)											
Methylene Chloride	0.0%	0	100	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Acetone	8.3%	230	200	1	38 U	230	N	13 U	15 U	16 U	36 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Chloroform	8.3%	3	300	0	3 J	13 U	N	13 U	15 U	16 U	14 U
2-Butanone	16.7%	11	300	0	6 J	11 J	N	13 U	15 U	16 U	14 U
1,1,1-Trichloroethane	0.0%	0	800	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Carbon Tetrachloride	0.0%	0	600	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Trichloroethene	0.0%	0	700	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Benzene	0.0%	0	60	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Tetrachloroethene	0.0%	0	1400	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Toluene	0.0%	0	1500	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Chlorobenzene	0.0%	0	1700	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Xylene (total)	0.0%	0	1200	0	14 U	13 U	N	13 U	15 U	16 U	14 U
Semivolatiles (ug/kg)											
Phenol	0.0%	0	30 or MDL	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
2-Methylphenol	0.0%	0	100 or MDL	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
4-Methylphenol	0.0%	0	900	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Benzoic Acid	NA	NA	2700	0	N	N	N	N	N	N	N
Naphthalene	7.1%	42	13,000	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
2-Methylnaphthalene	7.1%	53	36,400	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
2--Chloronaphthalene	0.0%	0	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
2-Nitroaniline	0.0%	0	430 or MDL	0	1200 U	1100 U	1100 U	1100 U	1200 U	1200 U	1100 U
Acenaphthylene	14.3%	540	41,000	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
2,6-Dinitrotoluene	0.0%	0	1000	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
3-Nitroaniline	7.1%	350	500 or MDL	0	1200 U	1100 U	350 J	1100 U	1200 U	1200 U	1100 U
Acenaphthene	14.3%	120	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Dibenzofuran	7.1%	52	6200	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
2,4-Dinitrotoluene	0.0%	0	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Diethylphthalate	0.0%	0	7100	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Fluorene	14.3%	130	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
N-Nitrosodiphenylamine	0.0%	0	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Hexachlorobenzene	0.0%	0	410	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Pentachlorophenol	7.1%	23	1000 or MDL	0	1200 U	1100 U	1100 U	23 J	1200 U	1200 U	1100 U
Phenanthrene	42.9%	1800	50,000*	0	490 U	470 U	470 U	26 J	480 U	480 U	470 U
Anthracene	21.4%	700	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Carbazole	28.6%	1200	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Di-n-butylphthalate	14.3%	24	8100	0	490 U	470 U	470 U	470 U	23 J	480 U	470 U
Fluoranthene	42.9%	3600	50,000*	0	490 U	470 U	470 U	50 J	480 U	480 U	470 U
Pyrene	50.0%	3900	50,000*	0	490 U	470 U	470 U	43 J	23 J	480 U	470 U
Butylbenzylphthalate	14.3%	86	50,000*	0	490 U	470 U	470 U	470 U	480 U	86 J	470 U
Benzo(a)anthracene	42.9%	2400	220 or MDL	3	490 U	470 U	470 U	22 J	480 U	480 U	470 U
Chrysene	42.9%	2700	400	1	490 U	470 U	470 U	27 J	480 U	480 U	470 U
bis(2-Ethylhexyl)phthalate	85.7%	16000	50,000*	0	60 J	25 J	470 U	470 U	98 J	31 J	94 J
Di-n-octylphthalate	7.1%	410	50,000*	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Benzo(b)fluoranthene	42.9%	3900	1100	1	490 U	470 U	470 U	26 J	480 U	480 U	470 U
Benzo(k)fluoranthene	42.9%	2800	1100	1	490 U	470 U	470 U	23 J	480 U	480 U	470 U
Benzo(a)pyrene	42.9%	2800	61 or MDL	4	490 U	470 U	470 U	20 J	480 U	480 U	470 U
Indeno(1,2,3-cd)pyrene	28.6%	1600	3200	0	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Dibenz(a,h)anthracene	14.3%	670	14 or MDL	2	490 U	470 U	470 U	470 U	480 U	480 U	470 U
Benzo(g,h,i)perylene	42.9%	960	50,000*	0	490 U	470 U	470 U	470 U	23 J	480 U	470 U

TABLE 4–17

SUMMARY OF COMPOUNDS DETECTED
DOWNWIND SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0–0.2 12/10/92 DW–01	OB 0–0.2 12/10/92 DW–02	OB 0–0.2 12/10/92 DW–02RE	OB 0–0.2 12/10/92 DW–03	OB 0–0.2 12/10/92 DW–04	OB 0–0.2 12/10/92 DW–05	OB 0–0.2 12/10/92 DW–06
Pesticides/PCBs (ug/kg)											
beta–BHC	0.0%	0	200	0	2.5 U	2.4 U	N	2.4 U	2.4 U	25 U	2.4 U
delta–BHC	0.0%	0	300	0	2.5 U	2.4 U	N	2.4 U	2.4 U	25 U	2.4 U
gamma–BHC (Lindane)	0.0%	0	60	0	2.5 U	2.4 U	N	2.4 U	2.4 U	25 U	2.4 U
Heptachlor	0.0%	0	100	0	2.5 U	2.4 U	N	2.4 U	2.4 U	25 U	2.4 U
Aldrin	0.0%	0	41	0	2.5 U	2.4 U	N	2.4 U	2.4 U	25 U	2.4 U
Heptachlor epoxide	0.0%	0	20	0	2.5 U	2.4 U	N	2.4 U	2.4 U	25 U	2.4 U
Endosulfan I	0.0%	0	900	0	2.5 U	2.4 U	N	2.4 U	2.4 U	25 U	2.4 U
Dieldrin	0.0%	0	44	0	4.9 U	4.7 U	N	4.7 U	4.8 U	48 U	4.7 U
4,4'–DDE	8.3%	2.4	2100	0	4.9 U	4.7 U	N	4.7 U	4.8 U	48 U	4.7 U
Endrin	16.7%	6.1	100	0	4.9 U	4.7 U	N	4.7 U	4.8 U	48 U	4.7 U
Endosulfan II	25.0%	480	900	0	18 J	4.7 U	N	4.7 U	4.8 U	480 J	4.7 U
4,4'–DDD	0.0%	0	2900	0	4.9 U	4.7 U	N	4.7 U	4.8 U	48 U	4.7 U
Endosulfan sulfate	8.3%	11	1000	0	4.9 U	4.7 U	N	4.7 U	4.8 U	48 U	4.7 U
4,4'–DDT	16.7%	7	2100	0	4.9 U	4.7 U	N	4.7 U	4.8 U	48 U	4.7 U
Endrin aldehyde	0.0%	0		NA	4.9 U	4.7 U	N	4.7 U	4.8 U	48 U	4.7 U
alpha–Chlordane	8.3%	3.9	540	0	2.5 U	2.4 U	N	2.4 U	2.4 U	25 U	2.4 U
Aroclor–1254	0.0%	0	1000	0	49 U	47 U	N	47 U	48 U	480 U	47 U
Aroclor–1260	0.0%	0	1000	0	49 U	47 U	N	47 U	48 U	480 U	47 U
Explosives (ug/kg)											
HMX	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
RDX	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
1,3,5–Trinitrobenzene	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
1,3–Dinitrotoluene	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
2,4,6–Trinitrotoluene	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
4–amino–2,6–Dinitrotoluene	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
4–amino–4,6–Dinitrotoluene	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
2,6–Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	N	120 U	120 U	120 U	120 U
2,4–Dinitrotoluene	0.0%	0		NA	120 U	120 U	N	120 U	120 U	120 U	120 U
Metals (mg/kg)											
Aluminum	100.0%	17400	17503.0	0	15400	13200	N	14100	17400	16100	16100
Antimony	0.0%	0	5	0	13.3 UJ	10 UJ	N	7.8 UJ	14.9 UJ	9.5 UJ	10.9 UJ
Arsenic	100.0%	6.2	7.5	0	3.3	4	N	4	6.2	4.7	4.7
Barium	100.0%	163	300	0	163	125	N	87.9	93.8	99.7	124
Beryllium	100.0%	0.88	1	0	0.88 J	0.72 J	N	0.62 J	0.78 J	0.83 J	0.85 J
Cadmium	16.7%	0.72	1.8	0	0.76 U	0.58 U	N	0.45 U	0.86 U	0.54 U	0.63 U
Calcium	100.0%	195000	46825.0	4	7140	2730	N	4990	1670	2840	4210
Chromium	100.0%	24.3	26.6	0	23.2	17.8	N	18.7	22.5	22.8	20
Cobalt	100.0%	12.5	30	0	9.2 J	9.5	N	9.7	11.1 J	12.3	9.1 J
Copper	100.0%	36.5	25	1	27.8	19	N	23.7	15.2	21.8	19.6
Iron	100.0%	26900	32698.0	0	25500	21100	N	20800	26700	24200	21600
Lead	100.0%	231	30	3	41.8	13.8 J	N	24	23.2	24.4	17.5 J
Magnesium	100.0%	13700	9071.1	4	3890	3270	N	4360	3580	3870	3200
Manganese	100.0%	938	1065.8	0	639	827	N	682	794	900	778
Mercury	100.0%	0.15	0.1	5	0.12 J	0.08 J	N	0.11 J	0.1 J	0.11 J	0.13 J
Nickel	100.0%	27.3	41.3	0	26.5	22.4	N	24.4	22.3	27.3	21.3
Potassium	100.0%	2160	1529.6	7	1770	1590	N	1960	1190 J	1690	1920
Selenium	100.0%	1	2	0	0.78 J	0.91 J	N	0.66 J	0.8 J	0.8 J	0.84 J
Silver	16.7%	0.98	0.6	2	0.78 U	0.98 J	N	0.46 U	0.88 U	0.56 U	0.65 U
Sodium	41.7%	1900	76	5	73.3 U	55.5 U	N	42.9 U	275 J	52.2 U	60.3 U
Thallium	0.0%	0	0.3	0	0.65 U	0.7 U	N	0.59 U	0.47 U	0.48 U	0.75 U
Vanadium	100.0%	29.5	150	0	26.4	24.4	N	23.7	27.8	26	27.7
Zinc	100.0%	122	89.1	2	81.9	51.3	N	75.8	71.8	70.1	62
Cyanide	0.0%	0	NA	NA	0.82 U	0.55 U	N	0.6 U	0.71 U	0.72 U	0.55 U

TABLE 4-17

SUMMARY OF COMPOUNDS DETECTED
DOWNWIND SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-0.2 12/10/92 DW-07	OB 0-0.2 12/10/92 DW-08	OB 0-0.2 12/10/92 DW-09	OB 0-0.2 12/10/92 DW-09RE	OB 0-0.2 12/10/92 DW-10	OB 0-0.2 12/10/92 DW-11	OB 0-0.2 12/10/92 DW-12
VOCs (ug/kg)											
Methylene Chloride	0.0%	0	100	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Acetone	8.3%	230	200	1	43 U	12 U	44 U	N	19 U	11 U	39 U
1,2-Dichloroethene (total)	0.0%	0	300 (b)	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Chloroform	8.3%	3	300	0	13 U	12 U	12 U	N	12 U	11 U	14 U
2-Butanone	16.7%	11	300	0	13 U	12 U	12 U	N	12 U	11 U	14 U
1,1,1-Trichloroethane	0.0%	0	800	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Carbon Tetrachloride	0.0%	0	600	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Trichloroethene	0.0%	0	700	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Benzene	0.0%	0	60	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Tetrachloroethene	0.0%	0	1400	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Toluene	0.0%	0	1500	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Chlorobenzene	0.0%	0	1700	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Xylene (total)	0.0%	0	1200	0	13 U	12 U	12 U	N	12 U	11 U	14 U
Semivolatiles (ug/kg)											
Phenol	0.0%	0	30 or MDL	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
2-Methylphenol	0.0%	0	100 or MDL	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
4-Methylphenol	0.0%	0	900	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
2,4-Dimethylphenol	0.0%	0	50,000*	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
Benzoic Acid	NA	NA	2700	0	N	N	N	N	N	N	N
Naphthalene	7.1%	42	13,000	0	490 U	42 J	430 U	2100 U	530 U	2100 U	510 U
2-Methylnaphthalene	7.1%	53	36,400	0	490 U	53 J	430 U	2100 U	530 U	2100 U	510 U
2-Chloronaphthalene	0.0%	0	50,000*	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
2-Nitroaniline	0.0%	0	430 or MDL	0	1200 U	1300 U	1000 U	5200 U	1300 U	5000 U	1200 U
Acenaphthylene	14.3%	540	41,000	0	490 U	540	430 U	2100 U	47 J	2100 U	510 U
2,6-Dinitrotoluene	0.0%	0	1000	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
3-Nitroaniline	7.1%	350	500 or MDL	0	1200 U	1300 U	1000 U	5200 U	1300 U	5000 U	1200 U
Acenaphthene	14.3%	120	50,000*	0	490 U	120 J	430 U	2100 U	44 J	2100 U	510 U
Dibenzofuran	7.1%	52	6200	0	490 U	52 J	430 U	2100 U	530 U	2100 U	510 U
2,4-Dinitrotoluene	0.0%	0	50,000*	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
Diethylphthalate	0.0%	0	7100	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
Fluorene	14.3%	130	50,000*	0	490 U	130 J	430 U	2100 U	37 J	2100 U	510 U
N-Nitrosodiphenylamine	0.0%	0	50,000*	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
Hexachlorobenzene	0.0%	0	410	0	490 U	540 U	430 U	2100 U	530 U	2100 U	510 U
Pentachlorophenol	7.1%	23	1000 or MDL	0	1200 U	1300 U	1000 U	5200 U	1300 U	5000 U	1200 U
Phenanthrene	42.9%	1800	50,000*	0	490 U	1800	140 J	420 J	420 J	180 J	510 U
Anthracene	21.4%	700	50,000*	0	490 U	700	27 J	2100 U	98 J	2100 U	510 U
Carbazole	28.6%	1200	50,000*	0	490 U	1200	34 J	2100 U	240 J	120 J	510 U
Di-n-butylphthalate	14.3%	24	8100	0	490 U	540 U	430 U	2100 U	530 U	2100 U	24 J
Fluoranthene	42.9%	3600	50,000*	0	490 U	3600	180 J	550 J	640	320 J	510 U
Pyrene	50.0%	3900	50,000*	0	490 U	3900	180 J	580 J	610	280 J	510 U
Butylbenzylphthalate	14.3%	86	50,000*	0	490 U	540 U	430 U	2100 U	51 J	2100 U	510 U
Benzo(a)anthracene	42.9%	2400	220 or MDL	3	490 U	2400	94 J	260 J	300 J	160 J	510 U
Chrysene	47.9%	2700	400	1	490 U	2700	140 J	360 J	370 J	240 J	510 U
bis(2-Ethylhexyl)phthalate	85.7%	16000	50,000*	0	110 J	100 J	10000 J	11000 J	4200	16000	42 J
Di-n-octylphthalate	7.1%	410	50,000*	0	490 U	540 U	430 U	2100 U	530 U	410 J	510 U
Benzo(b)fluoranthene	42.9%	3900	1100	1	490 U	3900	130 J	260 J	360 J	210 J	510 U
Benzo(k)fluoranthene	42.9%	2800	1100	1	490 U	2800	97 J	260 J	300 J	220 J	510 U
Benzo(a)pyrene	42.9%	2800	61 or MDL	4	490 U	2800	26 J	200 J	260 J	150 J	510 U
Indeno(1,2,3-cd)pyrene	28.6%	1600	3200	0	490 U	1600	82 J	130 J	140 J	2100 U	510 U
Dibenz(a,h)anthracene	14.3%	670	14 or MDL	2	490 U	670	23 J	2100 U	530 U	2100 U	510 U
Benzo(g,h,i)perylene	42.9%	960	50,000*	0	490 U	960	110 J	140 J	76 J	110 J	510 U

TABLE 4-17

SUMMARY OF COMPOUNDS DETECTED
DOWNWIND SOILS

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	TAGM (a)	NUMBER OF SAMPLES ABOVE TAGM	OB 0-0.2 12/10/92 DW-07	OB 0-0.2 12/10/92 DW-08	OB 0-0.2 12/10/92 DW-09	OB 0-0.2 12/10/92 DW-09RE	OB 0-0.2 12/10/92 DW-10	OB 0-0.2 12/10/92 DW-11	OB 0-0.2 12/10/92 DW-12
Pesticides/PCBs (ug/kg)											
beta-BHC	0.0%	0	200	0	2.5 U	4.2 U	2.2 U	N	2.1 U	1.9 U	2.6 U
delta-BHC	0.0%	0	300	0	2.5 U	4.2 U	2.2 U	N	2.1 U	1.9 U	2.6 U
gamma-BHC (Lindane)	0.0%	0	60	0	2.5 U	4.2 U	2.2 U	N	2.1 U	1.9 U	2.6 U
Heptachlor	0.0%	0	100	0	2.5 U	4.2 U	2.2 U	N	2.1 U	1.9 U	2.6 U
Aldrin	0.0%	0	41	0	2.5 U	4.2 U	2.2 U	N	2.1 U	1.9 U	2.6 U
Heptachlor epoxide	0.0%	0	20	0	2.5 U	4.2 U	2.2 U	N	2.1 U	1.9 U	2.6 U
Endosulfan I	0.0%	0	900	0	2.5 U	4.2 U	2.2 U	N	2.1 U	1.9 U	2.6 U
Dieldrin	0.0%	0	44	0	4.8 U	8.1 U	4.3 U	N	4.1 U	3.7 U	5.1 U
4,4'-DDE	8.3%	2.4	2100	0	4.8 U	8.1 U	4.3 U	N	2.4 J	3.7 U	5.1 U
Endrin	16.7%	6.1	100	0	4.8 U	7.7 J	6.1 J	N	4.1 U	3.7 U	5.1 U
Endosulfan II	25.0%	480	900	0	4.2 J	8.1 U	4.3 U	N	4.1 U	3.7 U	5.1 U
4,4'-DDD	0.0%	0	2900	0	4.8 U	8.1 U	4.3 U	N	4.1 U	3.7 U	5.1 U
Endosulfan sulfate	8.3%	11	1000	0	4.8 U	11 J	4.3 U	N	4.1 U	3.7 U	5.1 U
4,4'-DDT	16.7%	7	2100	0	4.8 U	8.1 U	3.4 J	N	7	3.7 U	5.1 U
Endrin aldehyde	0.0%	0		NA	4.8 U	8.1 U	4.3 U	N	4.1 U	3.7 U	5.1 U
alpha-Chlordane	8.3%	3.9	540	0	2.5 U	3.9 J	2.2 U	N	2.1 U	1.9 U	2.6 U
Aroclor-1254	0.0%	0	1000	0	48 U	81 U	43 U	N	41 U	37 U	51 U
Aroclor-1260	0.0%	0	1000	0	48 U	81 U	43 U	N	41 U	37 U	51 U
Explosives (ug/kg)											
HMX	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
RDX	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
1,3,5-Trinitrobenzene	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
1,3-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
Tetryl	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
2,4,6-Trinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
4-amino-2,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
4-amino-4,6-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
2,6-Dinitrotoluene	0.0%	0	1000	0	120 U	120 U	120 U	N	120 U	120 U	120 U
2,4-Dinitrotoluene	0.0%	0		NA	120 U	120 U	120 U	N	120 U	120 U	120 U
Metals (mg/kg)											
Aluminum	100.0%	17400	17503.0	0	10300	12700	9910	N	4940	4590	17000
Antimony	0.0%	0	5	0	9 UJ	9.2 UJ	11.8 UJ	N	11.4 UJ	7.6 UJ	8.7 UJ
Arsenic	100.0%	6.2	7.5	0	4.8	4.3	5.9	N	5.1	5	5.1
Barium	100.0%	163	300	0	82.5	127	72.5	N	66.3	29	94
Beryllium	100.0%	0.88	1	0	0.56 J	0.71 J	0.55 J	N	0.35 J	0.29 J	0.85
Cadmium	16.7%	0.72	1.8	0	0.52 U	0.6 J	0.72 J	N	0.65 U	0.44 U	0.5 U
Calcium	100.0%	195000	46825.0	4	3380	59700	77900	N	194000	195000	1830
Chromium	100.0%	24.3	26.6	0	14.4	18.3	24.3	N	17.5	13.4	23.3
Cobalt	100.0%	12.5	30	0	6.7 J	9.2	8.4 J	N	5.1 J	5.9 J	12.5
Copper	100.0%	36.5	25	1	14.8	28.5	36.5	N	26.2	23.1	15.9
Iron	100.0%	26900	32698.0	0	16100	21100	19100	N	15700	13500	26900
Lead	100.0%	231	30	3	20.6	26.1	144	N	231	101	22.4
Magnesium	100.0%	13700	9071.1	4	2610	13700	9220	N	10800	12700	3600
Manganese	100.0%	938	1065.8	0	395	666	522	N	378	370	938
Mercury	100.0%	0.15	0.1	5	0.15 J	0.04 J	0.06 J	N	0.1 J	0.06 J	0.1 J
Nickel	100.0%	27.3	41.3	0	15.8	26.3	24.7	N	17.1	18.9	22.8
Potassium	100.0%	2160	1529.6	7	2160	1970	1490	N	1080	901	1080
Selenium	100.0%	1	2	0	0.79 J	0.59 J	0.77 J	N	0.59 J	0.62 J	1 J
Silver	16.7%	0.98	0.6	2	0.53 U	0.54 U	0.79 J	N	0.67 U	0.45 U	0.51 U
Sodium	41.7%	1900	76	5	49.9 U	195 J	241 J	N	1900	356 J	47.9 U
Thallium	0.0%	0	0.3	0	0.44 U	0.47 U	0.59 U	N	2.3 U	2.5 U	0.59 U
Vanadium	100.0%	29.5	150	0	18	29.5	27.3	N	21.9	17.8	27.9
Zinc	100.0%	122	89.1	2	56.4	84	122	N	114	86.8	72.8
Cyanide	0.0%	0	NA	NA	0.75 U	0.62 U	0.57 U	N	0.61 R	0.55 U	0.76 U

NOTES:

a) * = As per proposed TAGM, Total VOCs <10 ppm, Total Semi-VOCs <500 ppm, Individual Semi-VOCs <50 ppm.
For certain metals, the TAGM is equal to the greater value between the proposed TAGM and site background.
The number of samples above the TAGM was determined by comparison to the actual number given, not the MDL.
b) The TAGM for 1,2-Dichloroethene (trans) was used for 1,2-Dichloroethene (total) since it was the only value available.
c) NA = not applicable
d) N = Compound was not analyzed.
e) U = Compound was not detected.
f) J = The reported value is an estimated concentration.
g) R = The data was rejected in the data validation process.
h) SB = Site background
i) MDL = Method detection limit

4.5.2.4 Explosives

No explosives were detected in any of the downwind soil samples collected on-site or in the four samples collected off site (DW-08, DW-09, DW-10, and DW-11), that were adjacent to Route 96A.

4.5.2.5 Metals

Table 4-17 summarizes the distribution of inorganic compounds found within the downwind soil samples collected. Only those compounds that were found above the detection limits are shown.

Barium was detected in all of the downwind soil samples analyzed. None of these samples was above the TAGM volume for barium (300 mg/kg). The highest concentration of barium detected in downwind soils was 163 mg/kg in sample DW-01. Copper was detected in all of the downwind soils. One of the samples had a copper concentration above the TAGM value (25 mg/kg). The highest concentration reported for copper was 36.5 mg/kg found in sample DW-09. Lead was detected in all of the downwind soil samples, three of these being above the TAGM value (30 mg/kg). The highest concentration reported for lead was 231 mg/kg found in sample DW-10. Zinc was detected in all downwind soil samples, however, only two were above the TAGM value of 89.1 mg/kg. Overall, metals concentrations found in soils were low compared to site background.

4.6 SURFACE WATER

4.6.1 Volatile Organic Compounds

A total of five volatile organic compounds were detected in six of the surface water samples collected at the OB grounds. Of these six, three were at estimated concentrations below the sample quantitation limit. The highest concentration reported was for the compound acetone found in the sample SW-180 at a concentration of 35 ug/L. Three of the surface water samples were above the New York State Ambient Water Quality Standards and Guidelines, one of these being below the sample quantitation limit.

4.6.2 Semivolatile Compounds

Only one semivolatile organic compound was detected in the surface water samples collected at the OB grounds. The compound. bis(2-ethylhexyl)phthalate was detected in only one sample, SW-192, at a concentration of 71 ug/L. This concentration is above the New York State Ambient Water Quality Standards and Guidelines.

4.6.3 Pesticides and PCBs

No pesticides or PCBs were detected in any of the surface water samples collected on-site.

4.6.4 Explosives

Figure 4-29 shows the locations where surface water and sediment samples were collected as part of this investigation. Also presented in this figure is a tabular summary of the Level IV analytical results for the analysis of explosives in surface water. Table 4-18 summarizes the distribution of explosive compounds found within the surface water samples collected at the site.

Only two explosives were detected in the surface water samples collected, RDX and Tetryl. RDX was detected in six of the surface water samples (SW-120, SW-160DL, SW-170, SW-193, SW194, and SW-195) and Tetryl in only one (SW-197). The highest concentration of explosives reported was for RDX found in the sample SW-160DL at a concentration of 9.4 ug/L. There are no ambient water quality guidelines and standards for explosives.

Of the six surface water and sediment sample locations on Reeder Creek (SW-110, SW-120, SW-130, SW-140, SW-150, and SW-196), only the surface water sample collected at station SW-120 had explosive compounds detected. A concentration of 0.67 ug/L of RDX was detected in this surface water sample. This station is downstream of both the OB grounds and the OD Mound so that a definitive source can not be attributed to this anomaly.

4.6.5 Metals

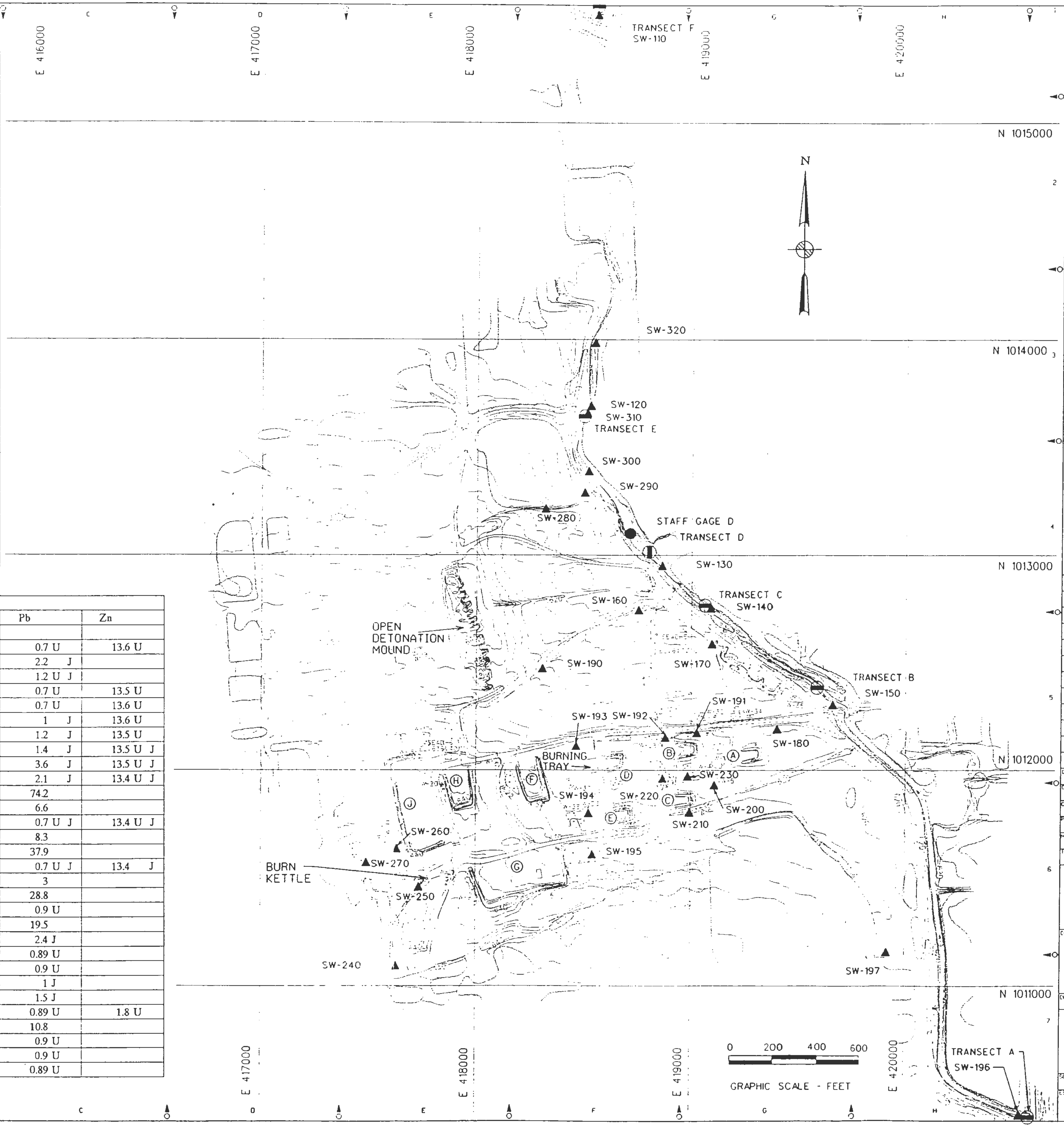
Figure 4-29 shows the locations where surface water and sediment samples were collected as part of this investigation. Also presented in this figure is a tabular summary of the Level IV analytical results for the analysis of barium, copper, lead, and zinc in surface water. Table 4-

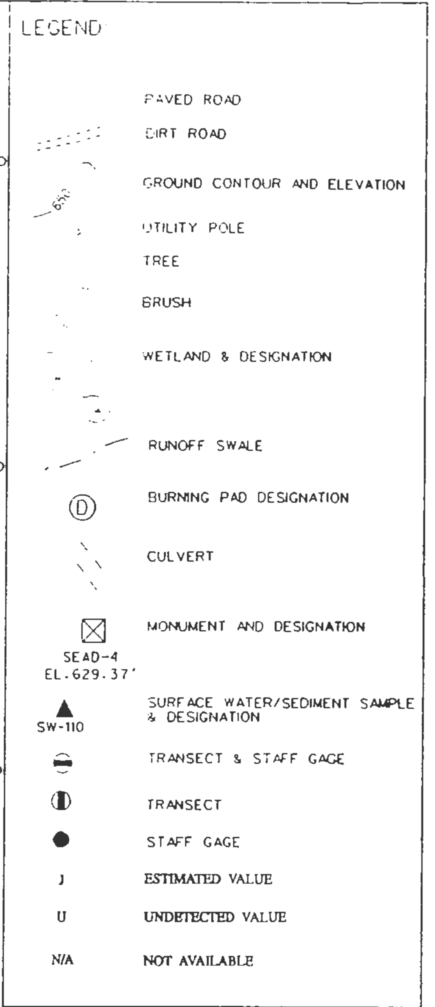
SURFACE WATER		
LOCATION	RDX	Tetryl
SW−110	0.12 U	0.12 U
SW−120	0.67	0.12 U
SW−120	0.12 U	0.4 U
SW−130	0.12 U	0.12 U
SW−140	0.12 U	0.12 U
SW−150	0.12 U	0.12 U
SW−150	0.12 U	0.12 U
SW−150	0.12 U	0.4 U
SW−160		0.4 U
SW−160 DL	9.4	
SW−170	0.67	0.4 U
SW−180	0.12 U	0.4 U
SW−191	0.12 U	0.12 U
SW−192	0.12 U	0.4 U
SW−193	1.3	0.4 U
SW−194	4.6	0.4 U
SW−195	0.44	0.4 U
SW−196	0.12 U	0.4 U
SW−197	0.12 U	0.52
SW−200	0.24 U	0.12 U
SW−210	0.26 U	0.12 U
SW−220	0.17 U	0.12 U
SW−230	0.19 U	0.12 U
SW−240	0.22 U	0.12 U
SW−250	0.18 U	0.12 U
SW−260	0.21 U	0.12 U
SW−261	0.2 U	0.12 U
SW−270	0.19 U	0.12 U
SW−290	0.24 U	0.12 U
SW−300	0.21 U	0.12 U
SW−310	0.15 U	0.12 U
SW−320	0.14 U	0.12 U

All concentrations in ug/L.

SURFACE WATER				
LOCATION	Ba	Cu	Pb	Zn
SW−110	66.6 J	19.7 U	0.7 U	13.6 U
SW−120	65.7 J	19.6 U	2.2 J	
SW−120	48.9 J	14.4 U J	1.2 U J	
SW−130	52.3 J	19.6 U	0.7 U	13.5 U
SW−140	51.2 J	19.7 U	0.7 U	13.6 U
SW−150	59.5 J	19.7 U	1 J	13.6 U
SW−150	53.2 J	19.6 U	1.2 J	13.5 U
SW−160		14.5 U J	1.4 J	13.5 U J
SW−170		14.5 U J	3.6 J	13.5 U J
SW−180	83 J	19.8 J	2.1 J	13.4 U J
SW−191	196 J	24 J	74.2	
SW−192	111 J	20.9 J	6.6	
SW−193		14.4 U J	0.7 U J	13.4 U J
SW−194	69.8 J	28.1	8.3	
SW−195	98.7 J	37.2	37.9	
SW−196	52.2 U J	14.4 U J	0.7 U J	13.4 J
SW−197	35.5 J	10.5 J	3	
SW−200	523	33.5	28.8	
SW−210	148 J	1.9 U	0.9 U	
SW−220	182 J	22.3 J	19.5	
SW−230	228	7.8 J	2.4 J	
SW−240	21.7 J	1.9 U	0.89 U	
SW−250	42.3 J	1.9 U	0.9 U	
SW−260	181 J	1.9 U	1 J	
SW−261	176 J	1.9 U	1.5 J	
SW−270	57.7 J	1.9 U	0.89 U	1.8 U
SW−290	112 J	59.8	10.8	
SW−300	51.7 J	1.9 U	0.9 U	
SW−310	47.2 J	1.9 U	0.9 U	
SW−320	51.3 J	1.9 U	0.89 U	

All concentrations in ug/L.





REV	DATE	DESCRIPTION
C	10/4/93	DRAFT PHASE II - RI/FS

DRAWN BY E.SCHACHT
CHECKED BY W.E.BAKER
DESIGN SUPV. G.A.KAELIN
RESP. ENGR.
CHIEF DISC. ENGR. W.E.BAKER
MGR. OF ENGR. J.P.CHAPLICK
PROJECT MANAGER W.N.DUCHESNEAU
MGR. OF PROJECTS J.P.CHAPLICK
IN CHARGE W.D.PATTERSON

DRAWN
CHECKED
DES.SUPV.
RESP.ENGR.
CH.DISC.ENG.
PROJ. MGR.
MF

ES

ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 4-29
EXPLOSIVES AND METALS IN SURFACE WATER

SCALE 1"=500'
ES'S DWG. NO. 720446-01022-4-29
REV C

/usr/si3/environ/misc/senp2t28.dgn
06-OCT-1993 14:04

TABLE 4-18

SUMMARY OF COMPOUNDS DETECTED
SURFACE WATER

SENECA ARMY DEPOT

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	NYS GUIDELINES (a)	NUMBER OF SAMPLES ABOVE NYS GUIDELINES	WATER SW-110 11/07/91	WATER SW-120 11/07/91	WATER SW-120 12/12/91	WATER SW-120 11/12/91	WATER SW-120 12/12/91	WATER SW-130 11/07/91	WATER SW-140 11/07/91	WATER SW-150 11/08/91	WATER SW-150 11/08/91	WATER SW-150 11/15/91	WATER SW-160 11/12/91	WATER SW-160 DL 1114/91
VOCs (ug/L)																
Methylene Chloride	3.3%	8	5	1	5 U	5 U	5 U	N	N	5 U	5 U	5 U	5 U	N	5 U	N
Acetone	6.7%	35	–	NA	10 U	10 U	10	N	N	10 U	10 U	10 U	10 U	N	10 U	N
Carbon Disulfide	3.3%	3	–	NA	5 U	5 U	5 U	N	N	5 U	5 U	5 U	5 U	N	5 U	N
1,2-Dichloroethane	3.3%	2	0.8	1	5 U	5 U	5 U	N	N	5 U	2 J	5 U	5 U	N	5 U	N
Trichloroethene	3.3%	17	3	1	5 U	5 U	5 U	N	N	5 U	5 U	5 U	5 U	N	5 U	N
Semivolatiles (ug/L)																
bis(2-Ethylhexyl)phthalate	3.2%	71	0.6	1	10 U	11 U	10 U	N	N	10 U	10 U	10 U	10 U	10 U	10 U	N
Explosives (ug/L)																
RDX	18.8%	9.4	–	NA	0.12 U	0.67	0.12 U	N	N	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	9.4 R	9.4
Tetryl	3.1%	0.52	–	NA	0.12 U	0.12 U	0.4 U	N	N	0.12 U	0.12 U	0.12 U	0.12 U	0.4 U	0.4 U	2 U R
Metals (ug/L)																
Aluminum	33.3%	5220	100	10	109 U	300	102 J	N	N	109 U	109 U	109 U	139 J	N	98.3 U J	N
Arsenic	10.0%	4.4	50	0	2.8 U	2.8 U	2.9 U J	N	N	2.8 U	2.8 U	2.8 U	2.8 U	N	3.7 U J	N
Barium	86.7%	523	1000	0	66.6 J	65.7 J	48.9 J	N	N	52.3 J	51.2 J	59.5 J	53.2 J	N	68.5 R	N
Beryllium	10.0%	1.4	3	0	3.5 U	3.5 U	1.4 J	N	N	3.5 U	3.5 U	3.5 U	3.5 U	N	1.2 U J	N
Calcium	100.0%	183000	–	NA	121000	114000	96000 J	N	N	100000	87100	85600	83800	N	93300 J	N
Chromium	3.3%	8.6	100	0	9.6 U	9.5 U	6.1 U J	N	N	9.5 U	9.6 U	9.6 U	9.5 U	N	6.2 U J	N
Copper	33.3%	59.8	12	8	19.7 U	19.6 U	14.4 U J	N	N	19.6 U	19.7 U	19.7 U	19.6 U	N	14.5 U J	N
Iron	73.3%	8550	300	15	98.4 J	670	142 J	N	N	236	314	737	737	N	189 J	N
Lead	56.7%	74.2	3	8	0.7 U	2.2 J	1.2 U J	N	N	0.7 U	0.7 U	1 J	1.2 J	N	1.4 J	N
Magnesium	100.0%	59900	35000	3	18700	17300	13700 J	N	N	14400	12800	12900	12700	N	9320 J	N
Manganese	86.7%	1080	300	2	14.6 J	121	43.7 J	N	N	34.5	68.4	236	230	N	14.9 R	N
Mercury	10.0%	0.17	0.2	0	0.08 U	0.08 U	0.08 U J	N	N	0.08 U	0.08 U	0.11 J	0.08 U	N	0.08 U J	N
Nickel	3.3%	5.6	96	0	35.2 U	34.9 U	15.8 U J	N	N	35 U	35.2 U	35.2 U	35 U	N	16 U J	N
Potassium	56.7%	6050	–	NA	3800 J	3800 J	949 J	N	N	3070 J	3000 J	3470 J	2800 J	N	1860 J	N
Selenium	50.0%	3.2	1	14	1.7 U	1.7 U	1 U J	N	N	1.7 U	1.7 U	1.7 U	1.7 U	N	1.7 U J	N
Sodium	93.3%	59100	20000	10	26500	24700	21900 J	N	N	24100	23100	22900 U	22500	N	4170 J	N
Vanadium	20.0%	39.2	14	4	30.9 U	30.7 U	30.3 U J	N	N	30.7 U	30.9 U	30.9 U	30.7 U	N	37.2 J	N
Zinc	3.3%	13.4	30	0	13.6 U	15.1 R	14.1 R	N	N	13.5 U	13.6 U	13.6 U	13.5 U	N	13.5 U J	N
Cyanide	6.7%	14.9	52	0	10 U	10 U	10 U J	N	N	10 U	10 U	10 U	10 U	N	10 U	N

NOTES: a) The New York State Ambient Water Quality Standards and Guidelines.
The lower concentration of both the aquatic and human health standards was used.
b) NA = not applicable
c) N = Compound was not analyzed.
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.

TABLE 4–18

SUMMARY OF COMPOUNDS DETECTED
SURFACE WATER

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	NYS GUIDELINES (a)	NUMBER OF SAMPLES ABOVE NYS GUIDELINES	WATER SW–220 12/03/92	WATER SW–230 12/03/92	WATER SW–240 12/04/92	WATER SW–250 12/04/92	WATER SW–260 12/07/92	WATER SW–261 12/07/92	WATER SW–270 12/07/92	WATER SW–290 12/07/92	WATER SW–300 12/08/92	WATER SW–310 12/08/92	WATER SW–320 12/08/92
VOCs (ug/L)															
Methylene Chloride	3.3%	8	5	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	8 J	10 U	10 U
Acetone	6.7%	35	–	NA	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Carbon Disulfide	3.3%	3	–	NA	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
1,2–Dichloroethane	3.3%	2	0.8	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Trichloroethene	3.3%	17	3	1	10 U	17	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Semivolatiles (ug/L)															
bis(2–Ethylhexyl)phthalate	3.2%	71	0.6	1	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	21 U	10 U	14 U
Explosives (ug/L)															
RDX	18.8%	9.4	–	NA	0.17 U	0.19 U	0.22 U	0.18 U	0.21 U	0.2 U	0.19 U	0.24 U	0.21 U	0.15 U	0.14 U
Tetryl	3.1%	0.52	–	NA	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
Metals (ug/L)															
Aluminum	33.3%	5220	100	10	219 R	62.3 U	62.1 U	188 R	553 R	665 R	62.4 U	2100	126 R	62.6 U	130 R
Arsenic	10.0%	4.4	50	0	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Barium	86.7%	523	1000	0	182 J	228	21.7 J	42.3 J	181 J	176 J	57.7 J	112 J	51.7 J	47.2 J	51.3 J
Beryllium	10.0%	1.4	3	0	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U
Calcium	100.0%	183000	–	NA	123000	151000	58000	117000	137000	134000	111000	138000	93800	93100	97800
Chromium	3.3%	8.6	100	0	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Copper	33.3%	59.8	12	8	22.3 J	7.8 J	1.9 U	1.9 U	1.9 U	1.9 U	1.9 U	59.8	1.9 U	1.9 U	1.9 U
Iron	73.3%	8550	300	15	8550	130 R	82.5 R	652	751	1070	4730	2310	276 R	170 R	326 R
Lead	56.7%	74.2	3	8	19.5	2.4 J	0.89 U	0.9 U	1 J	1.5 J	0.89 U	10.8	0.9 U	0.9 U	0.89 U
Magnesium	100.0%	59900	35000	3	27500	59900	10700	15200	37600	36500	28500	33800	15500	15500	16400
Manganese	86.7%	1080	300	2	608	19.9	32.6	291	28.4	39.6	1080	186	47	32	53
Mercury	10.0%	0.17	0.2	0	0.06 U	0.06 U	0.17 J	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
Nickel	3.3%	5.6	96	0	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	3.5 U	5.6 J	3.5 U	3.5 U	3.5 U
Potassium	56.7%	6050	–	NA	4040 R	5050 R	894 R	988 R	1920 R	2280 R	499 R	2100 R	1890 R	1780 R	1300 R
Selenium	50.0%	3.2	1	14	2 J	3.2 J	1.1 J	1.5 J	2.4 J	2.5 J	2.1 J	2.7 J	1.2 J	1.6 J	1.4 J
Sodium	93.3%	59100	20000	10	12900	34200	13100	2180 J	25700	24400	4240 J	7290	11900	10300	10600
Vanadium	20.0%	39.2	14	4	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U	2.1 U
Zinc	3.3%	13.4	30	0	65.8 R	17.2 R	8.1 R	21.6 R	6.2 R	7.4 R	1.8 U	97.4 R	3 R	3 R	5.3 R
Cyanide	6.7%	14.9	52	0	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	14.9	10 U	10 U

NOTES: a) The New York State Ambient Water Quality Standards and Guidelines.
The lower concentration of both the aquatic and human health standards v
b) NA = not applicable
c) N = Compound was not analyzed.
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.

TABLE 4–18

SUMMARY OF COMPOUNDS DETECTED
SURFACE WATER

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	NYS GUIDELINES (a)	NUMBER OF SAMPLES ABOVE NYS GUIDELINES	WATER SW–170 11/12/91	WATER SW–180 12/12/91	WATER SW–180 12/12/91	WATER SW–191 11/08/91	WATER SW–192 11/13/91	WATER SW–193 11/13/91	WATER SW–194 11/13/91	WATER SW–195 11/13/91	WATER SW–196 11/12/91	WATER SW–197 11/13/91	WATER SW–200 12/03/92	WATER SW–210 12/03/92
VOCs (ug/L)																
Methylene Chloride	3.3%	8	5	1	5 U	5 U	N	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	10 U
Acetone	6.7%	35	–	NA	12 U	35	N	10 U	14 U	14 U	13 U	11 U	10 U	16 U	10 U	10 U
Carbon Disulfide	3.3%	3	–	NA	5 U	5 U	N	5 U	5 U	5 U	5 U	5 U	5 U	3 J	10 U	10 U
1,2–Dichloroethane	3.3%	2	0.8	1	5 U	5 U	N	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	10 U
Trichloroethene	3.3%	17	3	1	5 U	5 U	N	5 U	5 U	5 U	5 U	5 U	5 U	5 U	10 U	10 U
Semivolatiles (ug/L)																
bis(2–Ethylhexyl)phthalate	3.2%	71	0.6	1	10 U	10 U	N	10 U	71	10 U	11 U	10 U	10 U	10 U	10 U	10 U
Explosives (ug/L)																
RDX	18.8%	9.4	–	NA	0.67	0.12 U	N	0.12 U	0.12 U	1.3	4.6	0.44	0.12 U	0.12 U	0.24 U	0.26 U
Tetryl	3.1%	0.52	–	NA	0.4 U	0.4 U	N	0.12 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.52	0.12 U	0.12 U
Metals (ug/L)																
Aluminum	33.3%	5220	100	10	98.3 U J	256 J	N	1430	74.8 R	269 J	481	5220	97.5 U J	1490	273 R	62.3 U
Arsenic	10.0%	4.4	50	0	3.7 U J	2.9 U J	N	2.8 U	3.7 U	4.4 J	3.9 J	3.9 J	3.7 U J	3.7 U	1.2 U	1.2 U
Barium	86.7%	523	1000	0	109 R	83 J	N	196 J	111 J	43.5 R	69.8 J	98.7 J	52.2 U J	35.5 J	523	148 J
Beryllium	10.0%	1.4	3	0	1.2 U J	1.2 U J	N	3.5 U	1.1 U	1.2 J	1.1 U	1.3 J	1.2 U J	1.1 U	0.3 U	0.3 U
Calcium	100.0%	183000	–	NA	78600 J	34000 J	N	183000	106000	66200 J	78000	42000	65800 J	24800	53400	66700
Chromium	3.3%	8.6	100	0	6.2 U J	6.2 U J	N	9.5 U	6.2 U	6.2 U J	6.2 U	8.6 J	6.1 U J	6.2 U	2 U	2 U
Copper	33.3%	59.8	12	8	14.5 U J	19.8 J	N	24 J	20.9 J	14.4 U J	28.1	37.2	14.4 U J	10.5 J	33.5	1.9 U
Iron	73.3%	8550	300	15	181 J	213 J	N	3190	152 R	319 J	741	6730	75.3 J	2210	307 R	43.7 R
Lead	56.7%	74.2	3	8	3.6 J	2.1 J	N	74.2	6.6	0.7 U J	8.3	37.9	0.7 U J	3	28.8	0.9 U
Magnesium	100.0%	59900	35000	3	10400 J	10900 J	N	34700	16000	7290 J	7900	7340	8980 J	4340 J	33600	11300
Manganese	86.7%	1080	300	2	12.6 R	38.5 J	N	240	13.5 J	31 R	29.9	297	16.8 R	247	25.5	3.7 J
Mercury	10.0%	0.17	0.2	0	0.08 U J	0.08 U J	N	0.08 U	0.08 U	0.08 U J	0.09 J	0.08 U	0.08 U J	0.08 U	0.06 U	0.06 U
Nickel	3.3%	5.6	96	0	16 U J	15.9 U J	N	35 U	14.8 U	15.9 U J	14.7 U	14.7 U	15.9 U J	14.7 U	3.5 U	3.5 U
Potassium	56.7%	6050	–	NA	4590 J	5720 J	N	6050	2700 J	1840 J	2360 J	5960	2420 J	5610	3580 R	1690 R
Selenium	50.0%	3.2	1	14	1.7 U J	1 U J	N	2 J	0.99 J	1.7 U J	1 U	1 U	1.7 U J	1 U	1.4 J	1.3 J
Sodium	93.3%	59100	20000	10	4850 U J	618 J	N	13800	7720	7400 J	5250	6010	59100 J	1830 J	6720	2660 J
Vanadium	20.0%	39.2	14	4	33 J	30.5 U J	N	30.7 U	11.2 J	30.4 U J	11 J	19.5 J	39.2 J	9.4 U	2.1 U	2.1 U
Zinc	3.3%	13.4	30	0	13.5 U J	13.4 U J	N	98 R	52.3 R	13.4 U J	26.6 R	154 R	13.4 J	39.3 R	29.5 R	4.5 R
Cyanide	6.7%	14.9	52	0	10 U	10 U J	N	10 U	10 U	10 U	10 U	10 U	10 J	10 U	10 U	10 U

NOTES: a) The New York State Ambient Water Quality Standards and Guidelines.
The lower concentration of both the aquatic and human health standards v
b) NA = not applicable
c) N = Compound was not analyzed.
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.

18 summarizes the distribution of inorganic compounds found within the surface water samples collected. Only those compounds that were found above the detection limits are shown.

Barium was detected in all but one of the surface water samples analyzed. However, none of these samples was above the NYS Ambient Water Quality Standard for barium (1000 ug/L). The highest concentration of barium detected in surface water was 523 ug/L in sample SW-200. Copper was detected in ten of the surface water samples, or 33%. Eight of these samples were above the NYS Ambient Water Quality Standard for copper (12 ug/L). The highest concentration reported for copper was 59.8 ug/L found in sample SW-290. Lead was detected in seventeen of the surface water samples, or 56.7%. Eight of these samples were above the NYS Ambient Water Quality Standard for lead (3 ug/L). The highest concentration reported for lead was 74.2 ug/L found in sample SW-191. Zinc was detected in only one surface water sample (SW-196) at a estimated concentration of 13.4 ug/L, which is less than the NYS Standard of 30 ug/L.

In general the surface water samples show high concentrations of calcium, iron, magnesium, potassium and sodium, reflective of the general soil and bedrock chemistry for the site. Elevated levels of aluminum were also detected within samples SW-120, SW-191, SW-193 through SW-195, SW-197, and SW-290. Since aluminum is generally a component of shale rocks it is assumed that these levels are associated with the background surface water chemistry.

Trace amounts of copper at low levels were recorded in samples SW-194 and SW-195. Elevated levels of lead within the surface water were detected at SW-191, SW-192, SW-194 and SW-195. Trace amounts of zinc at low concentrations were also detected at SW-191, SW-192, SW-194, SW-195, and SW-197. The presence of elevated levels of lead within the surface water samples at stations SW-191 and SW-192 corresponds to the location where the highest lead levels were found within the surface sediment samples.

4.7 GROUNDWATER

Two rounds of groundwater sampling were performed during the RI at the OB grounds. During Phase I a well development procedure utilizing surging and evacuation of the groundwater, and subsequent sampling with a bailer was followed. Based upon regulatory comment and approval the well development procedure was changed in Phase II to the use of very low flow pumping following by sampling with a bailer. High groundwater sample turbidities were noted during the Phase I sampling while generally very low turbidities were measured during Phase II sampling. It is felt that the groundwater data collected during the Phase II sampling, and in particular the metals and explosives results, are more representative of the water quality present within the overburden aquifer at the open burning grounds.

4.7.1 Distribution of Volatile Organic Compounds

Table 4-19 summarizes the results of the chemical analyses performed on Phase I and Phase II groundwater samples. The compound acetone was detected at estimated concentrations of 9 ug/L (MW-5) and 10 ug/L (MW-23) during the Phase I sampling. This compound, which is a common laboratory contaminant, was not detected in these wells during the Phase II sampling.

4.7.2 Distribution of Semivolatile Organic Compounds

The SVOCs diethylphthalate, di-n-butylphthalate and di-n-octylphthalate were detected within the groundwater samples analyzed. Diethylphthalate was detected in the Phase II groundwater sample collected at MW-17 at an estimated concentration of 1 ug/L. The Phase I sample from this location did not identify this compound above the detection limit of 11 ug/L. The compound di-n-octylphthalate was also identified in sample, MW-14, collected during Phase II, at an estimated concentration of 0.9 ug/L. The Phase I groundwater sample did not identify this compound above the detection limit of 10 ug/L. The compound di-n-butylphthalate was identified in four samples at a maximum estimated concentration of 2 ug/L in monitoring well MW-34. This compound was identified in groundwater samples collected during Phase II in the wells MW-14, MW-18, MW-34, and MW-35. Di-n-butylphthalate was not identified in these wells during the Phase I groundwater sampling.

4.7.3 Distribution of Pesticides and PCBs

No pesticide on PCBs were identified in any of the groundwater samples collected during Phase I or Phase II of the investigations.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	01/08/92 MW-5	01/08/92 MW-5 Filtered	03/01/93 MW-5	01/14/92 MW-6	01/14/92 MW-6 Filtered	03/02/93 MW-6	01/10/92 MW-7	01/10/92 MW-7 Filtered
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	9 J	N	5U	10U	N	5U	10U	N
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	10U	N	10U	11U	N	10U	11U	N
Di-n-butylphthalate	7.7%	2	-	50	50	0	10U	N	10U	11U	N	10U	11U	N
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	10U	N	10U	11U	N	10U	11U	N
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	3540 J	24.5U	2180	5490 J	24.5U	3440	27500	24.4U
Antimony	5.2%	65.7	6	3	6	NA	55.8U	53.2U	54U	53.2U	53.3U	53.7U	55.8U	53U
Arsenic	13.5%	15.8	50	50	50	0	3.5U	3.5U	1.7U	3.5U	3.5U	1.7U	3.5U	3.5U
Barium	83.3%	2230	2000	1000	2000	1	71.3 J	44 R	69.4J	108 J	68.6 J	94.1J	253	43.6 R
Beryllium	5.2%	2.4	4	3	4	NA	1.2U	1.1U R	0.3U	1.1U	1.3 R	0.3U	2.5 R	1.1U R
Cadmium	5.2%	51.9	5	10	5	3	2.9U	3U	3.1U	3U	3U	3.1U	2.9U	3U
Calcium	100.0%	1780000	-	-	-	NA	95500	98100	106000	110000	91300	108000	122000	84900
Chromium	32.3%	408	100	50	100	NA	7.1 R	6.2U R	3.9R	9.2 J	6.2U R	4.9J	36.7 R	6.3 R
Cobalt	18.8%	208	-	5	-	NA	19.9U	20.4U	5U	20.4U	20.5U	5U	19.9U	20.4U
Copper	37.5%	525	1300*	200	1300	3	24.7 J	10.2U	2.4R	12 J	10.2U	5.6J	42.7	10.1U
Iron	62.5%	469000	-	300	300	55	4960	7U R	2420	7660 J	7U R	4550	39600	6.9U R
Lead	52.1%	275	15*	250	15	20	1.4 J	1.2U	1.1J	3.4	1.2U	2.3J	37.3	1.2U
Magnesium	100.0%	227000	-	35000	-	NA	20600	22000	26100	38300	29200	33600	28700	17600
Manganese	90.6%	6980	-	300	300	21	71.6 J	5.9 J	51.2	151	5.5 J	77.9	707 J	4.8U
Mercury	5.2%	0.15	2	2	2	0	0.18 R	0.17 R	0.06U	0.17 R	0.15 R	0.06U	0.23 R	0.16 R
Nickel	44.8%	642	100	-	100	NA	15.9U	14.7U	4.3J	17.8 J	14.8U	8.5J	59.9	14.7U
Potassium	93.8%	25400	-	-	-	NA	1280 J	288U	1170J	2280 J	561 J	2130J	5600	287U
Selenium	45.8%	4.8	50	10	10	0	1U	1.8 J	1.1U	1.8 J	3 J	1.2J	1U	1 J
Silver	1.0%	5.7	-	50	50	0	9.1U	3.4U	3.2U	6.2 R	3.4U	3.2U	9.1U	3.4U
Sodium	100.0%	134000	-	20000	-	NA	17300	18400	17400	15700	14000	9900	5190	5490
Vanadium	38.5%	324	-	-	-	NA	30.5U	9.5U	4.3R	13 J	9.5U	5.9J	34.2 J	9.4U
Zinc	38.5%	3260	-	300	5000	0	27.3 R	8.5U	11.2R	41.5 R	8.5U	21.3R	133	8.4U
Cyanide	1.6%	32.5	200	100	200	NA	10U J	N	10U	10U	N	10U	10U J	N

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
h) MCL= Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	03/01/93 MW-7	01/15/92 MW-8	01/15/92 MW-8 Filtered	01/15/92 MW-8A	01/15/92 MW-8A Filtered	03/01/93 MW-8	01/09/92 MW-9	01/09/92 MW-9 Filtered
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	5U	10U	N	10U	N	5U	10U	N
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	10U	11U	N	11U	N	10U	10U	N
Di-n-butylphthalate	7.7%	2	-	50	50	0	10U	11U	N	11U	N	10U	10U	N
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	10U	11U	N	11U	N	10U	10U	N
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.12U	0.12U	N	0.12U	N	0.12U	0.12U	N
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	0.12U	N	0.12U	N	0.12U	0.12U	N
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	0.12U	N	0.12U	N	0.12U	0.12U	N
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	1130	52800 J	97.9U	82500 J	97.6U	564	5880 J	24.5U
Antimony	5.2%	65.7	6	3	6	NA	53.8U	52.9U	53.2U	53U	53U	53.8U	55.7U	53.3U
Arsenic	13.5%	15.8	50	50	50	0	1.7U	11.3	3.5U	15.8	3.5U	1.7U	3.5U	3.5U
Barium	83.3%	2230	2000	1000	2000	1	58.3J	827 J	14.8 J	1410 J	16.1 J	20.3J	181 J	46.5 R
Beryllium	5.2%	2.4	4	3	4	NA	0.3U	2.6 R	1.2U	3.7 R	1.2U	0.3U	1.9 R	1.1U R
Cadmium	5.2%	51.9	5	10	5	3	3.1U	10.7 R	3U	15.5 R	3U	3.1U	2.9U	3U
Calcium	100.0%	1780000	-	-	-	NA	74500	454000 J	355000	510000 J	331000	295000	169000	168000
Chromium	32.3%	408	100	50	100	NA	2.9R	81 J	6.2U	133 J	6.2U	2U	9.4 R	6.2U R
Cobalt	18.8%	208	-	5	-	NA	5U	65	19.9U	83.1	19.9U	5U	19.9U	20.5U
Copper	37.5%	525	1300*	200	1300	3	1.9U	53.1 J	14.4U	87.7 J	14.4U	1.9U	14.4U	10.2U
Iron	62.5%	469000	-	300	300	55	1970	83100 J	17U	137000 J	17U	688	7640	7U R
Lead	52.1%	275	15*	250	15	20	2.3J	86.3 J	1.2U	147 J	1.2U	0.89U	4.6	1.2U
Magnesium	100.0%	227000	-	35000	-	NA	17500	98200 J	74100	110000 J	66900	67700	40800	41000
Manganese	90.6%	6980	-	300	300	21	52.9	1780 J	10.3 J	2330 J	10.8 J	17.7	200 J	14.8 J
Mercury	5.2%	0.15	2	2	2	0	0.06U	0.19 R	0.03U	0.22 R	0.03U	0.06U	0.19 R	0.17 R
Nickel	44.8%	642	100	-	100	NA	3.5U	148 J	15.9U	232 J	15.9U	7J	16.7 J	14.8U
Potassium	93.8%	25400	-	-	-	NA	455J	12000	2850 J	14600	2500 J	1310J	2570 J	1690 J
Selenium	45.8%	4.8	50	10	10	0	1.1U	5U	1U	5U	1U	1.1U	1U	2 J
Silver	1.0%	5.7	-	50	50	0	3.2U	6.5 R	9.1U	5.9 R	9U	3.2U	9.1U	3.4U
Sodium	100.0%	134000	-	20000	-	NA	3650J	18200	18900	17900	17700	17900	13000	14000
Vanadium	38.5%	324	-	-	-	NA	2.5R	75.8	30.5U	115	30.4U	2.2R	30.4U	9.5U
Zinc	38.5%	3260	-	300	5000	0	10.9R	179 J	13.4U	302 J	13.4U	7.4R	29.3 R	8.5U
Cyanide	1.6%	32.5	200	100	200	NA	10U	10U	N	10U	N	10U	10U J	N

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
h) MCL = Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	01/10/92 MW-10	01/10/92 MW-10 Filtered	03/03/93 MW-10	01/15/92 MW-11	03/10/93 MW-11	01/15/92 MW-12	01/15/92 MW-12 Filtered	03/08/93 MW-12
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	10U	N	5U	10U	5U	10U	N	5U
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	11U	N	10U	11U	10U	11U	N	10U
Di-n-butylphthalate	7.7%	2	-	50	50	0	11U	N	10U	11U	10U	11U	N	10U
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	11U	N	10U	11U	10U	11U	N	10U
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.12U	N	0.12U	0.12U	0.12U	0.12U	N	0.12U
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	N	0.12U	0.12U	0.12U	0.12U	N	0.12U
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	N	0.12U	0.12U	0.12U	0.12U	N	0.12U
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	72200	24.5U	7350	222 J	75.2J	37400	97.5U	574
Antimony	5.2%	65.7	6	3	6	NA	55.6U	53.2U	53.8U	53.1U	54U	53U	52.9U	54U
Arsenic	13.5%	15.8	50	50	50	0	3.5U	3.5U	1.7U	3.5U	1.7U	3.5 J	3.5U	1.7U
Barium	83.3%	2230	2000	1000	2000	1	638	53.1 R	86.1J	124 J	92.4J	361	107 J	105J
Beryllium	5.2%	2.4	4	3	4	NA	4.3 R	1.1U R	0.3U	1.1U	0.3U	2.1 R	1.2U	0.3U
Cadmium	5.2%	51.9	5	10	5	3	7.1	3U	3.1U	3U	3.1U	6.3 R	3U	3.1U
Calcium	100.0%	1780000	-	-	-	NA	223000	172000	162000	198000	186000	97400	85600	95000
Chromium	32.3%	408	100	50	100	NA	96.7	6.2U R	9.6J	6.2U	2.1J	53.4	6.1U	2U
Cobalt	18.8%	208	-	5	-	NA	98.6	20.4U	5.6J	20.4U	5U	48.2 J	19.8U	5U
Copper	37.5%	525	1300*	200	1300	3	80.3	10.2U	7J	10.1U	4R	64.8	16.5 J	2.1R
Iron	62.5%	469000	-	300	300	55	108000	7U R	8830	486 J	151R	55200 J	17U	827
Lead	52.1%	275	15*	250	15	20	57.9	1.2U	4.9	1.2U	0.9U	46	1.2U	0.97J
Magnesium	100.0%	227000	-	35000	-	NA	36800	19300	20100	32400	30000	69100	51500	74400
Manganese	90.6%	6980	-	300	300	21	3970 J	15.7	160	23.8	73.1	1030	3.2U	17.5
Mercury	5.2%	0.15	2	2	2	0	0.27 R	0.16 R	0.07R	0.16 R	0.06U	0.26 R	0.03U	0.06U
Nickel	44.8%	642	100	-	100	NA	139	14.7U	12.9J	14.7U	4.5J	90.3	15.9U	3.5U
Potassium	93.8%	25400	-	-	-	NA	11000	1330 J	2440J	1470 J	935J	11300	6160	6670
Selenium	45.8%	4.8	50	10	10	0	10U	1U	1.1U	1U	1.1U	1U	2.8 J	1.1U
Silver	1.0%	5.7	-	50	50	0	9U	3.4U	3.2U	7.4 R	3.2U	8.1 R	9U	3.2U
Sodium	100.0%	134000	-	20000	-	NA	13700	13100	10000	33200	30700	23800	23200	18100
Vanadium	38.5%	324	-	-	-	NA	103	9.5U	10.2J	9.4U	2.1U	44.9 J	30.3U	2.1U
Zinc	38.5%	3260	-	300	5000	0	291	8.5U	32.8	8.4U	3.8R	194	13.4U	41.3
Cyanide	1.6%	32.5	200	100	200	NA	10U J	N	10U	10U	14.5	10U	N	10U

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
h) MCL= Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	01/09/92 MW-13	01/09/92 MW-13 Filtered	01/15/92 MW-14	01/15/92 MW-14 Filtered	01/15/92 MW-14A	01/15/92 MW-14A Filtered	03/10/93 MW-14	01/09/92 MW-15
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	10U	N	10U	N	10U	N	5U	10U
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	10U	N	10U	N	11U	N	10U	11U
Di-n-butylphthalate	7.7%	2	-	50	50	0	10U	N	10U	N	11U	N	0.5J	11U
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	10U	N	10U	N	11U	N	0.9J	11U
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.6	N	0.12U	N	0.12U	N	0.12U	0.082 J
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	N	0.12U	N	0.12U	N	0.12U	0.12U
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	N	0.12U	N	0.12U	N	0.12U	0.12U
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	12200	24.4U	29100 J	118 J	32000 J	97.5U	5590J	30700
Antimony	5.2%	65.7	6	3	6	NA	55.5U	52.9U	53.3U	53.1U	52.9U	53U	53.9U	55.5U
Arsenic	13.5%	15.8	50	50	50	0	3.5U	3.5U	6.2 J	3.5U	4.9 J	3.5U	1.7U	6.2 J
Barium	83.3%	2230	2000	1000	2000	1	160 J	68.2 J	801	51 J	768	51.8 J	93.2J	481
Beryllium	5.2%	2.4	4	3	4	NA	2.2 R	1.1U R	1.1U	1.2U	1.4 R	1.2U	0.91J	2.5 R
Cadmium	5.2%	51.9	5	10	5	3	2.9U	3U	5.8 R	3U	5.7 R	3U	3.1U	3.4 J
Calcium	100.0%	1780000	-	-	-	NA	142000	140000	188000	167000	189000	175000	169000	293000
Chromium	32.3%	408	100	50	100	NA	13.8 R	6.1U R	43.8	6.2U	46.1	6.2U	5.6J	50 R
Cobalt	18.8%	208	-	5	-	NA	19.8U	20.3U	32.2 J	19.9U	32.3 J	19.8U	5U	28.6 J
Copper	37.5%	525	1300*	200	1300	3	25.4	10.1U	57.9	14.4U	61.6	15.2 J	12.7J	67.4
Iron	62.5%	469000	-	300	300	55	13700	6.9U R	46300 J	17U	50500 J	17U	7380J	49600
Lead	52.1%	275	15*	250	15	20	32	1.2U	60.1	1.2U	63.5	1.2U	85.6	123
Magnesium	100.0%	227000	-	35000	-	NA	27100	25000	43800 J	32700	44200 J	32800	36200	54900
Manganese	90.6%	6980	-	300	300	21	175 J	4.8U	765	3.2U	807	3.2U	87.1	564 J
Mercury	5.2%	0.15	2	2	2	0	0.22 R	0.16 R	0.26 R	0.03U	0.25 R	0.05 J	0.12R	0.25 R
Nickel	44.8%	642	100	-	100	NA	22.4 J	14.7U	67.5	15.9U	85.5	15.9U	9.1J	71.8
Potassium	93.8%	25400	-	-	-	NA	3330 J	714 J	6170	697 J	7430	889 J	2930J	7100
Selenium	45.8%	4.8	50	10	10	0	1U	1.5 J	4.4 J	1U	4.2 J	1U	2.3J	1.5 J
Silver	1.0%	5.7	-	50	50	0	9U	3.4U	6 R	9U	4.9 R	9U	3.2U	9U
Sodium	100.0%	134000	-	20000	-	NA	16000	16700	36100	40400	38400	40700	35900	31600
Vanadium	38.5%	324	-	-	-	NA	31.1 J	9.4U	42.3 J	30.4U	51.4	30.4U	7.8J	34.1 J
Zinc	38.5%	3260	-	300	5000	0	86.1	8.4U	163	13.4U	154	13.4U	39.1	169
Cyanide	1.6%	32.5	200	100	200	NA	10U J	N	10U	N	10U	N	10U	10U J

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
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g) NY State Class GA Groundewater Regulations.
h) MCL= Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
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TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	01/09/92 MW-15 Filtered	03/02/93 MW-15	01/14/92 MW-16	01/14/92 MW-16 Filtered	01/14/92 MW-16A	01/14/92 MW-16A Filtered	03/10/93 MW-16	01/17/92 MW-17
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	N	5U	10U	N	10U	N	5U	10U
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	N	10U	11U	N	11U	N	10U	11U
Di-n-butylphthalate	7.7%	2	-	50	50	0	N	10U	11U	N	11U	N	10U	11U
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	N	10U	11U	N	11U	N	10U	11U
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	N	0.12U	0.12U	N	0.12U	N	0.12U	0.12U
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	N	0.12U	0.12U	N	0.12U	N	0.12U	0.12U
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	N	0.12U	0.12U	N	0.12U	N	0.12U	0.12U
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	24.4U	4440	6170 J	24.5U	5960 J	24.5U	930J	28200
Antimony	5.2%	65.7	6	3	6	NA	52.9U	53.8U	53U	53.2U	53.1U	53.3U	54U	65.7
Arsenic	13.5%	15.8	50	50	50	0	3.5U	1.7U	3.5U	3.5U	3.5U	3.5U	1.7U	3.5U
Barium	83.3%	2230	2000	1000	2000	1	39.7 R	145J	86.9 J	33.9 R	87.5 J	32.4 R	34.4J	355
Beryllium	5.2%	2.4	4	3	4	NA	1.1U R	0.3U	1.1U	1.4 R	1.1U	1.5 R	0.3U	2.8 R
Cadmium	5.2%	51.9	5	10	5	3	3U	3.1U	3U	3U	3U	3U	3.1U	3.6 J
Calcium	100.0%	1780000	-	-	-	NA	248000	241000	126000	129000	123000	122000	132000	126000
Chromium	32.3%	408	100	50	100	NA	7.7 R	5.9J	7.9 J	6.2U R	7.8 J	6.2U R	3.2J	40.7
Cobalt	18.8%	208	-	5	-	NA	20.3U	5U	20.3U	20.4U	20.4U	20.5U	5U	37.2 J
Copper	37.5%	525	1300*	200	1300	3	10.1U	10.8J	10.1U	10.2U	10.1U	10.2U	2.7J	66.9
Iron	62.5%	469000	-	300	300	55	6.9U R	5880	7930 J	7U R	8130 J	7U R	1290J	42200
Lead	52.1%	275	15*	250	15	20	1.2U	10.5	9.1	1.2U	11.3	1.2U	1.6J	42.5
Magnesium	100.0%	227000	-	35000	-	NA	47900	48900	26900	23200	26900	22700	24900	25400
Manganese	90.6%	6980	-	300	300	21	19.9	66.2	146	9.5 J	146	8.3 J	31.1	2240
Mercury	5.2%	0.15	2	2	2	0	0.15 R	0.06U	0.15 R	0.2 R	0.15 R	0.3 R	0.08R	0.03U
Nickel	44.8%	642	100	-	100	NA	14.7U	10.3J	14.7U	14.8U	19.7 J	14.8U	4.8J	109
Potassium	93.8%	25400	-	-	-	NA	1450 J	2060J	2890 J	970 J	2530 J	883 J	1270J	6360
Selenium	45.8%	4.8	50	10	10	0	1.7 J	1.1U	4.8 J	4.2 J	4.6 J	4.8 J	1.4J	0.99U
Silver	1.0%	5.7	-	50	50	0	3.4U	3.2U	5.3 R	3.4U	4.4 R	3.4U	3.2U	3.4U
Sodium	100.0%	134000	-	20000	-	NA	30700	23700	9920	10400	9830	10500	4830J	7840
Vanadium	38.5%	324	-	-	-	NA	9.4U	6.9J	10.7 J	9.5U	11 J	9.5U	3.1J	37.3 J
Zinc	38.5%	3260	-	300	5000	0	10.3 J	38.3	41.4 R	8.5U	39.8 R	8.5U	14.3R	154
Cyanide	1.6%	32.5	200	100	200	NA	N	10U	10U	N	10U	N	10U	10U

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
h) MCL = Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	01/17/92 MW-17 Filtered	03/09/93 MW-17	01/13/92 MW-18	01/13/92 MW-18 Filtered	01/13/92 MW-18A	01/13/92 MW-18A Filtered	03/09/93 MW-18	03/09/93 MW-18D
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	N	5U	10U	N	10U	N	5U	5U
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	N	1J	10U	N	10U	N	10U	10U
Di-n-butylphthalate	7.7%	2	-	50	50	0	N	10U	10U	N	10U	N	2J	10U
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	N	10U	10U	N	10U	N	10U	10U
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	N	0.12U	0.12U	N	0.12U	N	0.12U	0.12U
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	N	0.12U	0.12U	N	0.12U	N	0.12U	0.12U
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	N	0.12U	0.12U	N	0.12U	N	0.12U	0.12U
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	97.3U	5000	9100 J	24.4U	8660 J	24.6U	1400	1210
Antimony	5.2%	65.7	6	3	6	NA	52.9U	54U	56.8 J	52.9U	55.8U	61.3	53.9U	53.7U
Arsenic	13.5%	15.8	50	50	50	0	3.5U	1.7U	3.5U	3.5U	3.5U	3.5U	1.7U	1.7U
Barium	83.3%	2230	2000	1000	2000	1	78 J	104J	195 J	15.9 R	182 J	14.6 R	39.9J	36.5J
Beryllium	5.2%	2.4	4	3	4	NA	1.2U	0.37J	2 R	1.1U R	2.1 R	1.1U R	0.3U	0.3U
Cadmium	5.2%	51.9	5	10	5	3	3U	3.1U	2.9U	3U	2.9U	3U	3.1U	3.1U
Calcium	100.0%	1780000	-	-	-	NA	103000	79500	143000	131000	140000	130000	107000	113000
Chromium	32.3%	408	100	50	100	NA	6.1U	7.9J	11.8 R	6.1U R	10.9 R	8 R	2U	2U
Cobalt	18.8%	208	-	5	-	NA	19.8U	5U	19.9U	20.3U	19.9U	20.5U	5U	5U
Copper	37.5%	525	1300*	200	1300	3	16.2 J	7.6R	14.4U	10.1U	14.4U	10.2U	2.7R	4.1R
Iron	62.5%	469000	-	300	300	55	16.9U	5640	13000 J	6.9U R	11700 J	7U R	1550	1110
Lead	52.1%	275	15*	250	15	20	1.2U	5.3	11.4	1.2U	10.6	1.2U	1.5J	1J
Magnesium	100.0%	227000	-	35000	-	NA	14900	13600	27000	24500	26500	24500	21200	22200
Manganese	90.6%	6980	-	300	300	21	3.2U	198	289 J	110	271 J	108	155	148
Mercury	5.2%	0.15	2	2	2	0	0.04 J	0.06U	0.16 R	0.16 R	0.16 R	0.17 R	0.06U	0.06U
Nickel	44.8%	642	100	-	100	NA	15.8U	13.1J	22.9 J	14.7U	17.1 J	14.8U	5.2J	3.5U
Potassium	93.8%	25400	-	-	-	NA	629U	1410J	4130 J	1470 J	3870 J	1670 J	753J	702J
Selenium	45.8%	4.8	50	10	10	0	1.3 J	1.1U	1.5 J	1U	2.9 J	1.6 J	1.2J	1.1U
Silver	1.0%	5.7	-	50	50	0	9U	3.2U	9U	3.4U	9.1U	3.4U	3.2U	3.2U
Sodium	100.0%	134000	-	20000	-	NA	6450	3720J	28300	28100	28500	27500	19100	20200
Vanadium	38.5%	324	-	-	-	NA	30.3U	8.9J	30.4U	9.4U	30.5U	9.5U	2.6J	2.1U
Zinc	38.5%	3260	-	300	5000	0	13.4U	53.1	45.5	8.4U	46.6	10.5 J	19.6R	21.1R
Cyanide	1.6%	32.5	200	100	200	NA	N	10U	10U J	N	10U J	N	10U	10U

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
h) MCL= Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	01/16/92 MW 19	01/16/92 MW-19 Filtered	03/04/93 MW-19	01/08/92 MW-21	01/08/92 MW-21 Filtered	03/01/93 MW-21	01/13/92 MW-22	01/13/92 MW-22 Filtered
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	10U	N	5U	10U	N	5U	10U	N
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	11U	N	10U	10U	N	10U	10U	N
Di-n-butylphthalate	7.7%	2	-	50	50	0	11U	N	10U	10U	N	10U	10U	N
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	11U	N	10U	10U	N	10U	10U	N
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	243000	97.5U	40200	1880 J	24.4U	62.5U	13100	24.4U
Antimony	5.2%	65.7	6	3	6	NA	52.9U	53U	53.9U	55.9U	52.9U	54U	55.8U	53U
Arsenic	13.5%	15.8	50	50	50	0	4.1 J	3.5U	8J	3.5U	3.5U	1.7U	3.5U	3.5U
Barium	83.3%	2230	2000	1000	2000	1	2230	40.6 J	348	47.5 J	25.4 R	32.6J	154 J	22.5 R
Beryllium	5.2%	2.4	4	3	4	NA	12.8 R	1.2U	2.4J	1.6 R	1.1U R	0.3U	2 R	1.1U R
Cadmium	5.2%	51.9	5	10	5	3	51.9	3U	3.1U	2.9U	3U	3.1U	2.9U	3U
Calcium	100.0%	1780000	-	-	-	NA	2E+06	183000	279000	94100	91900	92100	121000	106000
Chromium	32.3%	408	100	50	100	NA	408	6.1U	58.9	6.2U	6.4 R	2U	18.7 R	6.2U R
Cobalt	18.8%	208	-	5	-	NA	208	19.8U	28J	20U	20.3U	5U	19.9U	20.4U
Copper	37.5%	525	1300*	200	1300	3	525	15.2 J	69.5	14.5U	10.1U	1.9U	30	10.1U
Iron	62.5%	469000	-	300	300	55	469000 J	17U	58000	2720	6.9U R	39.7R	19100	7U R
Lead	52.1%	275	15*	250	15	20	141	1.2U	35.7	1.8 J	1.2U	0.9U	14.1	1.2U
Magnesium	100.0%	227000	-	35000	-	NA	227000	54500	80300	12200	12800	12900	18800	15400
Manganese	90.6%	6980	-	300	300	21	6980	105	949	232 J	196	10.1J	239 J	29.6
Mercury	5.2%	0.15	2	2	2	0	0.49 R	0.03U	0.15J	0.15 R	0.15 R	0.06U	0.17 R	0.17 R
Nickel	44.8%	642	100	-	100	NA	642	15.9U	98	16U	14.7U	3.5U	33.2 J	14.7U
Potassium	93.8%	25400	-	-	-	NA	25400	4660 J	8450	3050 J	2530 J	1370J	4250 J	541 J
Selenium	45.8%	4.8	50	10	10	0	10U	1.1 J	1.1U	1U	1.2 J	1.2J	4.4 J	3.6 J
Silver	1.0%	5.7	-	50	50	0	5.7 R	9U	3.2U	9.1U	3.4U	3.2U	9.1U	3.4U
Sodium	100.0%	134000	-	20000	-	NA	107000	112000	80100	18400	17900	21500	4400 J	4330 J
Vanadium	38.5%	324	-	-	-	NA	324	30.3U	57.5	30.6U	9.4U	2.1U	30.5U	9.4U
Zinc	38.5%	3260	-	300	5000	0	3260	67.4	627	15.1 R	8.4U	4R	67.8	9.1 J
Cyanide	1.6%	32.5	200	100	200	NA	10U	N	10U	10U J	N	10U	10U J	N

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
h) MCL= Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	03/09/93 MW-22	01/14/92 MW-23	01/14/92 MW-23 Filtered	03/08/93 MW-23	01/14/92 MW-23RE	01/15/92 MW-24	01/15/92 MW-24 Filtered	03/03/93 MW-24
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	5U	10U J	N	5U	10U J	10U	N	5U
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	10U	11U	N	10U	N	11U	N	10U
Di-n-butylphthalate	7.7%	2	-	50	50	0	10U	11U	N	10U	N	11U	N	10U
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	10U	11U	N	10U	N	11U	N	10U
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.12U	0.12U	N	0.12U	N	0.12U	N	0.12U
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	0.12U	N	0.12U	N	0.21	N	0.12U
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	0.12U	N	0.12U	N	0.12U	N	0.12U
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	111J	3350 J	24.5U	98.2J	N	23500	97.4U	508
Antimony	5.2%	65.7	6	3	6	NA	54.1U	53U	53.2U	53.9U	N	53.1U	52.9U	53.9U
Arsenic	13.5%	15.8	50	50	50	0	1.7U	3.5U	3.5U	1.7U	N	3.5U	3.5U	1.7U
Barium	83.3%	2230	2000	1000	2000	1	37.1J	104 J	44.2 R	36.6J	N	507	96.5 J	93.5J
Beryllium	5.2%	2.4	4	3	4	NA	0.3U	1.1U	1.4 R	0.3U	N	1.2 R	1.2U	0.3U
Cadmium	5.2%	51.9	5	10	5	3	3.1U	3U	3U	3.1U	N	6 R	3U	3.1U
Calcium	100.0%	1780000	-	-	-	NA	115000	126000	123000	154000	N	153000	156000	155000
Chromium	32.3%	408	100	50	100	NA	2U	6.2U	6.2U R	2U	N	39.3	6.1	2U
Cobalt	18.8%	208	-	5	-	NA	5U	20.3U	20.4U	5U	N	27.6 J	19.8U	5U
Copper	37.5%	525	1300*	200	1300	3	2.3R	10.1U	10.2U	1.9U	N	257	14.4U	2.8J
Iron	62.5%	469000	-	300	300	55	150R	4960 J	7U R	555	N	38900 J	16.9U	659
Lead	52.1%	275	15*	250	15	20	0.9U	5.2	1.2U	0.89U	N	275	1.2U	2.5J
Magnesium	100.0%	227000	-	35000	-	NA	16600	29000	25000	29500	N	57600	46300	56000
Manganese	90.6%	6980	-	300	300	21	28.6	141	79.9	80.7	N	472	3.2U	8.8J
Mercury	5.2%	0.15	2	2	2	0	0.06U	0.16 R	0.16 R	0.06U	N	0.31 R	0.04 J	0.06U
Nickel	44.8%	642	100	-	100	NA	4.5J	17.8 J	14.7U	3.5U	N	70.7	15.9U	4.4J
Potassium	93.8%	25400	-	-	-	NA	446U	2500 J	1260 J	808J	N	6840	3120 J	3660J
Selenium	45.8%	4.8	50	10	10	0	1.1U	1U	1.3 J	1.1U	N	2.9 J	3.5 J	1.4J
Silver	1.0%	5.7	-	50	50	0	3.2U	4.7 R	3.4U	3.2U	N	8.2 R	9U	3.2U
Sodium	100.0%	134000	-	20000	-	NA	4900J	13900	134000	16100	N	39700	39900	39700
Vanadium	38.5%	324	-	-	-	NA	2.1U	9.4U	9.5U	2.4J	N	30.7 J	30.3U	2.1U
Zinc	38.5%	3260	-	300	5000	0	7.4R	18.4 R	8.5U	5.3R	N	423	13.4U	18.9R
Cyanide	1.6%	32.5	200	100	200	NA	10U	10U	N	10U	N	10U	N	10U

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
h) MCL= Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	03/03/93 MW-24D	01/13/92 MW-25	01/13/92 MW-25 Filtered	03/03/93 MW-25	01/15/92 MW-27	01/15/92 MW-27 Filtered	03/08/93 MW-27	01/14/92 MW-28
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	5U	10U	N	5U	10U	N	5U	10U
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	10U	11U	N	10U	11U	N	10U	10U
Di-n-butylphthalate	7.7%	2	-	50	50	0	10U	11U	N	10U	11U	N	10U	10U
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	10U	11U	N	10U	11U	N	10U	10U
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.12U	0.12U	N	0.12U	0.12U	N	0.12U	0.12U
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	0.12U	N	0.12U	0.12U	N	0.12U	0.12U
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	0.12U	N	0.12U	0.12U	N	0.12U	0.087 J
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	484	15200	24.5U	622	68400	98.1U	68.7J	34700
Antimony	5.2%	65.7	6	3	6	NA	54U	55.4U	53.2U	53.6U	53.2U	53.3U	53.6U	53.2U
Arsenic	13.5%	15.8	50	50	50	0	1.7U	3.5U	3.5U	1.7U	11.5	3.5U	1.7U	4.2 J
Barium	83.3%	2230	2000	1000	2000	1	90.5J	206	36.5 R	56.7J	734	75.5 J	80.8J	411
Beryllium	5.2%	2.4	4	3	4	NA	0.3U	2.2 R	1.1U R	0.3U	2.8 R	1.2U	0.3U	1.8 R
Cadmium	5.2%	51.9	5	10	5	3	3.1U	2.9U	3U	3.1U	14.1 R	3U	3.1U	6 R
Calcium	100.0%	1780000	-	-	-	NA	152000	130000	106000	86900	208000	97400	92400	172000
Chromium	32.3%	408	100	50	100	NA	2U	18 R	6.2U R	2U	118	6.2U	2U	53.9
Cobalt	18.8%	208	-	5	-	NA	5U	19.8U	20.4U	5U	58.1	20U	5U	24.6 J
Copper	37.5%	525	1300*	200	1300	3	2.8J	19.3 J	10.2U	1.9U	128	16.1 J	1.9U	37.9
Iron	62.5%	469000	-	300	300	55	676	23000	7U R	701	127000 J	17.1U	82.4R	50800 J
Lead	52.1%	275	15*	250	15	20	2.8J	18	1.2U	0.9U	118	1.2U	0.89U	34.9
Magnesium	100.0%	227000	-	35000	-	NA	54900	25000	18600	16400	93800	60700	70600	44600
Manganese	90.6%	6980	-	300	300	21	11.3J	281 J	34.3	28.7	1470 J	93.7	84.3	700 J
Mercury	5.2%	0.15	2	2	2	0	0.06U	0.19 R	0.15 R	0.06U	0.24 R	0.03U	0.06U	0.18 R
Nickel	44.8%	642	100	-	100	NA	3.5U	28.4 J	14.8U	3.5U	196	16U	3.5U	81.6
Potassium	93.8%	25400	-	-	-	NA	3560J	4400 J	658 J	921J	18100	8440	7420	10200
Selenium	45.8%	4.8	50	10	10	0	1.6J	1.9 J	1U	1.1U	5U	3.4 J	1.1U	5U
Silver	1.0%	5.7	-	50	50	0	3.2U	9U	3.4U	3.2U	5.2 R	9.1U	3.2U	6.8 R
Sodium	100.0%	134000	-	20000	-	NA	38800	3900 J	3760 J	2860J	17900	18300	18300	15300
Vanadium	38.5%	324	-	-	-	NA	2.1U	30.3U	9.5U	2.3J	107	30.5U	2.1U	45.3 J
Zinc	38.5%	3260	-	300	5000	0	9.7R	55.3	8.5U	5.5R	274	13.5U	4.3R	108 R
Cyanide	1.6%	32.5	200	100	200	NA	10U	10U J	N	10U	10U J	N	10U	10U J

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
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i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	01/14/92 MW-28 Filtered	03/02/93 MW-28	01/14/92 MW-29	01/14/92 MW-29 Filtered	03/02/93 MW-29	01/09/92 MW-30	01/09/92 MW-30 Filtered	03/10/93 MW-30
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	N	15	10U	N	5U	10U	N	5U
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	N	10U	11U	N	10U	10U	N	10U
Di-n-butylphthalate	7.7%	2	-	50	50	0	N	10U	11U	N	10U	10U	N	10U
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	N	10U	11U	N	10U	10U	N	10U
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	N	0.12U	0.12U	N	0.12U	0.12U	N	0.12U
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	N	0.12U	0.12U	N	0.12U	0.12U	N	0.12U
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	N	0.12U	0.12U	N	0.12U	0.12U	N	0.12U
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	24.5U	598	12600	24.4U	529	1440 J	24.5U	62.1U
Antimony	5.2%	65.7	6	3	6	NA	53.3U	54.1U	53U	52.9U	53.6U	58.3 J	53.1U	53.7U
Arsenic	13.5%	15.8	50	50	50	0	3.5U	1.7U	3.5U	3.5U	1.7U	3.5U	3.5U	1.7U
Barium	83.3%	2230	2000	1000	2000	1	53.9 R	59.5J	166 J	78.1 J	76.8J	94.2 J	74.9 J	81.4J
Beryllium	5.2%	2.4	4	3	4	NA	1.2 R	0.3U	1.1U	1.5 R	0.3U	1.8 R	1.1U R	0.3U
Cadmium	5.2%	51.9	5	10	5	3	3U	3.1U	3U	3U	3.1U	2.9U	3U	3.1U
Calcium	100.0%	1780000	-	-	-	NA	116000	53900	137000	116000	108000	164000	159000	161000
Chromium	32.3%	408	100	50	100	NA	6.2U R	2U	18.5	6.1U R	2U	6.2U	6.2U R	2U
Cobalt	18.8%	208	-	5	-	NA	20.4U	5U	20.3U	20.3U	5U	19.9U	20.4U	5U
Copper	37.5%	525	1300*	200	1300	3	10.2U	1.9U	27.2	10.1U	1.9U	14.4U	10.1U	1.9U
Iron	62.5%	469000	-	300	300	55	7U R	56.8J	19400 J	6.9U R	609	1870	7U R	21.7U
Lead	52.1%	275	15*	250	15	20	1.2U	0.9U	9.2	1.2U	0.9U	1.3 J	1.2U	0.89U
Magnesium	100.0%	227000	-	35000	-	NA	24500	2040J	39800	29700	29000	23800	24200	25200
Manganese	90.6%	6980	-	300	300	21	85.9	1.5J	432 J	4.8U	16.1	39.8 R	16.8	7.2J
Mercury	5.2%	0.15	2	2	2	0	0.2 R	0.06U	0.16 R	0.17 R	0.06U	0.15 R	0.3 R	0.06U
Nickel	44.8%	642	100	-	100	NA	14.8U	3.5U	35.3 J	14.7U	3.5U	15.9U	14.7U	3.5U
Potassium	93.8%	25400	-	-	-	NA	2220 J	11000	3700 J	592 J	966J	996 J	697 J	443U
Selenium	45.8%	4.8	50	10	10	0	2 J	1.1U	2 J	1.9 J	1.1U	1.1 J	1.3 J	1.1U
Silver	1.0%	5.7	-	50	50	0	5.7 J	3.2U	6.1 R	3.4U	3.2U	9U	3.4U	3.2U
Sodium	100.0%	134000	-	20000	-	NA	15000	56800	14900	14000	11200	17500	17800	17800
Vanadium	38.5%	324	-	-	-	NA	9.5U	5.1J	19.5 J	9.4U	2.1U	30.4U	9.5U	2.1U
Zinc	38.5%	3260	-	300	5000	0	8.5U	5.4R	84.3 R	8.4U	5.8R	21.1 R	11.1 J	2.6R
Cyanide	1.6%	32.5	200	100	200	NA	N	10U	10U J	N	10U	10U J	N	10U

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
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TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	01/16/92 MW 31	01/16/92 MW-31 Filtered	03/04/93 MW-31	01/16/92 MW 32	01/16/92 MW-32 Filtered	03/11/93 MW-32	01/08/92 MW-34	01/08/92 MW-34 Filtered
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	10U	N	5U	10U	N	5U	10U	N
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	11U	N	10U	11U	N	10U	10U	N
Di-n-butylphthalate	7.7%	2	-	50	50	0	11U	N	10U	11U	N	10U	10U	N
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	11U	N	10U	11U	N	10U	10U	N
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	N	0.12U	0.12U	N	0.12U	0.12U	N
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	120000	97.4U	1830	35200	97.9U	884J	131000	24.5U
Antimony	5.2%	65.7	6	3	6	NA	53.3U	52.9U	54U	54.4 J	53.2U	54U	55.8U	53.2U
Arsenic	13.5%	15.8	50	50	50	0	8.3 J	3.5U	1.7U	5.5 J	3.5U	1.7U	3.5U	3.5U
Barium	83.3%	2230	2000	1000	2000	1	955	21.2 J	55.7J	347	41.6 J	53.9J	779	10.7 R
Beryllium	5.2%	2.4	4	3	4	NA	6.6 R	1.2U	0.34J	2.8 R	1.2U	0.3U	7.8 R	1.1U R
Cadmium	5.2%	51.9	5	10	5	3	20 R	3U	3.1U	3.3 R	3U	3.1U	13.2	3U
Calcium	100.0%	1780000	-	-	-	NA	407000	149000	130000	151000	95400	93400	538000	66900
Chromium	32.3%	408	100	50	100	NA	202	6.1U	2.8J	62.6	6.2U	2.2J	200	6.2U R
Cobalt	18.8%	208	-	5	-	NA	78.8	19.8U	5U	20.5U	19.9U	5U	152	20.4U
Copper	37.5%	525	1300*	200	1300	3	176	14.4U	1.9U	43.1	14.4U	3.7R	233	10.2U
Iron	62.5%	469000	-	300	300	55	176000 J	17U	2010	52100 J	17U	957J	254000	7U R
Lead	52.1%	275	15*	250	15	20	159	1.2U	1.2J	41.6	1.2U	1.5J	62.4	1.2U
Magnesium	100.0%	227000	-	35000	-	NA	95500	38900	34100	41000	23500	23000	76500	7510
Manganese	90.6%	6980	-	300	300	21	2400 J	77.7	33	734 J	153	38.4	5610 J	18
Mercury	5.2%	0.15	2	2	2	0	0.21 R	0.03U	0.06U	0.17 R	0.04 J	0.06U	0.3 R	0.16 R
Nickel	44.8%	642	100	-	100	NA	282	15.9U	9.3J	83.3	15.9U	3.5U	362	14.7U
Potassium	93.8%	25400	-	-	-	NA	22300	2520 J	1210J	9900	2360 J	1360J	16200	418 J
Selenium	45.8%	4.8	50	10	10	0	10U	1.7 J	1.1U	10U	1U	1.1U	10U	2.3 J
Silver	1.0%	5.7	-	50	50	0	3.4U	9U	3.2U	3.4U	9.1U	3.2U	9.1U	3.4U
Sodium	100.0%	134000	-	20000	-	NA	12500	10800	17100	9100	7960	7140	4750 J	3590 J
Vanadium	38.5%	324	-	-	-	NA	180	30.3U	4.3J	54	30.5U	3.4J	167	9.5U
Zinc	38.5%	3260	-	300	5000	0	433	13.4U	24.9R	135	13.4U	10.2R	734	12.9 J
Cyanide	1.6%	32.5	200	100	200	NA	10U J	N	10U	10U J	N	10U	10U J	N

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
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g) NY State Class GA Groundewater Regulations.
h) MCL= Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
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SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	03/12/93 MW-34	01/08/92 MW-35	01/08/92 MW-35 Filtered	03/12/93 MW-35	03/12/93 MW-35D	03/11/93 MW-36	03/12/93 MW-38	03/04/93 MW-39
VOCs (ug/l)														
Acetone	3.0%	15	-	-	5	2	5U	10U	N	5U	5U	5U	5U	5U
Semivolatiles (ug/l)														
Diethylphthalate	1.5%	1	-	50	50	NA	10U	11U	N	10U	10U	10U	10U	10U
Di-n-butylphthalate	7.7%	2	-	50	50	0	2J	11U	N	0.7J	2J	10U	10U	10U
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	10U	11U	N	10U	10U	10U	10U	10U
Explosives (ug/l)														
RDX	3.1%	0.6	-	-	-	NA	0.12U	0.12U	N	0.12U	0.12U	0.12U	0.12U	0.12U
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	0.12U	0.12U	N	0.12U	0.12U	0.12U	0.12U	0.12U
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	0.12U	0.12U	N	0.12U	0.12U	0.12U	0.12U	0.12U
Metals (ug/l)														
Aluminum	66.7%	243000	-	-	50	NA	13000J	7550 J	24.5U	600J	1100J	103J	246J	473
Antimony	5.2%	65.7	6	3	6	NA	53.9U	55.5U	53.1U	53.9U	54.1U	53.7U	53.8U	53.8U
Arsenic	13.5%	15.8	50	50	50	0	3.3J	3.5U	3.5U	1.7U	1.7U	1.7U	1.7U	1.7U
Barium	83.3%	2230	2000	1000	2000	1	103J	103 J	37.5 R	80.2J	86.7J	64.3J	33.5J	58.1J
Beryllium	5.2%	2.4	4	3	4	NA	0.89J	1.8 R	1.1U R	0.3U	0.3U	0.3U	0.3U	0.3U
Cadmium	5.2%	51.9	5	10	5	3	3.1U	2.9U	3U	3.1U	3.1U	3.1U	3.1U	3.1U
Calcium	100.0%	1780000	-	-	-	NA	117000	94700	87800	88700	93200	84700	91100	113000
Chromium	32.3%	408	100	50	100	NA	21.5	15.3 R	6.2U R	2U	2.2J	2U	2U	2U
Cobalt	18.8%	208	-	5	-	NA	11.1J	19.9 J	20.4U	5U	5U	5U	5U	5U
Copper	37.5%	525	1300*	200	1300	3	21.1J	14.4U	10.1U	1.9U	2.7R	1.9U	2.2R	2.4R
Iron	62.5%	469000	-	300	300	55	19700J	10500	7U R	501J	1130J	155J	221J	746
Lead	52.1%	275	15*	250	15	20	7.2	3.3	1.2U	0.91J	1.1J	0.89U	0.9U	0.9U
Magnesium	100.0%	227000	-	35000	-	NA	15100	14600	12900	14200	15000	11500	11600	33800
Manganese	90.6%	6980	-	300	300	21	403	557 J	306	46.6	49.4	166	171	122
Mercury	5.2%	0.15	2	2	2	0	0.08R	0.18 R	0.18 R	0.07R	0.1R	0.06U	0.09R	0.06U
Nickel	44.8%	642	100	-	100	NA	30.1J	15.9U	14.7U	3.5U	3.5U	3.5U	3.5U	4.6J
Potassium	93.8%	25400	-	-	-	NA	3220J	4180 J	2790 J	1290J	1240J	2240J	2930J	4800J
Selenium	45.8%	4.8	50	10	10	0	1.1U	1.1 J	1.2 J	1.1U	1.1U	1.1U	1.1U	1.1U
Silver	1.0%	5.7	-	50	50	0	3.2U	9U	3.4U	3.2U	3.2U	3.2U	3.2U	3.2U
Sodium	100.0%	134000	-	20000	-	NA	3560J	44100	39600	7390	7880	6600	9870	33900
Vanadium	38.5%	324	-	-	-	NA	20.1J	30.3U	9.5U	2.1U	2.6J	2.1U	2.1J	2.1U
Zinc	38.5%	3260	-	300	5000	0	76	58.2	13.8 J	84.2	86.3	4.3R	4.4R	6.8R
Cyanide	1.6%	32.5	200	100	200	NA	10U	10U J	N	10U	10U	10U	10U	10U

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
h) MCL= Maximum Contaminant Level; USEPA Drinking Water Standards and Health Advisories, EPA 822-R-94-001, May 1994
i) * = MCL values given for copper and lead are action levels.

TABLE 4-19

MONITORING WELLS
SUMMARY OF COMPOUNDS DETECTED

SENECA ARMY DEPOT
OB GROUNDS

	FREQUENCY OF DETECTION	MAXIMUM DETECTED	MCL (h)	NY AWQS (g)	NYDWQS (a)	NUMBER OF SAMPLES ABOVE TAGM	03/09/93 MW-40	03/10/93 MW-40	03/08/93 MW-40	03/10/93 MW-40	03/04/93 MW-40	03/03/93 MW-41
VOCs (ug/l)												
Acetone	3.0%	15	-	-	5	2	N	N	N	N	5U	5U
Semivolatiles (ug/l)												
Diethylphthalate	1.5%	1	-	50	50	NA	10U	N	N	N	N	N
Di-n-butylphthalate	7.7%	2	-	50	50	0	10U	N	N	N	N	N
Di-n-octylphthalate	1.5%	0.9	-	50	50	NA	10U	N	N	N	N	N
Explosives (ug/l)												
RDX	3.1%	0.6	-	-	-	NA	N	0.12U	N	N	N	N
2,4,6-Trinitrotoluene	1.5%	0.21	-	500	-	NA	N	0.12U	N	N	N	N
2,6-Dinitrotoluene	1.5%	0.087	-	5	-	NA	N	0.12U	N	N	N	N
Metals (ug/l)												
Aluminum	66.7%	243000	-	-	50	NA	N	N	647	N	N	N
Antimony	5.2%	65.7	6	3	6	NA	N	N	53.6U	N	N	N
Arsenic	13.5%	15.8	50	50	50	0	N	N	1.7U	N	N	N
Barium	83.3%	2230	2000	1000	2000	1	N	N	53.3J	N	N	N
Beryllium	5.2%	2.4	4	3	4	NA	N	N	0.3U	N	N	N
Cadmium	5.2%	51.9	5	10	5	3	N	N	3.1U	N	N	N
Calcium	100.0%	1780000	-	-	-	NA	N	N	129000	N	N	N
Chromium	32.3%	408	100	50	100	NA	N	N	2U	N	N	N
Cobalt	18.8%	208	-	5	-	NA	N	N	5U	N	N	N
Copper	37.5%	525	1300*	200	1300	3	N	N	1.9U	N	N	N
Iron	62.5%	469000	-	300	300	55	N	N	653	N	N	N
Lead	52.1%	275	15*	250	15	20	N	N	0.9U	N	N	N
Magnesium	100.0%	227000	-	35000	-	NA	N	N	16100	N	N	N
Manganese	90.6%	6980	-	300	300	21	N	N	148	N	N	N
Mercury	5.2%	0.15	2	2	2	0	N	N	0.06U	N	N	N
Nickel	44.8%	642	100	-	100	NA	N	N	4.7J	N	N	N
Potassium	93.8%	25400	-	-	-	NA	N	N	442U	N	N	N
Selenium	45.8%	4.8	50	10	10	0	N	N	1.1U	N	N	N
Silver	1.0%	5.7	-	50	50	0	N	N	3.2U	N	N	N
Sodium	100.0%	134000	-	20000	-	NA	N	N	6950	N	N	N
Vanadium	38.5%	324	-	-	-	NA	N	N	2.1U	N	N	N
Zinc	38.5%	3260	-	300	5000	0	N	N	4.4R	N	N	N
Cyanide	1.6%	32.5	200	100	200	NA	N	N	N	32.5	N	N

NOTES: a) NY State Drinking Water Regulations and 10NYCRR Part 5, Subpart 5-1, 1992.
b) N = Compound was not analyzed.
c) NA = not applicable
d) U = Compound was not detected.
e) J = The reported value is an estimated concentration.
f) R = The data was rejected in the data validation process.
g) NY State Class GA Groundewater Regulations.
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i) * = MCL values given for copper and lead are action levels.

4.7.4 Distribution of Explosives

The three compounds RDX, 2,4,6-trinitrotoluene, and 2,6-dinitrotoluene were found in groundwater samples collected during the Phase I sampling. The compound RDX was identified in the two samples collected during Phase I from the monitoring wells MW-13 and MW-15 at concentrations of 0.6 ug/L and 0.082 ug/L (estimated), respectively. No Phase II groundwater sample was collected at MW-13, while the Phase II sample collected at MW-15 had no RDX identified above the detection limit of 0.12 ug/L.

The compound 2,4,6-trinitrotoluene was identified in the groundwater sample collected from monitoring well MW-24 during Phase I at a concentration of 0.21 ug/L. The Phase II groundwater sample collected from MW-24 had no 2,4,6-trinitrotoluene identified above the detection limit of 0.12 ug/L.

The compound 2,6-dinitrotoluene was identified in the groundwater sample collected from monitoring well MW-28 during Phase I at an estimated concentration of 0.087 ug/L. The Phase II groundwater sample collected from MW-28 had no 2,6-dinitrotoluene identified above the detection limit of 0.12 ug/L.

4.7.5 Distribution of Metals

The metal barium was found in the groundwater sample collected from monitoring well MW-19 during Phase I at a concentration of 2,230 ug/L which was above the NY DWQS of 2,000 ug/L. The phase II groundwater sample collected from MW-19 had a barium concentration of only 348 ug/L. During both Phase I and Phase II measured groundwater sample turbidities were both above 200 NTUs. Based upon the modified sampling procedure utilized during Phase II, it is felt that the second round of groundwater sampling is the more representative sample.

Copper was identified in three groundwater samples collected during Phase I at concentrations above the NY DWQS of 130 ug/L. Subsequent Phase II sampling yielded copper concentrations for these wells below the 130 ug/L standard. The groundwater sample collected from MW-19 during Phase I had a copper concentrations of 525 ug/L compared to a Phase II concentration of 69.5 ug/L. Turbidities during both phase of sampling were both over 200 NTUs. At monitoring well MW-24 the Phase I groundwater sample had a copper concentration of 257 ug/L compared to the Phase II concentration of 2.8 ug/L. While the turbidity of the Phase I sample was above 200 NTUs, the Phase II groundwater sample had a turbidity of 14.3 NTUs. At monitoring well MW-31 the Phase I groundwater sample had a copper concentration of 176 ug/L compared to the Phase II result which did not identify copper above the detection limit of 1.9 ug/L. During both Phase I and Phase II the measured groundwater sample turbidities were above 200 NTUs.

Lead was detected in 20 samples above the NY DWQS of 15 ug/L during the Phase I and Phase II sample. During Phase I, 15 groundwater samples were found to have lead concentrations above the 15 ug/L standard. Upon modification of the groundwater purging and sampling procedure, only two Phase II groundwater samples were found to have lead concentrations above the 15 ug/L limit. During Phase I, the maximum lead concentration in groundwater was found in the sample collected at monitoring well MW-24 where 275 ug/L of lead were identified. The Phase II groundwater ample collected at MW-24 had a lead concentration estimated at 2.5 ug/L. While the Phase I turbidity for this sample was above 200 NTUs, the Phase II sample turbidity was significantly lower at 14.3 NTUs. Similar variation in turbidities and lead concentrations from Phase I to Phase II were identified from 12 of the 15 groundwater samples that exceeded the lead limit during the Phase I sampling.

The three wells that had lead concentrations above the 15 ug/L limit were MW-13, MW-14, and MW-19. The Phase I groundwater sample collected at MW-13 had a lead concentration of 32 ug/L. No Phase II sample was collected at this well as the groundwater in the well was frozen during the Phase II sampling. The Phase I groundwater sample collected at MW-14 had a lead concentration of 60.1 ug/L compared to a concentration of 85.6 ug/L measured during Phase II. Turbidities of both samples were generally high with greater than 200 NTUs measured during Phase I and 155 NTUs measured during Phase II. The third set of samples where lead exceeded 15 ug/L were collected from monitoring well MW-19 where the Phase I concentration was 141 ug/L and the Phase II concentration was 35.7 ug/L. As previously noted, the turbidities of both the Phase I and Phase II samples collected from MW-19 were above 200 NTUs.

The metal zinc was not detected in any Phase I or Phase II groundwater samples above the NY DWQS of 5,000 ug/L. In general, zinc concentration were significantly higher in Phase I samples when compared to the Phase II data.

5.0 CONTAMINANT FATE AND TRANSPORT

5.1 CONCEPTUAL SITE MODEL

5.1.1 Physical Site Characterization

The Open Burning (OB) grounds are located in the northwest portion of the SEDA. The nine open-air munitions burning pads and adjoining area occupy a 30-acre area of concern within the entire explosives demolition area. An active ordnance disposal site is within this demolition area, but is not a part of this study. Annual rainfall is approximately 30 inches and surface water drainage flows eastward into Seneca Lake via several small creeks, including Reeder Creek. Overall site relief is low, approximately 20 feet in 2,500 feet (<1%), though steeper slopes are present on the berms and low hill.

The individual burn pads at the OB grounds are constructed of crushed shale that was quarried from on-site areas. The burn pads form the topographic highs on the site. The pads, described in detail in Sections 3 and 4, range in size from 100 by 100 feet (Pad D) to 300 by 800 feet (Pad G). In general, each pad surface is 2 to 3 feet above the surrounding land surface. The silty clay loam soils at the site have developed over glacial tills and have very poor percolation characteristics. The original burn pads were built directly on these seasonally wet soils. Eventually the pads were built up with crushed shale because it was difficult to maintain burning on these wet soils. Berms around the pads are composed of soil and till pushed up and around the pads.

The surficial geologic deposits at the site are composed of glacial till. The till has a high clay percentage and a variable distribution of sand and gravel present within it. The thickness of the till does not exceed 20 feet anywhere within the OB grounds. The till ranges in composition from a dense, clay rich till to a sandy gravel till although there does not appear to be any areally consistent pattern to this variation in geology across the site. This variation in composition also leads to variable hydraulic conductivities at the site.

Black fissile shale (±500 feet thick), with small interbedded limestone layers, is the bedrock. The shale has been relatively unaffected by tectonic events as evidenced by the shallow dip of bedding of approximately 35 feet per mile towards the south. The upper 3 to 5 feet of shale is highly weathered as a result of glaciation and normal erosion. RQD's for core samples taken from the upper 5 to 8 feet of shale were generally less than 5% with the highest measured RQD value being 37%. The tectonically undisturbed nature of the shales in this area reduces the potential of vertical migration of shallow groundwater into deeper (>100 feet) aquifers.

Two distinct geologic units exist in the OB grounds area which store and transmit groundwater. These include the glacial till and weathered shale immediately below the till, and the underlying competent shales and limestone. Groundwater flow within the shallow, unconfined aquifer present within the glacial till and weathered shale tends to follow surface water drainage which moves eastward towards Reeder Creek as described in Section 3. Measured hydraulic conductivities of the glacial tills and the wetland shale fall within a broad range, indicative of the poorly sorted nature of these deposits. The groundwater at the Seneca OB/OD grounds has been classified by NYSDEC as GA. The best usage of class GA waters is as a source of potable water supply. Class GA waters are fresh groundwater found in the saturated zone of unconsolidated deposits and consolidated rock or bedrock.

From the mouth of Reeder Creek to a point 2 miles upstream, the surface water at the site has been classified as C(T). From this point to the headwaters, the surface water is classified as D. The best use of Class C waters is for fishing and fish propagation. These waters shall be suitable for fish propagation and survival including trout. The (T) designation of the surface water classification refers to this stream being a trout stream. The water quality shall be suitable for primary and secondary contact recreation although other factors may limit the use for these purposes. Class C(T) refers to the suitability of these waters for trout, which is reflected in the water quality standards for dissolved oxygen, (the minimal daily average may not be less than 6.0 mg/l; the minimum single value is 5 mg/l). Class C(T) waters must also meet criteria for coliform, pH, and TDS. Class D waters are suitable for fishing. The water quality shall be suitable for primary and secondary contact recreation, even though other factors may limit the use for that purpose. Due to such natural conditions as intermittency of flow and the water conditions not being conducive to the propagation of game fishery of stream bed conditions, the waters will not support fish propagation. However, Class D waters must meet criteria set for coliform, pH, and dissolved oxygen.

One part of the conceptual site model which is especially helpful in evaluating the contaminant fate and transport at the OB grounds is the site water balance. A water balance was developed for this site using the rational method described in *Use of the Water Balance Method for Predicting Leachate Generation from Solid Waste Disposal Sites* (EPA, 1975). The results of these calculations are summarized in Table 5-1.

TABLE 5 – 1

MONTHLY WATER BALANCE

SENECA ARMY DEPOT
OB GROUNDS

Line #		*Jan*	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
1	**Mean Temp. (°F)**	22.5	23.4	32.0	44.8	54.5	64.6	69.1	66.9	60.6	50.4	39.4	27.9	46.3
2	**Heat Index**	0	0	0	1.7	4.0	7.0	8.5	7.8	5.8	2.9	0.7	0.0	38.4
3	**Unadj. PE (in)**	0.000	0.000	0.000	0.039	0.079	0.118	0.134	0.126	0.102	0.063	0.024	0.000	
4	**Corr. Factor**	24.6	24.6	30.9	33.6	37.8	38.1	38.4	35.7	31.2	28.5	24.6	23.7	
5	**Adj. PE (in)**	0.0	0.0	0.0	1.3	3.0	4.5	5.1	4.5	3.2	1.8	0.6	0.0	24.0
6	**P (in)**	1.88	2.16	2.45	2.86	3.17	3.70	3.46	3.18	2.95	2.80	3.15	2.57	34.3
7	**Corr. P (in)**	0	0	7.1	4.8	3.2	3.7	3.5	3.2	3.0	2.8	3.2	0	34.3
8	**C R/O**	0.22	0.22	0.22	0.22	0.20	0.18	0.18	0.18	0.18	0.18	0.20	0.22	
9	**R/O (in)**	0.0	0.0	1.6	1.1	0.6	0.7	0.6	0.6	0.5	0.5	0.6	0.0	6.8
10	**I (in)**	0.0	0.0	5.5	3.8	2.5	3.0	2.8	2.6	2.4	2.3	2.5	0.0	27.5
11	**I–PET(in)**	0.0	0.0	5.5	2.5	–0.4	–1.5	–2.3	–1.9	–0.8	0.5	1.9	0.0	3.5
12	**neg (I–PET)**					–0.4	–1.9	–4.2	–6.1	–6.9				
13	**ST (in)**	3.1	3.1	3.9	3.9	3.5	2.4	1.3	0.8	0.7	1.2	3.1	3.1	
14	**delta ST (in)**	0.0	0.0	0.8	0.0	–0.4	–1.1	–1.1	–0.5	–0.1	0.5	1.9	0.0	
15	**AET (in)**	0.0	0.0	0.0	1.3	3.0	4.1	3.9	3.1	2.5	1.8	0.6	0.0	20.4
16	**PERC (in)**	0.0	0.0	4.7	2.5	0.0	0.0	0.0	0.0	–0.0	0.0	0.0	0.0	7.1

Notes:
PET = Potential Evapotranspiration
P = Precipitation
Corr. P = Corrected precipitation (rain + melting snow)
C R/O = Surface Runoff Coefficient
R/O = Surface Runoff
I = Infiltration
I–PET = Infiltration minus Potentail Evapotranspiration
neg (I–PET) = Accumulated Potential Water Loss
ST = Soil Moisture Storage (for negative accumulated water loss values, soil storage values were obtained from Table 9 of "A Current Report on Solid Waste Management.")
delta ST = Change in Storage
AET = Actual evapotranspiration
PERC = Percolation

The first five lines of the table, which estimate the potential evapotranspiration (PET), at the site follow the procedure outlined by Thornthwaite and Mather (1957). The evapotranspiration is a measure of how much water leaves the site through both evaporation and plant release (transpiration). The next step in the water balance is determining the precipitation. Since no site-specific data were available, precipitation values from the nearby Aurora Research Farm were used, and entered on line 6 in Table 5-1. More complete weather data is presented in Table 3-1, and discussed in Section 3 of this report.

The monthly precipitation values were then corrected to account for snowfall in the months of December through March. For the purposes of the water balance it was assumed that all of the snowfall remained on the ground as snow, with no evaporation, infiltration, or runoff until March when the snow melted. It was assumed that 70% of the snow (the total precipitation for December, January, and February) melted in March, and therefore entered the water balance. The remaining 30% of the accumulated snowfall was assumed to melt in April.

The next line in Table 5-1, line 8, contains the Runoff Coefficient, C_{RO}. This factor is a measure of the amount of precipitation which will runoff from any given area, and could range from 0 to 1, depending on the soils, vegetation, and slopes found at a site. For most cases of interest, C_{RO} values range from 0.05 to 0.35 (EPA, 1975). At the OB grounds, the surface soils are primarily silty clay loams, as described in Section 1. Much of the area is covered with native grasses, though some of the pads and road areas have no vegetative cover. The site slopes generally range from 1 to 2% , though the slopes on the berms and hills are much greater. For these conditions, the C_{RO} values range from 0.13 (less than 2% slope) to 0.22 (2-7% slopes). For these calculations, the higher C_{RO} was chosen, since this gives a more conservative (higher) estimate of the volume of runoff. (Note: Since, as discussed below, surface water is considered to be the pathway with the potential for contaminant transport, a higher estimate of runoff volume would generate a more conservative estimate of the potential for contaminant transport.) As described in the EPA document (1975), a higher C_{RO} (0.22) was used for the cooler months, and a lower value (0.18) was used for the warmer months. For the transitional months, (May and November), a value of 0.20 was used.

As shown in the table, much of the runoff and almost all of the percolation (groundwater recharge) occurred in March and April, during the snow melt period. There is continued runoff throughout the time period when the temperature stays above freezing. These estimates are consistent with observations made at the site regarding runoff and groundwater. There is always runoff associated with any major rainfall event, since the clay soils present on-site prevent rapid infiltration. With respect to the groundwater, water levels measured in the spring have historically been the highest, with levels dropping throughout the summer months. Water levels measured in the winter have also been lower than those in the spring, indicating little or no recharge in the summer and fall.

The surface area of the site is approximately 30 acres, indicating a potential runoff of 17 acre-feet (5.5 million gallons) per year. While some of this runoff reaches Reeder Creek and is conveyed towards Seneca Lake, most of it is retained on site in the numerous freshwater wetlands and low spots. One portion of the site (approximately 5 acres) drains to the west, away from Reeder Creek. A full discussion of the use of the estimated values for infiltration and runoff in evaluating transport mechanisms for the potentially hazardous constituents present at the site, as well as a full discussion of the surface water pathway, is presented below.

5.1.2 Chemical Characterization

SEDA's primary mission has been the receipt, storage, maintenance, and supply of military items. This function includes the disposal of military ammunition and explosives by burning and detonation. During and subsequent to burning, potential contaminants may have been dispersed into the environment, away from the individual burning pads. Burning may have ejected materials from pad sites. Ash generated during burning, and ash and dust subsequent to burning, can result in the wind-blown dispersal of the more volatile or light-weight particles.

The primary activity conducted at the OB grounds was the burning of PEP materials. The amounts and types of PEP actually buried have not been recorded. According to USATHAMA (1985), the major explosives used by the Army are 2,4,6-TNT, tetryl, HMX, and RDX, all of which are potentially hazardous chemicals. Other potentially hazardous chemicals associated with OB and OD activities are the breakdown products of 2,4,6-TNT, which include 2,4-DNT, 2,6-DNT, aminonitrotoluenes, nitrobenzene, dinitrobenzene, and trinitrobenzene (USATHAMA, 1985). Heavy metals including lead and barium are also present in propellants, and are also of concern at this site.

Erosion, dissolution, degradation, and biodegradation allow a variety of materials to disperse into the soils beneath, and downslope from, the pads and berms. Surficial erosion may have transported dissolved and suspended materials along drainage paths, potentially into surface waters (on-site wetlands and Reeder Creek) and off the site. Relatively level topography and indirect drainage paths with intermittent poor draining areas decreases surface dispersal by erosion or surface water runoff. The high clay content of the soil and underlying till will reduce percolation of surface water into the groundwater but will encourage run-off, particularly during large storm events.

Activities associated with pad maintenance and construction, and possible unknown activities (i.e, trenches) increase the possibility of contaminants being dispersed. Visual inspection during a preliminary site visit found metallic materials on most of the pads, with some unexploded ordnance present. The contaminant levels in the berms may constitute the most significant area for pollutant accumulation, as field evidence and previous reports suggest the pads were cleared after each burning event by dozing the residual material into the berms. The berms may also be more permeable due to poor compaction and continued disturbance by heavy equipment.

Planning for burns included consideration of environmental factors. Although the possibility exists for dispersal during burn activities, precautions were taken to minimize these occurrences. These precautions would tend to reduce the possibility of contaminants leaving the disposal site. The precautions included burning only during very low wind conditions and during times of no precipitation. These restrictions reduced the risk of materials escaping the area of concern during burn operations via wind or surface erosion. Additionally, enclosed cages were used to minimize the risk of projectiles being ejected from burn sites. Propellant burns were policed to recover unburned materials which were collected and disposed of in subsequent burns.

5.2 CONTAMINANT PERSISTENCE

5.2.1 Overview

This section presents a general discussion of contaminant persistence (fate and transport) and a discussion of how these guidelines will be used to evaluate the contaminants present at SEDA. Brief contaminant-specific discussions are included in the toxicity profiles (Appendix H). This discussion will focus primarily on explosives and metals, the most prevalent contaminants present at SEDA, but the same principles apply to all contaminants. Secondary contaminants of concern at this site are several semivolatile organic compounds, most notably PAHs, and several pesticide and PCB compounds.

The fate of a constituent refers to the length of time a constituent remains in its present hazardous form. Organic constituents, including explosives, will degrade or decay over time, generally into nonhazardous chemicals. Metal constituents will not degrade, but may be converted into less hazardous or less mobile forms. Properties of both the hazardous constituents and the media (soil, sediment, surface water, and groundwater) are necessary to fully evaluate fate and transport. Examples of meaningful constituent-specific properties are solubility, volatility, degradability, and adsorptivity. These properties are discussed below. Representative indicators of these properties for the compounds of concern at this site are shown in Table 5-2. Media-specific properties include organic carbon content, moisture content, and mineralogy for soils and sediments, and organic content, charge balance, redox condition, and pH for surface water and groundwater.

Volatile constituents will enter the air in void spaces in the soil above the saturated zone. These constituents may then leave the system through the ground surface. The tendency of compound to volatilize is usually expressed in terms of a Henry's Law constant K_H. Henry's Law holds in cases where the solute concentration is very low, which is applicable to most constituents found at hazardous waste sites. Henry's Law states that the concentration of a constituent in the vapor phase is directly proportional to the concentration of that constituent in the aqueous phase. The proportionality factor is the Henry's Law constant. Henry's Law constants for a number of the organic compounds present at SEDA are shown in Table 5-2. Generally, for compounds with a Henry's Law constant less than 5×10^{-3}, volatilization from the soils will not be a major pathway (Dragun, 1988). This indicates that volatilization will play a minimal role in the partitioning of the contaminants of concern at the OB grounds.

Compounds in soil usually are mobilized by entering the aqueous phase. The compounds may enter meteoric water as runoff during rainfall events, or as it percolates through the soil column to the groundwater. Hazardous constituents present in soils may also dissolve directly into the groundwater during periods of high water tables. In some cases, the contaminants enter the system directly into the water fraction via spills or leaks.

Important soil properties to consider include the fraction of organic carbon, the mineralogy, and the porosity. Many organic compounds and some metals adsorb more strongly to the

TABLE 5 – 2

SUMMARY OF FATE AND TRANSPORT PARAMETERS FOR ORGANIC COMPOUNDS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	SOLUBILITY (mg/l)	VAPOR PRESSURE (mmHg)	HENRY'S LAW CONSTANT (atm–m^3/mol)	Koc (ml/g)	Kow	HALF – LIFE (days)	BCF
Volatile Organic Compounds							
Methylene Chloride	20000	438	2.03E–03	8.80E+00	2.00E+01	1–3	0.8
Acetone	infinite	288	2.06E–05	2.80E–01	5.75E–01		0.03
1,2–Dichloroethene (total)	6300	5.3	6.60E–03	5.90E+01	1.23E+02		4.5
Carbon Disulfide	2940	366	1.32E–02	5.40E+01	1.00E+02		7.9
Chloroform	8200	208	2.87E–03	4.70E+01	9.33E+01		4.5–6
2–Butanone	353000	70.6	4.35E–05	9.40E–01	1.95E+00		0.09–1.86
1,2–Dichloroethane	8520	80	9.78E–04	1.40E+01	3.02E+01	2–18	1.4–2
Trichloroethene	1100	75	9.10E–03	1.26E+02	2.40E+02	3–300	13–39
Tetrachloroethene	150	19	2.59E–02	3.64E+02	3.98E+02	1–13	49–66
Toluene	535	30	6.37E–03	3.00E+02	5.37E+02	3–39	2.6–27.1
Chlorobenzene	490	8.8	3.46E–03	3.33E+02	6.92E+02		10–33
Xylene (total)	0.3	9	6.91E–03	6.91E+02	1.45E+03		70
Semivolatile Organic Compounds							
Phenol	93000	0.341	4.54E–07	1.42E+01	2.88E+01	3–5	1.4–2
2–Methylphenol	25000	0.24	1.50E–06	2.74E+02	8.91E+01	1–3	
4–Methylphenol		0.11	4.43E–07	2.67E+02	8.51E+01	1–3	
2,4–Dimethylphenol	4200	0.0573	2.38E–06	2.22E+02	2.63E+02	1–3	9.5–150
Benzoic Acid	2700			2.48E+02	7.41E+01		
Naphthalene	31.7	0.23	1.15E–03	1.30E+03	2.76E+03	1–110	44–95
2–Methylnaphthalene	25.4	0.0083	5.80E–05	8.50E+03	1.30E+04	1–3	
2–Chloronaphthalene	6.74	0.017	4.27E–04	4.16E+03	1.32E+04		
2,6–Dinitrotoluene	1320	0.018	3.27E–06	9.20E+01	1.00E+02	4	4.6
Acenaphthene	3.42	0.00155	9.20E–05	4.60E+03	1.00E+04		
Dibenzofuran				4.16E+03	1.32E+04		
2,4–Dinitrotoluene	240	0.0051	5.09E–06	4.50E+01	1.00E+02	5	
Diethylphthalate	896	0.0035	1.14E–06	1.42E+02	3.16E+02	1–3	14–117
Fluorene	1.69	0.00071	6.42E–05	7.30E+03	1.58E+04		
N–Nitrosodiphenylamine	113		1.40E–06	6.50E+02	1.35E+03	4	65–217
Hexachlorobenzene	0.006	0.000019	6.81E–04	3.90E+03	1.70E+05		
Phenanthrene	1	0.00021	1.59E–04	1.40E+04	2.88E+04	1–200	
Anthracene	0.045	0.000195	1.02E–03	1.40E+04	2.82E+04		
Di–n–butylphthalate	13	0.00001	2.82E–07	1.70E+05	3.98E+05	1–3	89–1800
Fluoranthene	0.206	0.0177	6.46E–06	3.80E+04	7.94E+04	140–440	
Pyrene	0.132	2.50E–06	5.04E–06	3.80E+04	7.59E+04	9–1900	
Butylbenzylphthalate	2.9	8.60E–06	1.20E–06	2.84E+04	5.89E+04		663
Benzo(a)anthracene	0.0057	1.50E–07	1.16E–06	1.38E+06	3.98E+05	240–680	
Chrysene	0.0018	6.30E–09	1.05E–06	2.00E+05	4.07E+05	160–1900	
Bis(2–Ethylhexyl)phthalate	0.285	2.00E–07	3.61E–07	5.90E+03	9.50E+03	Neg. Deg.	
Di–ni–octylphthalate	3			2.40E+06	1.58E+09		
Benzo(b)fluoranthene	0.014	5.00E–07	1.19E–05	5.50E+05	1.15E+06	360–610	
Benzo(k)fluoranthene	0.0043	5.10E–07	3.94E–05	5.50E+05	1.15E+06	910–1400	
Benzo(a)pyrene	0.0012	0.000568	1.55E–06	5.50E+06	1.15E+06	220–530	
Indeno(1,2,3–cd)pyrene	0.00053	1.00E–10	6.86E–08	1.60E+06	3.16E+06	600–730	
Dibenz(a,h)anthracene	0.0005	5.20E–11	7.33E–08	3.30E+06	6.31E+06	750–940	
Benzo(g,h,i)perylene	0.0007	1.03E–10	5.34E–08	1.60E+06	3.24E+06	590–650	

TABLE 5 – 2

SUMMARY OF FATE AND TRANSPORT PARAMETERS FOR ORGANIC COMPOUNDS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	SOLUBILITY (mg/l)	VAPOR PRESSURE (mmHg)	HENRY'S LAW CONSTANT (atm–m³/mol)	Koc (ml/g)	Kow	HALF – LIFE (days)	BCF
Pesticides/PCBs							
beta–BHC	0.24	2.80E–07	4.47E–07	3.80E+03	7.94E+03		
gamma–BHC (Lindane)	7.8	0.00016	7.85E–06	1.08E+03	7.94E+03	Neg. Deg.	250
Heptachlor	0.18	0.0003	8.19E–04	1.20E–04	2.51E+04	Neg. Deg.	3600–37000
Aldrin	0.18	6.00E–06	1.60E–05	9.60E+04	2.00E+05	Neg. Deg.	3890–12260
Endosulfan I	0.16	0.00001	3.35E–05	2.03E+03	3.55E+03		
Heptachlor epoxide	0.35	0.0003	4.39E–04	2.20E+02	5.01E+02	Neg. Deg.	851–66000
Dieldrin	0.195	1.78E–07	4.58E–07	1.70E+03	3.16E+03	Neg. Deg.	3–10000
4,4'–DDE	0.04	6.50E–06	6.80E–05	4.40E+06	1.00E+07	Neg. Deg.	110000
Endrin	0.024	2.00E–07	4.17E–06	1.91E+04	2.18E+05	Neg. Deg.	1335–49000
Endosulfan II	0.07	0.00001	7.65E–05	2.22E+03	4.17E+03		
4,4'–DDD	0.16	2.00E–09	3.10E–05	2.40E+05	3.60E+05		
Endosulfan sulfate	0.16			2.33E+03	4.57E+03		
4,4'–DDT	0.005	5.50E–06	5.13E–04	2.43E+05	1.55E+06	Neg. Deg.	38642–110000
Endrin aldehyde							
alpha–Chlordane	0.56	0.00001	9.63E–06	1.40E+05	2.09E+03	Neg. Deg.	400–38000
Aroclor–1254	0.012	0.00008	2.70E–03	4.25E+04	1.07E+06	42	10E4–10E6
Aroclor–1260	0.0027	0.000041	7.10E–03	1.30E+06	1.38E+07	Neg. Deg.	10E4–10E6
Explosives							
HMX	66	3.90E–09		5.08E+02	1.30E–01		
RDX	50	4.10E–09	2.00E–05	5.38E+02	7.80E–01		
1,3,5–Trinitrobenzene	35	2.20E–04	1.30E+00	5.20E+02			
1,3–Dinitrobenzene	470			1.50E+02	4.17E+01		
Tetryl							
2,4,6–Trinitrotoluene	130	0.0001	1.37E–06	5.34E+02	1.90E+00		
4–amino–2,6–Dinitrotoluene							
2–amino–4,6–Dinitrotoluene							
2,6–Dinitrotoluene	182	0.018	3.27E–06	2.49E+02	1.00E+02	4	4.6
2,4–Dinitrotoluene	270	0.0051	5.09E–06	2.01E+02	1.00E+02	5	

Notes:

Koc = organic carbon partition coefficient
Kow = octanol–water partition coefficient
BCF = bioconcentration factor
Neg. Deg. = Negligible Biodegradation

References:

1. IRP Toxicology Guide
2. Basics of Pump–and–Treat Ground–Water Remediation Technology (EPA, 1990).
3. Handbook of Environmental Fate and Exposure Data (Howard, 1989).
4. Soil Chemistry of Hazardous Materials (Dragun, 1988)
5. Hazardous Waste Treatment, Storage, and Disposal Facilities, Air Emissions Models (EPA, 1989).
6. USATHAMA, 1985
7. Values for Koc not found were estimated by: logKoc = 0.544logKow + 1.377 (Dragun, 1988).

organic fraction in the soil or sediment. Therefore, the larger the amount of organics in the soil, the less mobile organic constituents will be.

One measure of the affinity of a compound for the organic fraction of the soil is the organic carbon partition coefficient, K_{oc}. The K_{oc} is the ratio of the amount of the compound present in the organic fraction to that present in the aqueous fraction. K_{oc} values are presented in Table 5-2 for the contaminants of concern at the OB grounds. The units used in Table 5-2 are milliliters per gram (mL/g). Table 5-3 describes the relative relationship between K_{oc} and mobility. As can be seen, compounds with a K_{oc} between 500 mL/g and 2000 mL/g are generally considered to have low mobility compounds greater than 2000 mL/g are considered to be immobile (Dragun, 1988). As shown in Table 5-2, most of the PAHs and pesticides have K_{oc} values well greater than 500 mL/g, and have low mobility. The explosives have K_{oc} values ranging from 45 to 500 mL/g, and therefore may be considered mobile.

Soils with higher organic content will adsorb more organics than soils with more clays. Generally, surface soils will have higher organic content than deeper soils, due to the presence of live and dead plant matter at the surface.

K_{oc} values are generally determined by experiment, but are often estimated using octanol-water partition coefficients (K_{ow}). Octanol-water partition coefficients are determined in the laboratory, and then converted to K_{oc} via empirical relationships. Like the K_{oc}, K_{ow} values are also presented in Table 5-2. Since these values are a ratio of concentrations, they are dimensionless.

Other compounds adsorb more strongly to the clay fraction of a soil or sediment. Understanding the type and amount of clays present is crucial to estimating the mobility of the compounds. Most of the soils at SEDA are classified as clay loams. These soils generally have low permeabilities and high water retention capabilities. Because of these properties, contaminants tend to move slowly through these soils.

Transport refers to the movement of hazardous constituents at a site. There are three major pathways through which hazardous contaminants may migrate and threaten human health and the environment, and which must be evaluated for every site: air, groundwater, and surface water. At SEDA, the major pathways of concern are surface water runoff, the interaction of surface water with surficial soils, and the air pathway, primarily through the entrainment of particulates.

TABLE 5-3

RELATIVE RELATIONSHIPS BETWEEN K_{oc} AND MOBILITY

K_{oc}	Mobility Class
>2000	I - Immobile
500-2000	II - Low Mobility
150-500	III - Intermediate Mobility
50-150	IV - Mobile
<50	V - Very Mobile

K_{oc} - Organic carbon partition coefficient

Source: The Soil Chemistry of Hazardous Materials; James Dragun, Ph.D; The Hazardous Materials Control Research Institute; 1988.

This mobilization might take place on different scales -- adsorption of the lead onto organic matter or leaching of metal complexes into surface water during runoff of precipitation. Any evaluation of transport must involve characteristics and data from the total site, and cannot look solely at chemical data or general soil and surface water information. The transport mechanisms must also be understood in terms of small to large-scale phenomena.

The discussion of the fate mechanisms is separated into three groups, explosives, heavy metals, and other organics, as the mechanisms are somewhat different for each class. For organic constituents such as explosives, fate is evaluated in terms of degradation or conversion of the compounds. Compounds can biodegrade, hydrolyze, photodegrade, or be converted into other organic compounds. Usually, organic compounds are converted to less hazardous compounds, with carbon dioxide and water being the major end products of aerobic degradation. Occasionally, more hazardous constituents may result from degradation. However, the degradation products of the explosives discussed in Section 5.2.2 are not more hazardous than the parent compounds. Photodegradation is only important when the organic compounds are present at the surface and exposed to the sun. At SEDA, all of these mechanisms may contribute to the degradation of organics.

Important factors of organics (used to assess the degradation) include the degradation rate which is a measure of how rapidly a compound will biodegrade; solubility, which helps to determine the availability of the compound to the bacteria and to hydrolysis reactions; and toxicity, which is a measure of how toxic the compound is to the bacteria present in the soil. Biodegradation is often assumed to be a first order mechanism, and degradation rates may be expressed as first order rate constants or as half-lives. A half-life refers to the time it would take for half of the mass of the organic constituent to degrade to either an intermediate compound or to carbon dioxide and water. A detailed analysis of biodegradation would evaluate the complete pathway. Half-lives for some of the organic compounds detected at SEDA are shown in Table 5-2. The first order degradation rate is often assumed to be independent of the mass of the constituent present in order to facilitate modeling, but in reality, as the mass of a compound decreases, the degradation rate will also decrease.

The major fate mechanisms for metals are complexation, adsorption, precipitation, oxidation and reduction. Complexation and adsorption are very similar. Both involve the bonding of the metal ion with other materials present in the media, such as organic matter or clay minerals. In complexation, metals are bound up by larger molecules present in the aqueous fraction of the system, while adsorption generally refers to the binding up of the metals in the minerals or clays present in the soil or sediment. Metal complexes may still be mobile, while adsorbed metals are not. Precipitation involves the formation of a metal compound which is insoluble. Examples of insoluble compounds are metal hydroxides and metal carbonates.

Another aspect of fate and transport is bioaccumulation, or bioconcentration. A range of bioconcentration factors (BCFs) for some of the constituents present at the OB grounds is included in Table 5-2. While some of these values indicate a large potential for bioaccumulation, the overall potential at the site is low, since most of the chemicals of concern, both organics and inorganics are present in forms which are not readily available to plants and animals and the major chemicals of concern at the site, the heavy metals, tend to have lower BCFs. The organics are primarily adsorbed in the organic matter in the soil (as evidenced by the high K_{oc} values), and the inorganics are present primarily in insoluble forms in part due to the pH of the soil boring in the 6 to 7 range (SCS, 1972). Therefore, there will be little plant uptake of the hazardous constituents.

Another bioaccumulation mechanism involved uptake through ingestion of contaminated surface water or sediment by the various animals and insects at the site. This is a viable exposure pathway, though direct ingestion of contaminated surface water and sediment is of greater concern. Lead, for example, does not bioaccumulate in terrestrial ecosystems to any major degree. In general, lead may be found in the animals living in the sediment, such as insects and amphibians. Animals that eat the insects tend to show slightly elevated lead levels, but lead does not tend to move further up the food chain (USFWS, 1988). These exposure pathways will be described in the ecological risk assessment (Section 6).

A third common mechanism for bioaccumulation is ingestion of fish which have bioaccumulated hazardous chemicals. Fish may accumulate these chemicals by swimming in contaminated water or by ingesting lower topic organics that have also bioaccumulated chemicals. Surface water samples collected from Reeder Creek, the only fishing stream which passes near the site showed little or no contamination, indicating little or no potential for the fish in the stream to become contaminated. Fish tissue samples were not obtained, following Phase 1, because the ecological survey performed during Phase 1 indicated that the aquatic community was diverse and healthy. Since there was little evidence for impacts from bioaccumulation, this mechanism was not evaluated in detail at this site.

5.2.2 Explosives

Table 5-2 presents the information which will serve as a basis for understanding the likely environmental fate of explosives at the burning grounds. The chemical class of the compounds identified in Table 5-2 is considered to be semivolatile. This is based upon the high molecular weights of these compounds and their low vapor pressures, typical of most semivolatile compounds. The most volatile of the five explosives considered at this site is 2,6-dinitrotoluene (2,6 DNT), with a vapor pressure of 0.018 millimeters mercury (mm Hg). Compared to benzene, a volatile compound, which has a vapor pressure of 95.2 mm Hg it is apparent that volatilization of this compound is expected to be low, especially in soils which have a high clay content. Soils with a high clay content generally have a high, i.e. >50%, ratio of water filled to air filled porosity, therefore, there is a small amount of air space through which vapor can migrate. Compounds such as RDX and HMX have extremely low vapor pressures and would not volatilize through the soils. Consequently, volatilization of RDX and HMX are not expected to represent a significant environmental pathway.

The potential for explosives to leach to the groundwater is a complicated consideration and influenced by many factors such as solubility, cation exchange capacity (CEC), clay content and percolation rate. For this evaluation, solubility has been considered as the most representative parameter for leaching potential. Of the six explosives considered, the most soluble of the explosives are the di- and trinitrotoluenes. Their solubilities range from approximately 130 mg/l to 270 mg/l. These are similar to the solubilities of organic hydrocarbons such as toluene, (500 mg/l), or the xylenes, (150 mg/l). This range of solubilities is considered to represent a moderate degree of leaching potential. Compounds which would represent a high degree of leachibility, i.e., high solubility, would be methylene chloride, (20,000 mg/l), benzene (1780 mg/l) and TCE, (1100 mg/l). The solubilities of HMX and RDX are approximately four times less than that for the di- and trinitrotoluenes and therefore represent a smaller potential for leaching.

A review of the melting points of these compounds indicates that explosives are solids at room temperature and therefore would not migrate through soil as separate liquid phases. Instead, as precipitation interacts with these solid residues a small portion would dissolve or erode away. Complete leaching would require a long interaction period.

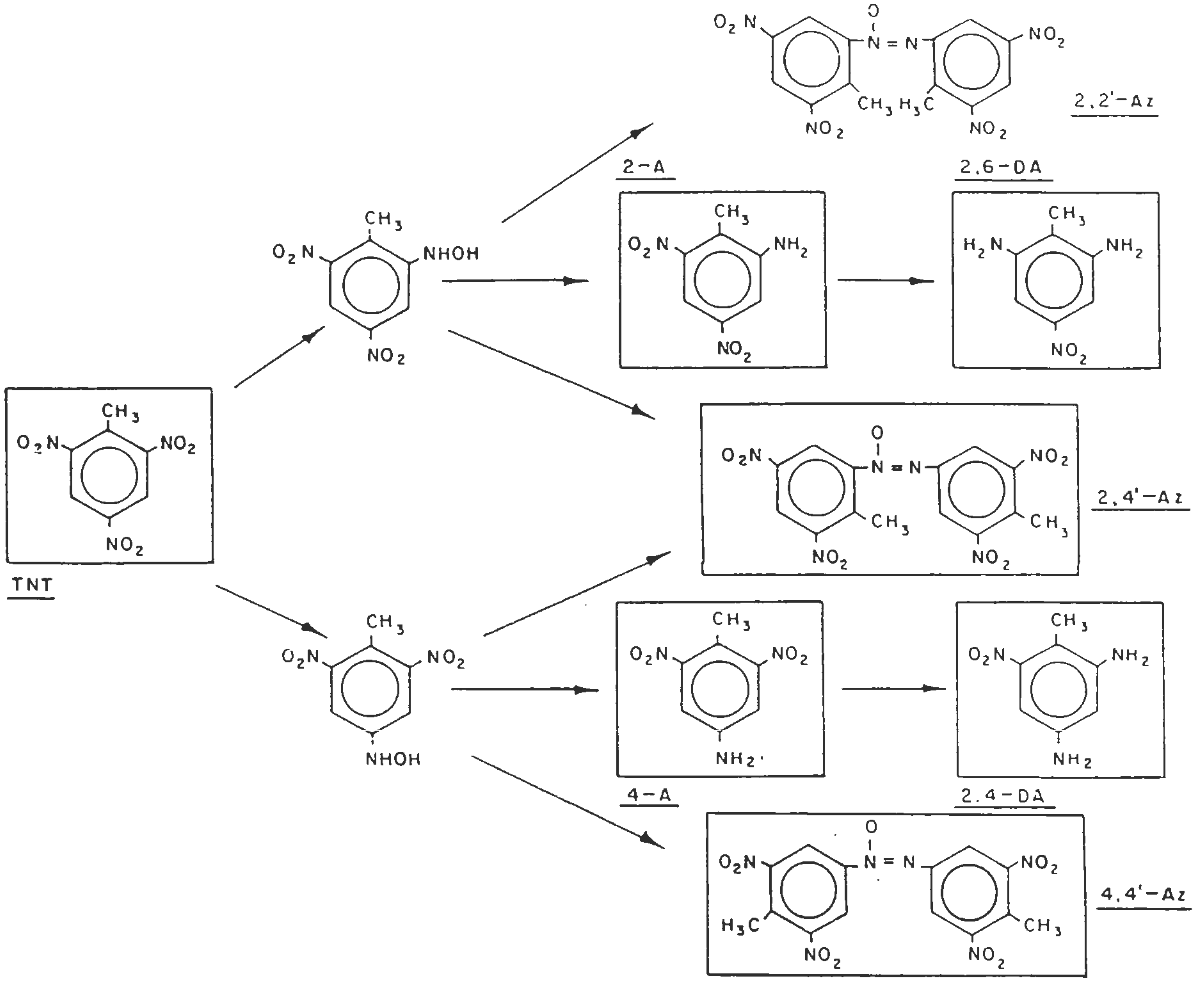
Field studies have confirmed the long-term potential for leaching of explosives into the groundwater. An evaluation of the critical parameters affecting the migration of explosives through soils indicated that at a former propellant manufacturing facility, 2,4-DNT leached from soil contaminated with smokeless powder for over 35 years after cessation of operations (USATHAMA, 1985). At another facility, leaching of 2,4-DNT into groundwater from former burning grounds has been documented to occur for as long as 10 years after operations had been discontinued.

Another factor to examine is the tendency of explosives compounds to adsorb to the soil. The compounds considered in this evaluation show K_{oc} values which range from approximately 100 to 500 mL/g. The OB site soils have been shown to possess a high percentage of fines including clay, thereby increasing the sorption potential of these compounds to the soil. As shown in Table 5-3, for the range of K_{oc} exhibited by explosives, i.e., 100-500 mL/g, these compounds would be considered intermediately mobile.

Environmental degradation of these parent organic compounds has been shown to occur by various investigators. The information available on this subject is substantial and a detailed discussion is beyond the scope of this document. However, ES has performed a review of the available information which indicates that nitroaromatics and nitramines are susceptible to environmental transformations. Since some of the byproducts of these transformations may be environmentally persistent, there is a potential for concern.

Much of the available research has been conducted on the environmental transformation of TNT. Figure 5-1 provides a summary of the identified breakdown products resulting from environmental degradation of TNT. Figure 5-2 presents breakdown products which have been identified from the breakdown of 2,4-DNT. The environmental fate of RDX is less defined than that of the other two compounds previously mentioned. Figure 5-3 provides an overview of the expected degradation pathways and the byproducts produced as a result of the environmental degradation of RDX. Clearly, the breakdown byproducts which have been identified are diverse. Analytical methods have only recently been developed which are capable of accurately detecting these compounds. The widespread application of these analytical techniques are greatly limited

by the availability of standards which are essential for the analyses. Responding to the need for accurate analytical procedures and recognizing that standards for every breakdown product are not available, USATHAMA has developed Method 8330 (A copy of this method is included in the workplan). This method is intended for the analysis of explosive residues in water, soils and sediments.



NOMENCLATURE:

2-A - 2-amino-4,6-dinitrotoluene
4-A - 4-amino-2,6-dinitrotoluene
2,2'-AZ - 4,4'-dinitro-2,2'-azoxytoluene
2,4'-AZ - 2'4-dinitro2,4'-azoxytoluene
4,4'-AZ - 2,2'-dinitro-4,4'-azoxytoluene
2,6-DA - 2,6-diamino-4-nitrotoluene
2,4-DA - 2,4-diamino-6-nitrotoluene

SOURCE:

Special Report 90-2; Environmental Transformation Products of Nitroaromatics and Nitramines; Literature Review and Recommendations for Analytical Method Development;

U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Feb. 1990

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

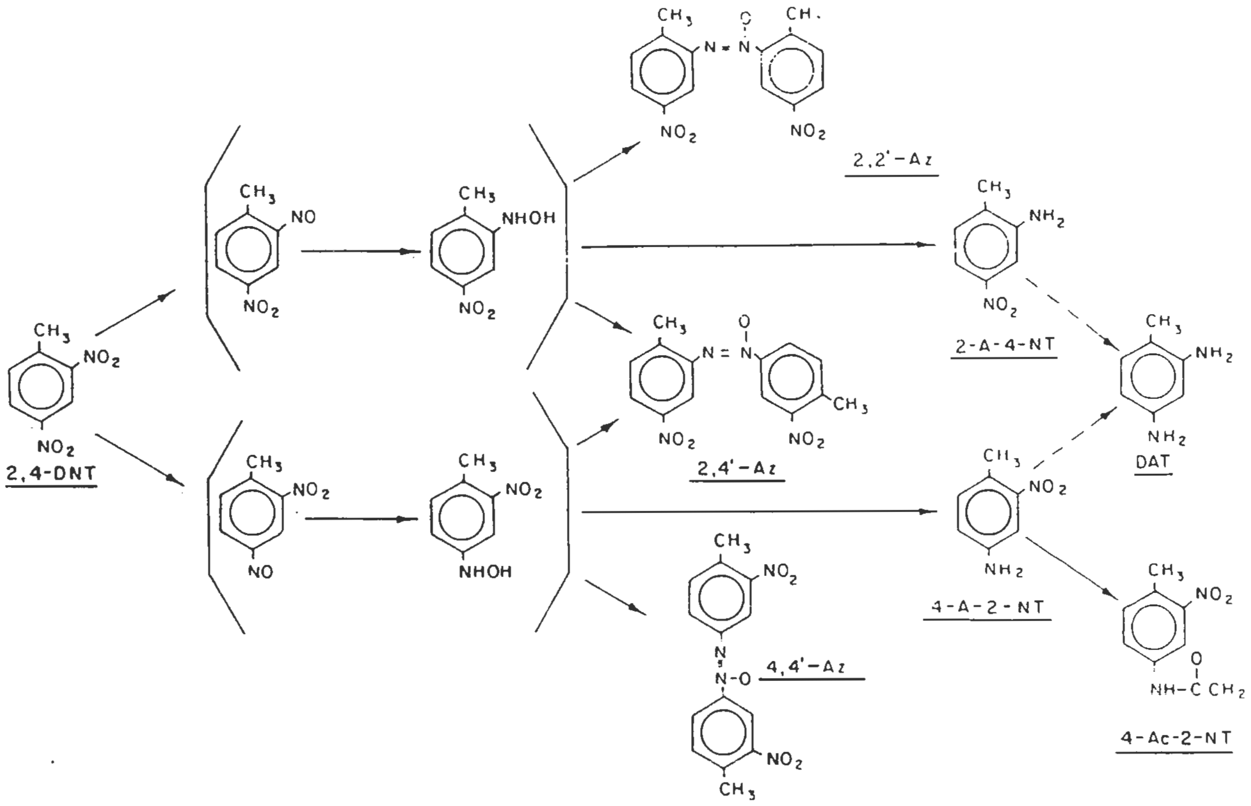
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 5-1

TRANSFORMATION PATHWAYS AND PRODUCTS FOR TNT

SCALE



NOMENCLATURE:

2,2'-AZ - 4,4'-dinitro-2,2'-azoxytoluene
2,4'-AZ - 2',4-dinitro-2,4'-azoxytoluene
4,4'-AZ - 2,2'-dinitro-4,4'-azoxytoluene
DAT - Diaminotoluene
2-A-4-NT - 2-amino-4-nitrotoluene
4-A-2-NT - 4-amino-2-nitrotoluene
4-AC-2-NT - 4-acetamide-2-nitrotoluene

SOURCE:

Special Report 90-2; Environmental Transformation Products of Nitroaromatics and Nitramines; Literature Review and Recommendations for Analytical Method Development;

U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Feb. 1990

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OPEN BURNING GROUNDS

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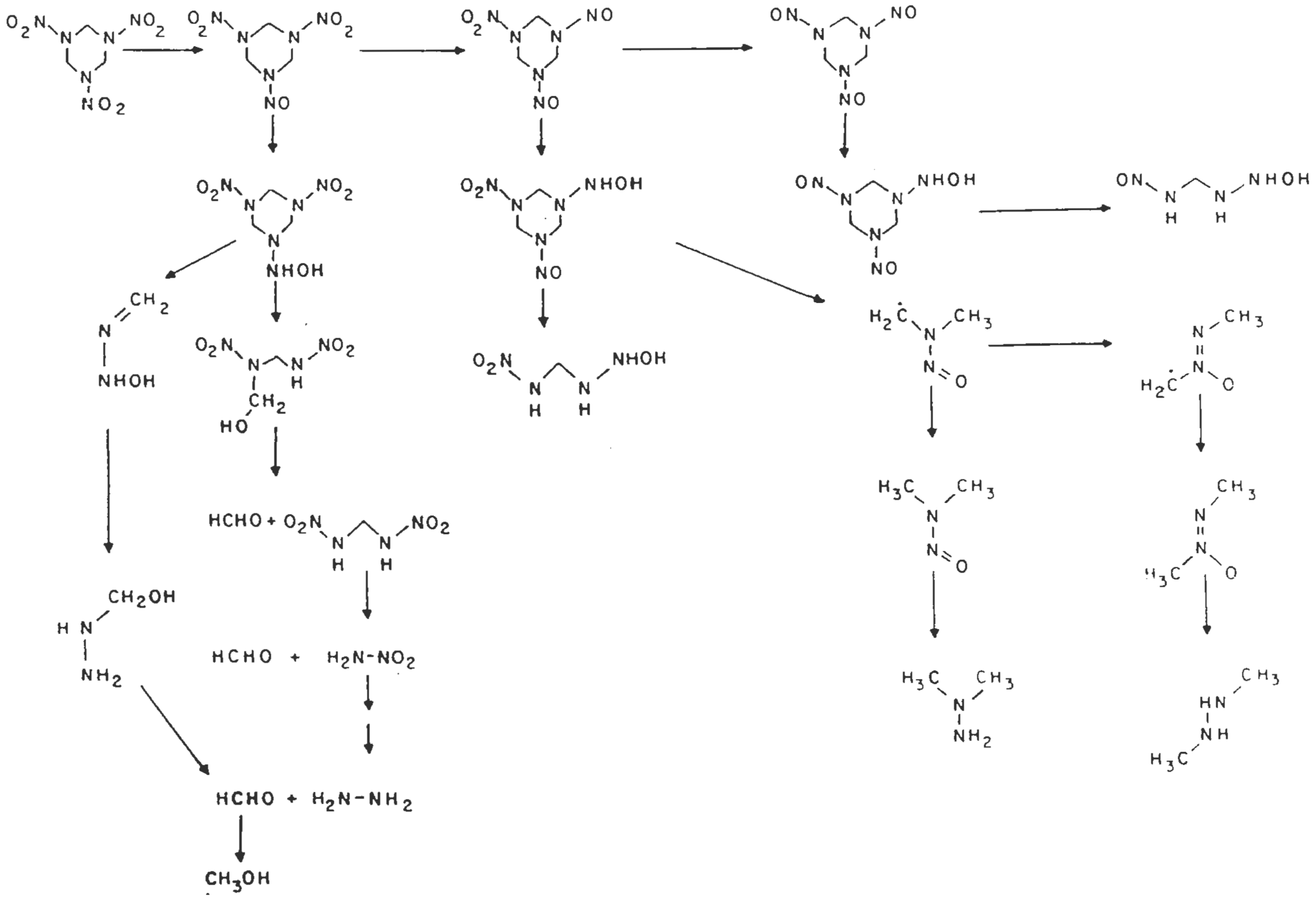
NO 720446-01000

FIGURE 5-2

TRANSFORMATION PATHWAYS AND PRODUCTS FOR 2,4-DNT

SCALE



SOURCE:

Special Report 90-2; Environmental Transformation Products of Nitroaromatics and Nitramines; Literature Review and Recommendations for Analytical Method Development;

U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory, Feb. 1990

ES
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OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING	NO 720446-01000

FIGURE 5-3

TRANSFORMATION PATHWAYS AND PRODUCTS FOR RDX

SCALE

5.2.3 Heavy Metals

The behavior of heavy metals in soil is unlike organic compounds in many aspects. For example, volatilization of metals from soil is not considered a realistic mechanism for contaminant migration and is not considered here. However, leaching and sorption will be considered.

Leaching of heavy metals from soil is controlled by numerous factors. The most important consideration for leaching of heavy metals is the chemical form (base metal or cation) present in the soil. The leaching of metals from soils is substantial if the metal exists as a soluble salt. Metallic salts have been identified as a component of such items as tracer ammunition, ignitor compositions, incendiary ammunition, flares, colored smoke and primer explosive compositions. In particular, barium nitrate, lead stearate, lead carbonate, and mercury fulminate are likely heavy metal salts or complexes which were burned on the pads. During the burning of these materials, a portion of these salts were likely oxidized to their metallic oxide forms. In general, metal oxides are considered less likely to leach metallic ions than metallic salts. Upon contact with surface water or precipitation, the heavy metals can be solubilized, eventually leaching to the groundwater.

Heavy metals may also exist in the base metallic form as a component of the projectile itself. Bullets are composed mainly of lead, which may contain trace amounts of cadmium and selenium. Metals which exist in metallic form, i.e., as bullets or projectiles, will tend to dissolve more slowly than the metallic salts.

Oxidation and reduction involves the change of the valence state of the metals and has a large influence on the other fate mechanisms. A good example of the variation in contamination fate due to oxidation and reduction changes is chromium. Chromium (Cr) normally exists in one of two valence states, +3 and +6 [Cr(III) and Cr(VI)]. Cr(VI) generally exists in groundwater as CrO_2^{-2}, which is far more soluble than Cr(III), the dominant environmental form of Cr(III), and therefore represents a greater threat to human health or the environment. Cr(VI) is the dominant form of chromium under oxidizing conditions, while Cr(III) would be more prevalent under reducing conditions. The redox state may also affect the toxicity of a compound.

One property of the soil which is often correlated with potential metal migration is soil pH. If the soil pH is greater than 6.5, most metals, especially those normally present as cations, are fairly immobile. At higher pH values, metals form insoluble carbonate and hydroxide complexes. Metals would be most mobile in highly acidic soils, i.e. those with a pH of less than 5.

The surface soils at the OB grounds have pH values ranging from 5 to 8.4 (SCS, 1972). Subsurface soils have even higher pHs, with the data indicating values ranging from 7 to 9. Therefore, metals at the OB grounds would be expected to be present primarily in insoluble forms.

Four metals, barium, copper, lead, and zinc, are considered the primary metals of concern at this site, and merit a more detailed evaluation. A complete discussion of the rationale for selecting these four metals is included in the risk assessment (Section 6).

Barium is a highly reactive metal that occurs naturally only in the combined state. Most barium released to the environment from industrial sources is in forms that do not become widely dispersed. In the atmosphere, barium is likely to be present in the particulate form. Environmental fate processes may transform one barium compound to another; however, barium itself is not degraded. It is removed from the atmosphere primarily by wet or dry deposition.

In aquatic media, barium is likely to precipitate out of solution as an insoluble salt, or adsorb to suspended particulate matter. Sedimentation of suspended solids removes a large portion of the barium from surface waters. Barium in sediments is found largely in the form of barium sulfate. Bioconcentration in freshwater aquatic organisms is minimal.

Barium in soil may be taken up to a small extent either by vegetation, or transported through soil with precipitation. Barium is not very mobile in most soil systems. The higher the level of organic matter, the greater the adsorption. The presence of calcium carbonate will also limit mobility, since barium will form $BaCO_3$, an insoluble carbonate.

Copper is dispersed throughout the atmosphere primarily as a result of anthropogenic activities. Environmental fate processes may transform one copper compound to another; however, copper itself is not degraded. Most of the copper in the atmosphere occurs in the aerosol form, and long-distance transport may occur. Wet or dry deposition is expected to be the primary fate process in air.

Several processes determine the fate of copper in aquatic environments, these being: formation of complexes, especially with humic substances; sorption to hydrous metal oxides, clays, and organic materials; and bioaccumulation. Organic complexes of copper are more easily adsorbed on clay and other surfaces than the free form. The aquatic fate of copper is highly dependent on factors such as pH, oxidation-reduction potential, concentration of organic matter, and the presence of other metals. With regard to the latter, it has been demonstrated that coprecipitation of copper with hydrous oxides of iron effectively scavenges copper from solution, although in most surface waters organic materials prevail over inorganic ions in complexing copper.

Generally, copper is considered to be among the more mobile of the heavy metals in surface environments. Seasonal fluctuations have been observed in surface water copper concentrations, with higher levels in fall and winter, and lower levels in the spring and summer. Copper is not expected to volatilize from water. Since copper is an essential nutrient, it is strongly accumulated by all plants and animals, but is probably not biomagnified.

The degree of persistence of copper in soil depends on the soil characteristics and the forms of copper present. For example, in soils of low organic content, soluble copper compounds may move into groundwater at a significant rate. On the other hand, the presence of organic complexing agents may restrict movement in soil, and copper may be immobilized in the form of various inorganic complexes. Copper is not expected to volatilize from soil.

Lead is extremely persistent in both water and soil. Environmental fate processes may transform one lead compound to another; however, lead is generally present in the +2 oxidation state, and will form lead oxides, although lead itself is not degraded. It is largely associated with suspended solids and sediments in aquatic systems, and it occurs in relatively immobile forms in soil. Lead which has been released to soils may become airborne as a result of fugitive dust generation.

Elemental zinc is a bluish-white, lustrous metal having a distorted hexagonal close-packed structure. It is stable in dry air, but upon exposure to moist air will form a white coating composed of basic carbonate. Zinc loses electrons (oxidizes) in aqueous environments. In the environment, zinc is found primarily in the +2 oxidation state. Elemental zinc is insoluble; most zinc compounds show negligible solubility as well, with the exception of elements (other than fluoride) from Group VIIa of the Periodic Table compounded with zinc (i.e., $ZnCl_2$, ZnI_2) showing a general 4:1 compound to water solubility level. In contaminated waters, zinc often complexes with a variety of organic and inorganic ligands. Therefore, the overall mobility of zinc in an aqueous environment, or through moist-to-wet soils, may be accelerated by compounding/complexing reactions.

Zinc has a tendency to adsorb to soils and to sediment and suspended solids in waters. Adsorption to sediments and suspended solids is the primary fate for zinc in aqueous environments, and will greatly limit the amount of solubilized zinc. Zinc is an essential element and, therefore, is accumulated by all organisms. Zinc concentrations in air are relatively low except near industrial sources. Volatilization is not an important process from soil or water.

5.2.4 Other Organic Compounds

A number of other organic compounds were detected at the OB grounds during the RI. Volatile organics, both solvent related, such as methylene chloride, and fuel related, such as xylene, were found. Also detected were several semivolatile organic compounds including PAHs and phthalates, pesticides, and PCBs. The persistence of these compounds can be evaluated in much the same way as for explosives, though the relative importance of the different mechanisms will vary.

Volatile organics were detected in only a few of the samples collected at the OB grounds, and are not considered a major threat to human health and the environment. These compounds have higher vapor pressures, and Henry's Law constants, and would tend to migrate through volatilization. In addition, high solubilities and low sorption coefficients indicate a potential for migration through surface water runoff and infiltration to groundwater. There is no data available to evaluate the air pathway, but since the soil concentrations of these compounds are so low, it is unlikely that measurable concentrations would be present in the air at the site. Substantial surface water and groundwater data were collected during the two phases of the RI, and there is no evidence that these compounds have migrated though either of these pathways. As with the explosives, the surface water runoff and wind erosion pathways were evaluated in detail. The results of that evaluation are discussed below.

The semivolatile organics, pesticides, and PCBs behave very similarly to the explosives in the environment. These chemicals are characterized by low vapor pressures and Henry's Law constants, indicating little potential for volatilization. High sorption coefficients (7500 mL/g) indicate that these chemicals will be tightly bound up in the soil, and would tend to migrate only in conjunction with the soil itself. Most PAHs have K_{oc} values greater than 2000 mL/g, indicating that they are immobile. A complete discussion of these two mechanisms is included below.

5.3 CONTAMINANT MIGRATION

5.3.1 Overview

There are two methods by which contaminant migration may be assessed. The first is to look for evidence of a release by collecting samples of the different media and analyzing them for the constituents of concern. The presence of these analytes in a given media would provide evidence of an observed release. For example, if explosives were detected in groundwater that would be evidence of a release via the groundwater pathway. At the OB grounds, samples were collected from soil sediment, surface water, and groundwater. The analytical results for these samples are discussed in detail within Section 4.

Sometimes it is not feasible to collect samples from a given pathway or there is an interest in the potential for future releases from a site. In these cases models are used to evaluate pathways. Models may also be used to examine how a contaminant plume might change over time. Models range from complicated numerical simulations to simple analytical models.

As with persistence, it is easier to model separately the migration for the different types of constituents for each pathway, though the mechanisms involved are similar. The primary means of transport for hazardous constituents is via water or air both above and below ground. Therefore, it is important to understand the partitioning of the hazardous constituents between air, water and solid media. The media investigated at SEDA were soil, sediment, groundwater, and surface water.

Hazardous constituents present in soil and sediment are practically immobile, except when they partition into a mobile fraction, such as water or air. The primary mechanism for air transport is volatization. An exception is the case where the soil itself is mobilized, and nonvolatile constituents, such as metals and explosives, become airborne in association with this soil particulate matter. This may be an important mechanism at the OB grounds. These emissions can be estimated by first calculating the particulate emissions from the surface soils, and then multiplying these values by the concentrations of the contaminants of concern in the surface soils.

A first step in evaluating partitioning is to determine the contact between phases. Porosity is a measure of the void space in the soil, and is used to estimate the amount of air or water which could contact the soil. Generally, the less the effective porosity of the soil, the less mobile the potentially hazardous constituents would be, since there is less water or air available for the constituents to partition into. The predominant soil at SEDA is clay, which has a high effective porosity and a low hydraulic conductivity. Effective porosities for undisturbed clays are generally on the order of 30% (de Marsily, 1986).

In surface water, the water itself is the primary transport media, with soils providing base and side boundaries as well as organic and particulate matter to the water. Transport mechanisms are as described above i.e., partitioning between soil, water, and the contaminant(s) on a small scale and advective-dispersion movement on a large scale. As surface water does not move through soil or rock, transport can be relatively rapid, without the filtration or adsorption effects of soil in groundwater.

Transport via surface water is considered to be the primary pathway of concern at the OB grounds. Nonmobile contaminants associated with surface soils will be carried as sediment in surface water runoff. In addition, the more soluble contaminants may dissolve in the surface water and be carried to Reeder Creek. In order to estimate the magnitude of the transport via surface water runoff, two factors must be considered. First, it is necessary to estimate the mass of each contaminant that will be in the surface water runoff, either through entrainment of surface soils or through solubilization. The other item to estimate is the quantity of water which actually flows to Reeder Creek. As discussed in Section 5.1, most of the surface water collects in the numerous small wetlands throughout the site, and will only flow to Reeder Creek after overflowing the wetlands. These wetlands actually serve as sedimentation basins, collecting much of the sediment entrained in the runoff. This sedimentation helps minimize the flow of contaminants to Reeder Creek.

5.3.2 Surface Water

The first major transport mechanism evaluated in detail at the site is soil erosion in surface water runoff. Most of the contaminants of concern at the site, primarily explosives and metals, are present in insoluble forms, either as insoluble precipitates or adsorbed onto soil particles. The transport of these insoluble forms can be estimated by calculating the soil loss due to erosion and multiplying this value by the adsorbed concentration of each constituent. There are two steps to consider in evaluating this transport mechanism. First, the amount of each contaminant mobilized by soil erosion is estimated. Next, the amount of this eroded soil which reaches Reeder Creek, and is therefore subject to offsite migration, must be estimated. There are a number of low lying areas and freshwater wetlands located on the site which serve to hold up surface water runoff and act as sedimentation basins.

Contaminants may migrate in surface water in either dissolved or sorbed forms. In this analysis, metals which exist as insoluble forms are considered to be sorbed. Most of the contaminants of concern at the OB grounds, including metals, explosives, semivolatiles, and pesticides will be present almost exclusively in sorbed or insoluble forms. As shown in Table 5-2, the K_{oc} values for these contaminants are high, indicating that these chemicals are more likely to be adsorbed in the soil organic matter than dissolved in the soil water. During runoff events, these chemicals will remain adsorbed in the soil rather than dissolve in the runoff water. The amount of contaminant runoff can then be estimated by determining the quantity of soil which is eroded, and then determining the mass of each contaminant present in that quantity of soil.

The soil loss at the OB grounds was estimated using the Modified Universal Soil Loss Equation (EPA, 1988). Calculations are provided in Appendix J. This equation can be used to calculate soil loss for any individual storm event. All the storm events in a year are then summed to estimate the annual soil loss. The model assumes that a storm event must be larger than a site-specific threshold value in order for any runoff to occur. Therefore, the EPA (1988) recommends that each individual storm event be assumed to be a 1-year 24-hour storm event. At SEDA this is assumed to be a 2.25 inch rainfall event (USDC, 1961). This is a conservative assumption. For each storm event, assuming that the contaminated surface area of the site is 12 acres (40% of the site), the runoff of contaminated sediment was calculated to be 0.16 tons. Based upon an annual rainfall total of 34.3 inches, there are 15.2 runoff events per year, for a total loss of 2.43 tons per year of soil.

Data for Geneva and Ithaca, NY indicate that the actual mean storm event is approximately 0.43 inches, with a duration of 10.6 hours. There are 64 mean storm events per year. On average, there are only 4 to 5 days a year with greater than 1 inch of precipitation. Using the mean storm event to estimate runoff yields estimated soil loss of 0.002 tons per event, or 0.14 tons per year.

Next, a partioning model was used to estimate the sorbed and dissolved fraction of each organic contaminant. Metals were assumed to exist only in insoluble (sorbed) forms. For almost all of the contaminants, and for all the explosives and semivolatile organics, the sorbed fraction was greater than 90%, indicating that the assumption that the dissolved fraction was insignificant was valid. The mass of each sorbed contaminant which migrated during each storm event and during the entire year was estimated. These values are shown in Table 5-4 and 5-5. The concentrations used in the analysis were the 95% upper confidence limit of the arithmetic mean of the concentrations reported for the surface soil samples at the site. The statistical analysis of the data, whereby these numerical limits were determined, is described in Section 6.

TABLE 5 – 4

SUMMARY OF SURFACE WATER TRANSPORT CALCULATIONS FOR ORGANICS

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	NUMBER OF HITS	NUMBER OF SAMPLES	95 % CONFIDENCE LIMIT	AVERAGE	Koc (ml/g)	Kd	SORBED FRACTION	SORBED LOSS PER EVENT (g)	TOTAL LOSS PER YEAR (g)
Volatile Organics (μg/kg)									
Methylene Chloride	3	118	5.15	4.84	8.80E+00	8.80E−02	0.45	1.80E−03	0.027
Acetone	2	114	10.99	7.97	2.80E−01	2.80E−03	0.03	2.18E−04	0.003
1,2−Dichloroethene (total)	2	118	4.84	4.59	3.50E+01	3.50E−01	0.77	2.87E−03	0.044
Chloroform	13	119	5.18	4.88	4.70E+01	4.70E−01	0.82	3.27E−03	0.050
2−Butanone	4	118	6.16	6.05	9.40E−01	9.40E−03	0.08	3.87E−04	0.006
Trichloroethene	4	118	6.55	5.29	1.26E+02	1.26E+00	0.92	4.68E−03	0.071
Tetrachloroethene	8	118	4.88	4.60	3.64E+02	3.64E+00	0.97	3.67E−03	0.056
Toluene	5	118	4.84	4.59	3.00E+02	3.00E+00	0.97	3.61E−03	0.055
Chlorobenzene	2	118	4.87	4.63	3.33E+02	3.33E+00	0.97	3.65E−03	0.056
Xylene (total)	2	118	4.89	4.64	6.91E+02	6.91E+00	0.98	3.73E−03	0.057
Semivolatile Organics (μg/kg)									
Benzoic acid	1	46	1896.73	1812.18	2.48E+02	2.48E+00	0.96	1.41E+00	21.387
Naphthalene	11	105	280.65	262.54	1.30E+03	1.30E+01	0.99	2.15E−01	3.274
2−Methylnaphthalene	20	112	306.52	279.97	8.50E+03	8.50E+01	1.00	2.37E−01	3.600
2−Chloronaphthalene	2	103	285.78	270.56	4.16E+03	4.16E+01	1.00	2.21E−01	3.352
2,6−Dinitrotoluene	14	108	299.21	282.65	2.49E+02	2.49E+00	0.96	2.22E−01	3.374
Acenaphthene	5	105	284.22	268.72	4.60E+03	4.60E+01	1.00	2.19E−01	3.335
Dibenzofuran	2	104	286.62	271.23	4.16E+03	4.16E+01	1.00	2.21E−01	3.362
2,4−Dinitrotoluene	31	117	826.92	643.70	2.01E+02	2.01E+00	0.95	6.08E−01	9.235
Diethylphthalate	9	107	283.73	265.78	1.42E+02	1.42E+00	0.93	2.04E−01	3.104
Fluorene	4	106	286.74	271.37	7.30E+03	7.30E+01	1.00	2.22E−01	3.367
N−Nitrosodiphenylamine	17	112	326.25	299.25	6.50E+02	6.50E+00	0.98	2.48E−01	3.775
Hexachlorobenzene	4	105	287.08	270.94	3.90E+03	3.90E+01	1.00	2.22E−01	3.367
Phenanthrene	27	115	308.45	277.44	1.40E+04	1.40E+02	1.00	2.38E−01	3.625
Anthracene	6	106	289.60	271.92	2.60E+04	2.60E+02	1.00	2.24E−01	3.404
Di−n−butylphthalate	35	113	457.88	369.78	1.70E+05	1.70E+03	1.00	3.54E−01	5.384
Fluoranthene	18	113	354.96	302.67	3.80E+04	3.80E+02	1.00	2.75E−01	4.173
Pyrene	21	115	355.32	299.94	3.80E+04	3.80E+02	1.00	2.75E−01	4.177
Butylbenzylphthalate	3	104	284.28	268.83	2.84E+04	2.84E+02	1.00	2.20E−01	3.342
Benzo(a)anthracene	11	111	325.58	290.12	1.38E+06	1.38E+04	1.00	2.52E−01	3.829
Chrysene	11	113	342.36	303.45	2.00E+05	2.00E+03	1.00	2.65E−01	4.026
Bis(2−Ethylhexyl)phthalate	46	115	973.70	668.72	5.90E+03	5.90E+01	1.00	7.52E−01	11.430
Di−n−octylphthalate	2	103	285.17	270.53	2.40E+06	2.40E+04	1.00	2.21E−01	3.354
Benzo(b)fluoranthene	12	111	360.68	304.75	5.50E+05	5.50E+03	1.00	2.79E−01	4.241
Benzo(k)fluoranthene	9	111	336.12	295.62	5.50E+05	5.50E+03	1.00	2.60E−01	3.953
Benzo(a)pyrene	12	111	333.40	292.42	5.50E+06	5.50E+04	1.00	2.58E−01	3.921
Indeno(1,2,3−cd)pyrene	7	109	310.57	284.71	1.60E+06	1.60E+04	1.00	2.40E−01	3.652
Dibenz(a,h)anthracene	3	104	290.36	273.69	3.30E+06	3.30E+04	1.00	2.25E−01	3.415
Benzo(g,h,i)perylene	10	106	292.43	273.15	1.60E+06	1.60E+04	1.00	2.26E−01	3.439

TABLE 5 – 4

SUMMARY OF SURFACE WATER TRANSPORT CALCULATIONS FOR ORGANICS

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	NUMBER OF HITS	NUMBER OF SAMPLES	95 % CONFIDENCE LIMIT	AVERAGE	Koc (ml/g)	Kd	SORBED FRACTION	SORBED LOSS PER EVENT (g)	TOTAL LOSS PER YEAR (g)
Pesticides/PCBs (µg/kg)									
beta–BHC	1	111	5.34	4.69	3.80E+03	3.80E+01	1.00	4.12E–03	0.063
gamma–BHC (Lindane)	1	111	5.33	4.68	1.08E+03	1.08E+01	0.99	4.08E–03	0.062
Heptachlor	1	111	5.69	4.92	1.20E–04	1.20E–06	0.00	4.96E–08	0.000
Aldrin	7	111	5.42	4.77	9.60E+04	9.60E+02	1.00	4.19E–03	0.064
Endosulfan I	5	111	5.37	4.72	3.55E+03	3.55E+01	1.00	4.14E–03	0.063
4,4'–DDE	19	116	31.51	19.64	4.40E+06	4.40E+04	1.00	2.44E–02	0.371
Endrin	5	113	11.55	10.06	1.91E+04	1.91E+02	1.00	8.93E–03	0.136
Endosulfan II	6	114	22.04	15.00	4.17E+03	4.17E+01	1.00	1.70E–02	0.259
4,4'–DDD	9	111	10.70	9.39	2.40E+05	2.40E+03	1.00	8.27E–03	0.126
Endosulfan sulfate	5	111	10.72	9.41		0.00E+00			
4,4'–DDT	11	116	18.42	13.68	2.43E+05	2.43E+03	1.00	1.42E–02	0.217
Endrin aldehyde	1	37	3.69	2.88	NA				
alpha–Chlordane	7	112	49.53	41.59	1.40E+05	1.40E+03	1.00	3.83E–02	0.582
Aroclor–1254	1	111	110.80	96.80	4.25E+04	4.25E+02	1.00	8.57E–02	1.303
Aroclor–1260	1	111	106.64	93.43	1.30E+06	1.30E+04	1.00	8.25E–02	1.254
Explosives (µg/kg)									
HMX	3	117	286.63	249.49	5.08E+02	5.08E+00	0.98	2.17E–01	3.301
RDX	14	117	215.67	137.96	5.38E+02	5.38E+00	0.98	1.64E–01	2.487
1,3,5–Trinitrobenzene	20	117	103.80	89.21	5.20E+02	5.20E+00	0.98	7.87E–02	1.196
1,3–Dinitrobenzene	5	116	73.28	67.11	1.50E+02	1.50E+00	0.93	5.29E–02	0.805
Tetryl	8	117	159.71	140.09	NA				
2,4,6–Trinitrotoluene	13	117	206.95	134.29	5.34E+02	5.34E+00	0.98	1.57E–01	2.386
4–amino–2,6–Dinitrotoluene	20	117	359.58	225.40	NA				
2–amino–4,6–Dinitrotoluene	21	117	406.96	245.19	NA				
2,4–Dinitrotoluene	46	117	603.95	456.71	2.01E+02	2.01E+00	0.95	4.44E–01	6.745

Notes:
1) Koc = organic carbon partition coefficient
2) Kd = soil partition coefficient

TABLE 5 – 5

SUMMARY OF SURFACE WATER TRANSPORT CALCULATIONS FOR INORGANICS

SENECA ARMY DEPOT
OB GROUNDS

METALS (mg/kg)	NUMBER OF HITS	NUMBER OF SAMPLES	95 % CONFIDENCE LIMIT	AVERAGE	LOSS PER EVENT (g)	LOSS PER YEAR (g)
Barium	111	111	1315.53	978.70	190.8	2899.4
Copper	111	111	897.41	583.60	130.1	1977.9
Lead	115	115	959.95	709.99	139.2	2115.7
Zinc	117	117	1623.91	1623.91	235.5	3579.1

The results of the model indicate that there will be some migration of the sorbed constituents in runoff. For organics, the amount of the contaminants ranged from less than 1 to 21 grams per year, while the amount of metals migration was much greater. Up to 1.6 kilograms of lead and 3.9 kilograms of zinc may migrate each year. Part of the metals migration is due to the natural elemental makeup of the soils, but the rest is due to site activities. These contaminants then accumulate in the low areas on the site, as is evidenced for example by the high lead concentrations in the sediment samples collected in the low areas on the site, such as SW-191 (463 mg/kg), SW-192 (280 mg/kg), SW-180 (274 mg/kg), and SD-220 (1120 mg/kg). Levels of contaminants drop off significantly in the sediment samples collected in Reeder Creek immediately downstream from the site, as seen by the lead concentrations in SW-150 (24.6 and 49.9 mg/kg) and SW-140 (20.3 mg/kg). This supports the theory that the low areas and wetlands on the site serve as sedimentation basins which collect the contaminated sediment. In addition, no observed releases to Reeder Creek were documented during the RI.

These low lying areas and wetlands are a potential exposure point. Site workers wading in the wetlands, or animals who use the wetlands as a water or food source may be exposed to the chemicals of concern. The risks associated with these exposure pathways are discussed in Section 6.

Several of the major low areas on the site are shown in Figure 5-4. The total surface area of these wetlands is approximately 2 acres. Assuming an average depth throughout these areas of six inches, the total holding capacity of just these areas would be 1 acre-foot. This is the amount of water which would fall on the portion of the site which drains towards Reeder Creek (approximately 25 acres) in a 0.5-inch rainfall. This means that it would take runoff greater than 0.5 inches before significant quantities of water could leave the site. Allowing for infiltration and other losses of rainwater, this means that an inch or more of rainfall would be required to exceed the capacity of these on-site wetlands. This does not even account for the holding capacity of the wetlands. Generally, the storm events at the site are relatively small (the 1-year 24-hour rainfall is only 2.25 inches) and surface water runoff would be expected to occur primarily in conjunction with the spring thaw. The snowmelt is a slow process, and sediment transport would be expected to be minimal. As the climate data shows daily precipitation exceeds 1 inch only 4 to 5 times a year.

In addition, as shown in Table 5-1, monthly runoff totals at the site are usually less than 1 inch, except for March and April. This further supports the concept that surface water runoff is sufficient only to move the contaminants to the low lying areas on the site.

REV	DATE	DESCRIPTION
B	7/5/93	PRE-DRAFT PHASE II- RI/FS
A	1/12/92	ISSUED WITH PRELIMINARY SITE CHARACTERIZATION REPORT

DRAWN BY E. SCHACHT	CHECKED BY M.E.BAKER
DESIGN SUPV. G.A.KAEUN	RESP. ENGR. M.N.DUCHESNEAU
CHIEF DISC. ENGR. M.E.BAKER	MGR. OF ENGR. J.P.CHAPUCK
PROJECT MANAGER M.N.DUCHESNEAU	
MGR. OF PROJECTS J.P.CHAPUCK	
IN CHARGE W.D.PATTERSON	

DRAWN CHECKED DES.SUPV. RESP.ENGR. CH.DISC.ENG. PROJ. MGR.

ES

ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION/
FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 5-4
SURFACE WATER
COLLECTION AREAS

SCALE 1" = 250'

ES'S DWG. NO. 720446-01022-5-4
REV B

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5.3.3 Air

One of the pathways which must be evaluated in detail at the OB grounds is transport via the air pathway. There are two major mechanisms through which potentially hazardous constituents may be transported offsite via the air pathway. The first mechanism is volatilization, in which contaminants enter the air as vapors. However, as discussed previously, the primary contaminants of concern at this site, i.e., explosives and heavy metals, are not considered volatile. Therefore, this mechanism is considered insignificant at this site.

The second mechanism is fugitive dust emissions. Particulate matter which contains sorbed and complexed contaminants may be entrained and carried offsite as fugitive dust emissions. The protocol described in the *Superfund Exposure Assessment Manual* (EPA, 1988) was followed in order to evaluate the total emission rates for this transport mechanism. This method is further defined in Agricultural Handbook No. 346, *"Wind Erosion Forces in the United States and Their Use in Predicting Soil Loss,"* (USDA, 1968). This technique, which estimates annual losses of surface soil to wind erosion, was used to estimate the potential particulate emissions of hazardous constituents associated with the surface soils at the site. Fugitive dust emissions may also be generated by vehicular traffic or soil tilling. At the OB grounds their is little or no vehicular traffic or construction activity conducted on the areas of contamination. Therefore, these mechanisms were not evaluated.

Fugitive dust emissions are generated when soil particulates are entrained by the wind, and carried away from the site. Larger, heavier particles are deposited short distances from the source, while smaller particles may remain suspended for greater distances. The prevailing wind direction (based upon data for Rome, New York which is located near Syracuse) is easterly, and an east-west direction was chosen as the primary wind erosion direction in the estimation. The model indicated a potential soil loss of 1360 kg/year (1.5 tons/year). Of this soil, 50 percent was assumed to be respirable (PM_{10}). Of this fraction, 75 percent was assumed to derive from the contaminated areas on the site, for a total respirable quantity of 511 kg/year (0.56 tons/year) of contaminated surface soil. The amount of each specific contaminant was estimated by multiplying the mass of soil eroding from the site by the 95 percent upper confidence level of the arithmetic mean of the concentrations of the contaminants in the surface soils at the site. A full discussion of the statistical methods used is presented in Section 6. The estimated emission rates for the individual constituents are shown in Table 5-6.

TABLE 5 – 6

SUMMARY OF WIND EROSION CALCULATIONS

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	NUMBER OF HITS	NUMBER OF SAMPLES	95 % CONFIDENCE LIMIT	AVERAGE	POTENTIAL RELEASE (g/year)	POTENTIAL RECEPTOR CONCENTRATION ($\mu g/m^3$)
Volatile Organics ($\mu g/kg$)						
Methylene Chloride	3	118	5.15	4.84	0.003	8.82E–08
Acetone	2	114	10.99	7.97	0.006	1.88E–07
1,2–Dichloroethene (total)	2	118	4.84	4.59	0.002	8.28E–08
Chloroform	13	119	5.18	4.88	0.003	8.86E–08
2–Butanone	4	118	6.16	6.05	0.003	1.05E–07
Trichloroethene	4	118	6.55	5.29	0.003	1.12E–07
Tetrachloroethene	8	118	4.88	4.60	0.002	8.35E–08
Toluene	5	118	4.84	4.59	0.002	8.27E–08
Chlorobenzene	2	118	4.87	4.63	0.002	8.34E–08
Xylene (total)	2	118	4.89	4.64	0.002	8.37E–08
Semivolatile Organics ($\mu g/kg$)						
Benzoic acid	1	46	1896.73	1812.18	0.969	3.25E–05
Naphthalene	11	105	280.65	262.54	0.143	4.80E–06
2–Methylnaphthalene	20	112	306.52	279.97	0.157	5.24E–06
2–Chloronaphthalene	2	103	285.78	270.56	0.146	4.89E–06
2–Nitroaniline	1	111	1212.82	1102.23	0.620	2.07E–05
2,6–Dinitrotoluene	14	108	299.21	282.65	0.153	5.12E–06
Acenaphthene	5	105	284.22	268.72	0.145	4.86E–06
Dibenzofuran	2	104	286.62	271.23	0.146	4.90E–06
2,4–Dinitrotoluene	31	117	826.92	643.70	0.423	1.41E–05
Diethylphthalate	9	107	283.73	265.78	0.145	4.85E–06
Fluorene	4	106	286.74	271.37	0.147	4.91E–06
N–Nitrosodiphenylamine	17	112	326.25	299.25	0.167	5.58E–06
Hexachlorobenzene	4	105	287.08	270.94	0.147	4.91E–06
Phenanthrene	27	115	308.45	277.44	0.158	5.28E–06
Anthracene	6	106	289.60	271.92	0.148	4.95E–06
Di–n–butylphthalate	35	113	457.88	369.78	0.234	7.83E–06
Fluoranthene	18	113	354.96	302.67	0.181	6.07E–06
Pyrene	21	115	355.32	299.94	0.182	6.08E–06
Butylbenzylphthalate	3	104	284.28	268.83	0.145	4.86E–06
Benzo(a)anthracene	11	111	325.58	290.12	0.166	5.57E–06
Chrysene	11	113	342.36	303.45	0.175	5.86E–06
Bis(2–Ethylhexyl)phthalate	46	115	973.70	668.72	0.498	1.67E–05
Di–n–octylphthalate	2	103	285.17	270.53	0.146	4.88E–06
Benzo(b)fluoranthene	12	111	360.68	304.75	0.184	6.17E–06
Benzo(k)fluoranthene	9	111	336.12	295.62	0.172	5.75E–06
Benzo(a)pyrene	12	111	333.40	292.42	0.170	5.70E–06
Indeno(1,2,3–cd)pyrene	7	109	310.57	284.71	0.159	5.31E–06
Dibenz(a,h)anthracene	3	104	290.36	273.69	0.148	4.97E–06
Benzo(g,h,i)perylene	10	106	292.43	273.15	0.149	5.00E–06
Pesticides/PCBs ($\mu g/kg$)						
beta–BHC	1	111	5.34	4.69	0.003	9.13E–08
gamma–BHC (Lindane)	1	111	5.33	4.68	0.003	9.12E–08
Heptachlor	1	111	5.69	4.92	0.003	9.74E–08
Aldrin	7	111	5.42	4.77	0.003	9.27E–08
Endosulfan I	5	111	5.37	4.72	0.003	9.19E–08
4,4'–DDE	19	116	31.51	19.64	0.016	5.39E–07
Endrin	5	113	11.55	10.06	0.006	1.98E–07
Endosulfan II	6	114	22.04	15.00	0.011	3.77E–07
4,4'–DDD	9	111	10.70	9.39	0.005	1.83E–07
Endosulfan sulfate	5	111	10.72	9.41	0.005	1.83E–07
4,4'–DDT	11	116	18.42	13.68	0.009	3.15E–07
Endrin aldehyde	1	37	3.69	2.88	0.002	6.31E–08
alpha–Chlordane	7	112	49.53	41.59	0.025	8.47E–07
Aroclor–1254	1	111	110.80	96.80	0.057	1.90E–06
Aroclor–1260	1	111	106.64	93.43	0.054	1.82E–06

TABLE 5 – 6

SUMMARY OF WIND EROSION CALCULATIONS

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	NUMBER OF HITS	NUMBER OF SAMPLES	95 % CONFIDENCE LIMIT	AVERAGE	POTENTIAL RELEASE (g/year)	POTENTIAL RECEPTOR CONCENTRATION ($\mu g/m^3$)
Explosives ($\mu g/kg$)						
HMX	3	117	286.63	249.49	0.146	4.90E–06
RDX	14	117	215.67	137.96	0.110	3.69E–06
1,3,5–Trinitrobenzene	20	117	103.80	89.21	0.053	1.78E–06
1,3–Dinitrobenzene	5	116	73.28	67.11	0.037	1.25E–06
Tetryl	8	117	159.71	140.09	0.082	2.73E–06
2,4,6–Trinitrotoluene	13	117	206.95	134.29	0.106	3.54E–06
4–amino–2,6–Dinitrotoluene	20	117	359.58	225.40	0.184	6.15E–06
2–amino–4,6–Dinitrotoluene	21	117	406.96	245.19	0.208	6.96E–06
2,4–Dinitrotoluene	46	117	603.95	456.71	0.309	1.03E–05
Metals (mg/kg)						
Barium	111	111	1315.53	978.70	672.2	2.25E–02
Copper	111	111	897.41	583.60	458.6	1.54E–02
Lead	115	115	959.95	709.99	490.5	1.64E–02
Zinc	117	117	3407.75	1623.91	1741.4	5.83E–02

Next, the mass emission rates were converted to exposure concentrations. A Box Model (GRI, 1987) was used to estimate the exposure to an SEDA employee working on the site. Off site concentrations were not estimated since they would be much lower than on site exposures due to dispersion. The estimated exposure concentrations are also shown in Table 5-6. These values were then used as part of the baseline risk assessment (Section 6). A full discussion of the potential health risks associated with particulate air emissions is presented in Section 6.

As discussed in previous sections, several downwind soil samples were collected at this site. The primary purpose of this sampling was to evaluate the potential of contaminant migration due to wind dispersal of smoke and other particulates during open burning activities. This data can also be used to evaluate the wind erosion pathway. These samples showed little or no spread of contaminants off-site due to wind, further supporting the results of this model. The only sample which had significant contamination was DW-8, which was collected near Highway 96A. The contaminants detected at this sample location were primarily PAHs, which are indicative of fuel and oil contamination and may have been due to runoff from the highway. No explosives or other site-specific contamination was found.

In summary, this pathway does not appear to be a significant mechanism for the spread of site contaminants. The model indicates that little contamination will be spread via wind erosion. In addition, the results of the downwind soil sampling further support the premise that off-site contamination due to airborne dispension is not occurring at the OB grounds.

6.0 BASELINE RISK ASSESSMENT

6.1 INTRODUCTION

6.1.1 Overview

The primary mandate of the Superfund program is to protect both human health and the environment from current and potential threats posed by uncontrolled hazardous substance releases. As part of the RI/FS at the OB grounds, an evaluation of potential risks to human health and the environment is provided in this baseline risk assessment. The goal of this baseline risk assessment is to provide a framework for developing and presenting the necessary risk information to assist in remedial action decisions at the OB grounds. The OB grounds comprise a single operable unit and was evaluated as a single site.

The objectives of the baseline risk assessment are: to help determine whether additional response actions are necessary at the site; to provide a basis for determining residual chemical levels that are adequately protective of human health and the environment; to provide a basis for comparing potential health impacts of various remedial alternatives; and to help support selection of the "No Action" remedial alternative, where appropriate. To meet these objectives, the *Risk Assessment Guidance for Superfund Manual* (RAGS) Vol. 1, The Human Health Evaluation Manual (USEPA, 1989b) was followed. However, as stated in this guidance document, all site circumstances cannot be accounted for. Technical judgment, consultation with USEPA staff, and specific state of New York requirements were all considered and used in the development of the baseline risk assessment.

The baseline risk assessment is divided into two basic components: the human health evaluation and the ecological risk assessment evaluation. Separate risk calculations are presented for current on-site workers and current and future residential land-use scenarios. Included as appendices are the chemical toxcity profiles, and the risk assessment database.

6.1.2 Site Description

Seneca Army Depot is an active military facility constructed in 1941. The depot is located near Romulus, New York in the finger lakes region of central New York (Figure 1-1). The facility is located in an uplands area, at an elevation of approximately 600 feet Mean Sea Level (MSL), that forms a divide separating two of the New York Finger Lakes, Cayuga Lake on the east and Seneca Lake on the west. Sparsely populated farmland covers most of the surrounding area. New York State Highways 96 and 96A adjoin SEDA on the east and west boundaries, respectively. Since its inception in 1941 SEDA's primary mission has been the receipt, storage, maintenance, and supply of military items. This function includes the disposal of military ammunition and explosives by burning and detonation.

The OB area is situated on gently sloping terrain, vegetated with grasses and brush. Drainage is generally to the east-northeast via a series of drainage ditches and culverts into Reeder Creek. Shallow groundwater flow at the OB grounds site is also directed northeast into Reeder Creek which is in a sub-basin within the main Seneca Lake drainage basin. There are several poor drainage areas where water collects at certain times of the year. Low surface gradients of less than 40 feet in 2,500 feet, and a high fine content in the surface soils and underlying glacial till deposits contribute to poor drainage conditions.

6.1.3 General Site History

Open burning-open detonation operations have been conducted for more than forty years in the 90 acre munitions destruction area. The OB grounds occupy an area of approximately 30 acres within the southern portion of the munitions destruction area. Originally open burning was conducted directly upon the ground surface. Due to the seasonally wet nature of the local soils the individual burn pads were subsequently built up with shale to provide a drier environment in which to perform the munitions burning. The berms around the burn pads were formed by bulldozing of the surrounding soils, including those soils containing residues of the burning process. The burning of munitions was performed at the nine burning pads labeled A through G and J beginning in the early 1960s (USATHAMA, 1980). During this time, items burned possibly included explosive trash from an old washout plant, fuses containing lead compounds, and projectiles containing TNT.

The burning process was performed by preparing combustible beds of pallets and wooden boxes on the pads and placing the ammunition or components to be destroyed on the beds. A trail of propellant approximately 5 feet long, 6 inches wide and 3 inches deep was placed on the ground leading to the combustible bed. Electric squib was placed in the propellant trail and connected to firing wires. The operator fired the circuits from an office (USAEHA, July 1987). Also, according to this report, Pads G and J were only used for trash and rubbish, while Pads A, B, C, D, E, F, and H were used for projectiles, explosives and propellants. Pads A and J were the first to be abandoned for open burning. The practice of open burning on all pads was discontinued in 1987. At present, the burning of munitions is done within an open air, steel enclosure located immediately west of Pad D.

An elongated, low hill is located in the southern portion of the open burning area. The low hill is mostly covered by brush and trees and forms a pseudo barrier in this portion of the site. According to SEDA personnel, the hill was formed during clearing activities early in the history of the open burning area. The clearing of surface vegetation and some soil was performed as a routine safety measure to prevent high grass from causing a potential fire hazard in the burn pad areas.

A burn kettle is located between Pads C and J. The burn kettle is a small rectangular-shaped furnace formerly used to burn small caliber arms.

6.1.4 Local Area Well Survey

Three geologic units near SEDA have been used to produce water for both domestic and agricultural purposes. These units include: 1) a bedrock aquifer, which in this area is predominantly shale; 2) an overburden aquifer, which includes Pleistocene deposits (glacial till); and 3) a deep aquifer present within beds of limestone interlying the underlying shale. The occurrence of water derived from limestone is considered to be unusual for this area and is more commonplace to the north.

The groundwater in the county is very hard, and therefore, the quality is minimally acceptable for use as potable water. Figure 1-8 shows the distribution of known private wells near the northwestern perimeter of SEDA based on information obtained from the Town of Romulus. Eleven private homes with private drinking water wells were identified within a one-mile radius of the OB grounds. The wells are located west and north of the site. The nearest location with a well is a house located approximately 2,400 feet west of the OB grounds on Route 96A. Other off-site wells are located along 96A and McGrane Road.

6.1.5 General Sampling Locations and Media

During the RI and previous investigations samples of soil, sediment, surface water, and groundwater have been collected. Subsurface soil samples from soil borings were collected from pad borings located on each burn pad, and from borings established in a grid located outside each pad. Other soil samples were collected from the berms around each pad, the low hill, and from low lying areas on the site. Groundwater was sampled from 35 existing or newly installed wells located on and around the site. Surface water and sediment were collected from low lying areas on the site and from Reeder Creek. Detailed sampling discussions are included in Sections 3 and 4 of this report.

Following the collection, validation and screening of this database, a subset of this collected data was utilized to establish the Exposure Point Concentrations (EPC)s used in the human health risk assessment. The selection of the data used as the EPC was based upon consideration of the sample media and the location and the depth of the sample, which was consistent with the identified exposure scenarios.

EPCs for the following exposure scenarios were considered for this risk assessment:

1. Dermal contact to surface water and sediments while swimming in Reeder Creek (Current and Future Land Use Scenarios)
2. Ingestion of and dermal contact with groundwater (Future Land Use Scenarios)
3. Inhalation of fugitive dust (Current and Future Land Use Scenarios)
4. Incidental ingestion and dermal contact to on-site soils (Current and Future Land Use Scenarios)
5. Dermal contact to surface water and sediment while while wading in on-site wetlands (Current and Future Land Use Scenarios).
6. Ingestion of surface water and sediment while swimming in Reeder Creek (Current and Future Land use Scenarios).

All on-site and off-site surface water and sediment data collected from the on-site wetlands and Reeder Creek were used to estimate the EPC for both the current and future land scenarios. The on-site groundwater data was used to estimate the EPC for the future residential exposure scenario. Ingestion of on-site groundwater is not a current exposure pathway. The same groundwater database was used to estimate the future EPCs for the exposure due to dermal contact while showering/bathing. On-site surface soil samples from the 0- to 2- foot range were used in estimating the EPC due to on-site dermal exposure and soil ingestion. During Phase I, surficial soil samples were collected from the 0-2 foot depth. This was refined to the 0-0.5 foot depth during Phase II. Both data sets were combined for estimating dermal exposure.

6.1.6 Methodology and Organization of Document

The methodology employed for this baseline risk assessment follows USEPA guidance. The relationships of the major steps involved are presented in flowchart form in Figure 6-1. This section contains seven major subsections, as follows:

1. Identification of Chemicals of Concern (Section 6.2)

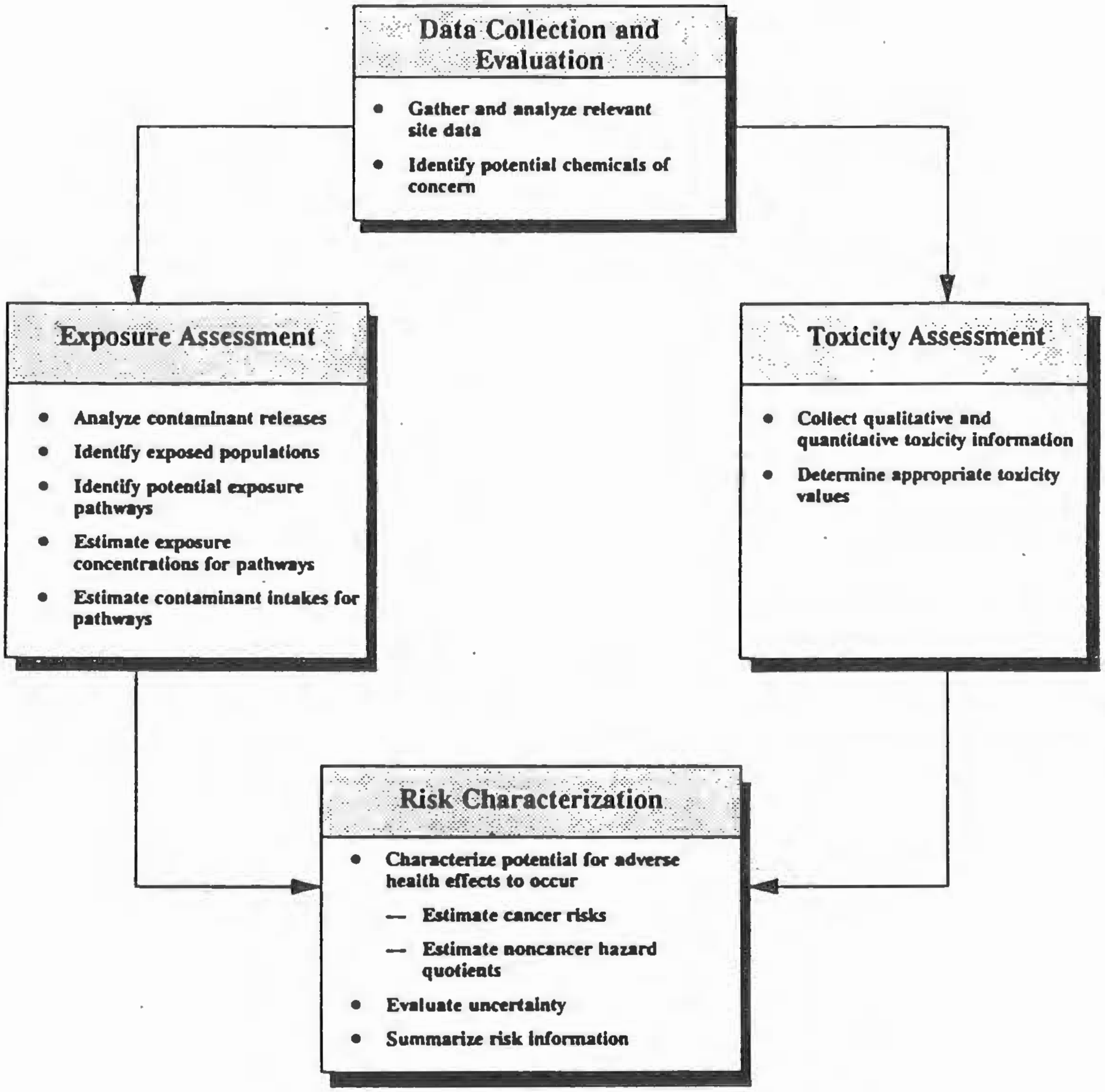
This section provides site-related data including both on- and off-site source related chemical data, along with background chemical data. Detailed summaries and statistical analyses of these data are provided in this section. All validated datapoints in the applicable environmental media were evaluated in the risk assessment. The relevant exposure pathway risks were calculated for each detected chemical. Also included in the Data Evaluation section is an evaluation of site background data. Relevant background data are presented and, where appropriate, statistical analyses were performed to allow for comparing on-site chemical concentrations with available background data.

2. Exposure Assessment (Section 6.3)

This section includes derivation and presentation of the applicable exposure point concentrations and resulting chemical intakes used in the human health risk assessment.

Exposure point concentrations for the baseline risk assessment are based on analytical data and modeling results. Exposure point concentrations and chemical intakes are provided for both current and future land-use scenarios, and correspond to the applicable exposure pathways for the baseline risk assessment.

For the current land-use scenario, the exposed population or receptors considered are SEDA personnel and nearby residents. The calculated risk values for the current land-use scenario do not apply to a specific individual, but rather represent risk to a reasonable maximum exposed (RME) individual based on Superfund guidance. These risk values are dictated by the environmental sampling data collected from the various sampling locations. For the



Source:EPA, 1989a

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 6-1

BASELINE RISK ASSESSMENT PROCESS

SCALE

future land-use scenario, on-site residents are the relevant exposed population. In this scenario, the calculated risk values apply to a hypothetical RME individual living adjacent to the site, and the risk values are dictated by the collected environmental sampling data used in the risk assessment. In both land-use scenarios, children (ages 1 to 6) and adults (ages 7 to 30) are considered, and a 30-year residential exposure duration is used.

The three primary exposure routes are ingestion, inhalation, and dermal and are all considered in the baseline risk assessment. Chemical intake values for both current and future land use scenarios are calculated based on exposure pathways, site specific exposure concentrations, and standard EPA defined default exposure assumptions. Equations used to calculate intakes for all applicable exposure pathways are presented in this section.

3. Toxicity Assessment (Section 6.4)

This section presents oral, inhalation, and dermal toxicity values used in the human health risk calculations. Appropriate data sources and, when necessary, calculation rationale are provided to support the toxicity values.

4. Risk Characterization (Section 6.5)

This section presents the risk calculations for all human health exposure pathways for current and future land use. This includes a summary table by pathway for non-carcinogenic and carcinogenic risk values. Total hazards and risks are also presented by environmental medium and by individual chemical.

5. Ecological Risk Assessment (Section 6.6)

This section provides an identification and characterization of potential risks posed to environmental receptors. Included is an assessment of the ecological communities and dominant flora and fauna in the vicinity of the OB grounds, and an identification of potential pathways for receptor exposure.

6. Uncertainty (Section 6.7)

This section discusses the potential uncertainties of the methodology, assumptions, judgments, and data used in the risk assessment.

7. Summary (Section 6.8)

In this, the final section, all conclusions and results are summarized for the human health and ecological risk assessments.

6.2 IDENTIFICATION OF CHEMICALS OF CONCERN

The usability of site-related chemical data is a critical factor in assessing the human health effects of chemical contamination. The usability of these data depends on their availability, defensibility, and quality. Data availability depends on sampling history, while data defensibility depends on documentation, analytical methods, detection and reporting limits, and data validation. Data quality is measured via precision, accuracy, representativeness, completeness, and comparability.

Site-related chemical data must be managed and manipulated in order to determine representative concentrations of contaminants. Elements of data manipulation include combining multiple analyses of individual samples, incorporating the results from the analyses of blind field duplicates, and addressing non-detected analytes in computing pertinent statistics. This section discusses these issues along with summarizing detected chemicals in environmental media and background.

Data collected during the RI were evaluated for suitability of use in the risk assessment as discussed in RAGS (EPA, 1989b). These decisions were based on analytical methods, quantitation limits, qualifiers, and blank contamination. The suitable RI data were then evaluated to determine chemicals of potential concern, for which an exposure assessment, a toxicity assessment, and a risk characterization were performed.

6.2.1 General Site-specific Data Collection Considerations

6.2.1.1 Detailed Historical Information Relevant to Data Collection

A substantial volume of data is available for the OB grounds. Soil, groundwater, surface water, and sediment have been previously sampled under various investigative programs. Information is available on all of the affected media. The historical information was used to plan the RI, but this risk assessment uses only data collected during this RI.

A number of reports contain historical data on the OB grounds. These are described in Section 1,.and include:

1. Installation Assessment of Seneca Army Depot, Report No. 157, AMXTH-IR-A-157, January 1980; Conducted by USATHAMA.
2. Phase 2, Hazardous Waste Management Special Study: No. 39-26-0147-83, US Army Material Development and Readiness Command (DARCOM) Open-Burning/Open Detonation Grounds Evaluation, 1983.
3. O'Brien and Gere Engineers, Burning Pads B and H Closure, 1985.
4. Phase 4 Evaluation of the Opening Burning/Open Detonation Grounds. Investigation of Soil Contamination, 1984; Conducted by the USAEHA.
5. Closure of Open-Burning/Open Detonation Ground Burning Pads Seneca Army Depot, Hazardous Waste Study No. 37-26-0778-86, 1986; conducted by USAEHA.
6. Evaluation of Solid Waste Management Units, Seneca Army Depot, Interim Final Report, Groundwater Contamination Survey No. 38-26-0868-88, 1988; Conducted by USAEHA.
7. Update of the Initial Installation Assessment of Seneca Army Depot prepared for SEDA and USATHAMA August 1988; prepared by Environmental Science and Engineering, Inc.

8. Metcalf & Eddy, Criteria Development Report for Closure of Nine Burning Pads, 1989.

6.2.1.2 Background Sampling

A total of 15 background soil samples were compiled for this RI. Only inorganic constituents have been evaluated. Anthropogenic organic constituents have not been considered. This has produced a more conservative risk assessment since all organic constituents have been assumed to be present due to previous site activities. The results are discussed in Section 3.5 and have been presented for review in Table 3-3. Soil samples from the OB grounds and the Ash Landfill site, located approximately 3 miles north of the OB grounds, have been combined into the background database. This was done so that the statistical evaluation of the data would be representative of the variations in the site soil. Geologically, the material is identical, having been deposited from the same source. This fact justifies combining the background soil chemical composition data from these two sites into one larger database.

However, the background quality of groundwater is site specific since numerous factors affect the chemical equilibrium of inorganic components between the aqueous phase and the solid phase. Therefore, groundwater background quality has been determined on a site specific basis. Two overburden (MW-5 and MW-34) and three weathered bedrock (MW-21, MW-35 and MW-36) monitoring wells, each upgradient of the OB grounds were installed to determine the background water quality. Only the Phase 2 data has been included in the background database because the Phase 1 data was collected as filtered samples. Unfiltered Phase 1 samples were also collected but contained suspended sediment, as evidence by the high turbidity of the samples. As would be expected, the filtered samples contained low concentrations of inorganics and the unfiltered samples contained high concentrations of inorganics. Both situations are not likely representative of the in-situ, equilibrium condition of the groundwater system. Following Phase 1, a revised sampling protocol was instituted that provided low turbidity samples without filtering. This protocol allows collection of groundwater samples that represent the equilibrium condition between the aqueous phase and the solid phase. Therefore, only the Phase 2 samples have been considered for this analysis. The locations of these wells is shown on Figure 3-12.

6.2.1.3 Sampling Locations and Media

Four media were sampled during the OB RI, soil, groundwater, surface water, and sediment. A total of 29 sediment samples and 28 surface water samples were analyzed. When possible, grab surface water and sediment samples were collected from the same locations. The majority of these samples were taken from Reeder Creek, nearby drainage channels, low lying areas, and wetlands. These sampling locations are shown on Figure 2-4 in Section 2.

As part of the OB RI 22 monitoring wells; ten overburden and 12 weathered bedrock, were installed in addition to the 14 existing wells at the OB grounds.

Figure 2-8 in Section 2 shows the locations of the new and existing wells.

The soil sampling program consisted of soil sample collection from several types of borings or excavations. These included:

- 28 pad borings,
- 63 berm excavations,
- 34 grid borings,
- 43 low hill excavations,
- 11 downwind surficial soil samples,
- 5 burn kettle surficial soils, and
- 3 geophysical anomaly excavations.

Figures 2-5 through 2-7 in Section 2 show the locations of the soil samples.

6.2.1.4 Sampling Methods

Detailed sampling methods are described in Section 2 , however a brief description of the sampling of the four media, surface water, sediment, soil, and groundwater, is provided below.

Surface water samples were collected as grab samples by directly filling unpreserved sample bottles, or using clean sample bottles to collect water which was then poured into preserved sample bottles. Samples were taken at mid-channel and mid-depth in Reeder Creek.

Sediment samples were also grab samples. An appropriate sample container was used to scrape up sediments in the on-site surface water and Reeder Creek.

Low hill excavations, berm excavations, and geophysical anomaly excavations were all grab samples. A backhoe was used to perform the excavations and the samples were collected from mid-depth. The excavated material was placed adjacent to the excavated area and returned to the excavation following the sampling. All soil samples were inspected by UXO personnel for the presence of UXO components prior to handling of shipment to an off-site lab.

Burn kettle soils and downwind soils were surface soil samples, as were the first samples collected from the pad and grid borings. These samples were collected from 0 to 6 inches with the aid of a stainless steel trowel or scoop. Using stainless steel sampling equipment, enough solid material was removed from a specified depth to fill the required containers and placed in a decontaminated stainless steel bowl. Samples for VOC analysis were placed in vials, and the remainder of the sample was homogenized by mixing thoroughly. The subsurface samples collected from the pad and grid borings were collected using a standard two-inch diameter, two-foot long carbon steel split spoon barrel. Split spoon samples were collected continuously for the length of the boring.

For Phase I groundwater sampling, the wells were purged of at least three well volumes using a decontaminated Teflon bailer until indicator parameters (pH, temperature and specific conductance) were observed to vary by less than 10 percent and the turbidity was less than 50 NTUs. While stabilization of indicator parameters was achieved, water samples with turbidities less than 50 NTUs were rarely obtained. If during the purging process the well went to near dryness, purging was stopped and the well was allowed to recover to 80 percent of the original water column before additional water was removed. If the well went to near dryness again, purging was stopped. Sampling occurred within three hours of purging for high yield wells. For low yield wells groundwater was removed from the well as permitted to fill the appropriate sample containers. Samples were collected using a decontaminated Teflon bailer. The samples were collected in the following order: volatiles, semivolatiles, pesticides and PCBs, explosives, metals and cyanide. In Phase I, if the turbidity for a well was greater than 50 NTUs, both total and dissolved (filtered) metals were collected.

The groundwater sampling procedure changed significantly from Phase I to Phase II due to the high turbidity of the Phase I groundwater samples. Phase II data consists only of unfiltered samples collected according to the new procedure. The revised procedure included three steps: 1) removal of silt at the bottom of the well, 2) purging the water standing in the well until the turbidity was less than 50 NTU, and 3) sampling the water. At least three well volumes were removed from the well. Additional volumes were removed until the pH, temperature, and specific conductance were observed to vary less than 10 percent and the turbidity was less than 50 NTUs. Groundwater was sampled for VOCs with a Teflon bailer or peristaltic pump with Teflon tubing for non-volatile organics and metals.

6.2.1.5 QA/QC Methods

QA/QC samples were analyzed for the purpose of assessing the quality of the sampling effort and the analytical data. The QA/QC samples included splits, replicates, field equipment blanks, trip blanks, and matrix spike/matrix spike duplicates.

Split samples were analyzed by an EPA contract laboratory and the Corps of Engineers Missouri River Division (MRD) to assess the quality of the analytical data. One replicate sample was collected per batch of 20 or fewer samples per matrix. A field equipment blank was collected at a rate of one in twenty (5 percent) for each matrix sampled. They were collected to detect possible sources of cross-contamination introduced from field sampling equipment or from carry over from one sample to the next. One field trip blank was collected per day of water sampling and analyzed for VOCs. The purpose of trip blanks is to determine if samples are being contaminated during transit or sample collection. The use of matrix spikes gives insight to the analytical extinction proficiency and efficiency of the analytical methods. For each matrix spike/matrix spike duplicate pair, triple the sample volume was collected. This was used to fill all the appropriate bottles for the sample, the matrix spike sample and the matrix spike duplicate sample.

6.2.1.6 Special Analytical Services (SAS)

NYSDEC CLP methods were used for the analysis of organic and inorganic constituents in soil, sediment, groundwater, and surface water. Special analytical services included the use of EPA Method 8330 for the analysis of explosives in soil and water using a High Performance Liquid Chromatography (HPLC) system.

6.2.1.7 Modelling Parameter Needs

A model was used to estimate the concentration of contaminants in fugitive dust in the air. A full discussion of the model and data used is presented in Section 5.3.3. The protocol used to model this phenomenon was obtained from the *Superfund Exposure Assessment Manual* (EPA, 1988).

6.2.2 Data Useability

The data usability criteria of documentation, analytical methods, data validation, precision, accuracy, representativeness, comparability, and completeness are discussed in this section. The data was sorted by medium: soil, surface water, sediment, and groundwater. The RI data was collected over two time periods, Phase I and Phase II as described in Section 2. Phase I began in September 1991, and ended in January 1992. Phase II began in November 1992 and ended in January 1993.

6.2.2.1 Documentation

Documentation of sample collection and laboratory analysis is essential in order to authenticate conclusions derived from data. Standard operating procedures (SOPs) for field collection of samples are in Appendix A of the project workplan and were followed during sample collection. Engineering-Science maintained formal chain-of-custody records that included sample IDs, date sampled, sample collector, analyses and methods required, matrix, preservation per analysis, and comments.

Laboratory SOPs were used for all analyses required. Deviations from these SOPs were documented in case narratives per sample delivery group (SDG). Deviations from these SOPs were minor and did not adversely affect data quality.

6.2.2.2 Evaluation of Analytical Methods

Since the RI/FS ultimately requires decisions regarding future site remedial actions the data collected must be of sufficient quality to support this decision making process. All data used in the risk assessment represents EPA Level IV CLP data. Although Level II laboratory screening data and Level I field screening data were collected as part of the RI, neither of these were used in the quantitative risk assessment.

The data was validated in compliance with EPA Region II validation guidelines. The following parameters and the results of the QA/QC samples were considered and used to validate the data: data completeness, holding times, GC/MS tuning, calibration, blanks, surrogate recoveries, matrix spike/matrix spike duplicates recoveries, field duplicates, internal standard performance, pesticide instrument performance, compound identification, compound quantitation, spike sample recovery for metals, laboratory duplicates for metals, interference for metals, and qualifiers.

6.2.2.3 Evaluation of Quantitation Limits and Data Reduction

Five points were considered when evaluating methods and reducing data based on sample quantitation limits (SQLs), as described below:

1. sample quantitation limits and their relation to ARARs,
2. unusually high SQLs,
3. when only some samples in a medium test positive for a chemical,
4. when SQLs are not available, and
5. when chemicals are not detected in any sample in a medium.

Volatile organic analyses of groundwater were compared to the NYS drinking water and groundwater standards. SQLs for the NYSDEC CLP volatile organics are not sufficiently low enough to show compliance with these standards and therefore whenever the Phase I VOC result for a particular well was a non-detect, the Phase II sample collected from the same well was analyzed according to EPA Method 524.2 with a Level IV data package. EPA Method 524.2 provided the lower sample quantitation limits necessary to show ARAR compliance.

The data for each medium were evaluated to determine if any unusually high SQLs were present. To do this, the mean and standard deviation in each of the four media were calculated. For the purposes of determining if any SQL were unusually high and should be eliminated, all data was assumed to be normally distributed. Unusually high SQLs occur because samples are occasionally diluted in orderd to quantify one or two analytes present at high concentrations. The SQL for each analyte not detected is also increased by the dilution factor which can be a factor of 10 or 100. If a non-detected analyte is then considered in the risk assessment at one-half the SQL, the previously non-detected value is now considered real and can be substantial depending upon the dilution factor. Unless this situation is corrected, the risk that would be calculated will not be representative of the true conditions of the site.

Next, the 95th upper confidence limit of the mean (95th UCL) was calculated as follows (USEPA, 1992):

$$95th\ UCL = \bar{x} + t\frac{s}{\sqrt{n-1}}$$

$\bar{x}$ = the mean concentration
s = the standard deviation of the sample results
n = the number of samples
t = the t-statistic for a one-tailed t-test at the 95th confidence interval

The 95th UCL is the value for which there is 95 percent confidence that the site mean will not exceed this value. If any unusually high SQLs caused this value to exceed the actual maximum detected value these, high SQLs were eliminated. The 95th UCL was then recalculated and the comparison repeated until no SQLs caused the 95th UCL to exceed the maximum detected value. According to RAGS (Section 5.3.2), unusually high SQLs that would "cause the calculated exposure concentration to exceed the maximum detected concentration should be eliminated" (EPA, 1989b).

Sometimes only some samples in a medium tested positively for a chemical. In the other samples the chemical was not measured above the quantitation limit. The chemical could of course be present just below the quantitation limit or it may not be there at all. To account for this possibility, non-detected results were included in the risk assessment at one-half the SQL.

SQLs were provided by the laboratory for every compound that was not detected so no adjustment had to be made for non-detects without SQLs.

If for a given compound in a medium, the validated results were either all non-detects or rejected datapoints (qualifier = U, UJ, UR, or R) that chemical was eliminated from the risk assessment for that particular medium because no data would exist for an evaluation of risk.

6.2.2.4 Evaluation of Qualified and Coded Data

Qualifiers are attached to certain data by laboratories conducting analyses and by data validation personnel. These qualifiers often pertain to QA/QC problems and may indicate questions concerning chemical identity, chemical concentration, or both. The qualifiers used are as follows:

U	The analyte was not detected.
UJ	The analyte was not detected; however, the associated reporting limit is approximate.
J	The analyte was positively identified; however, QC results indicate that the reported concentration may not be accurate and is therefore an estimate.
R	The analyte was rejected due to laboratory QC deficiencies, sample preservation problems, or holding time exceedance. The presence or absence of the analyte cannot be determined.

Before data can be used in the quantitative risk assessment, all qualifiers must be addressed. This was done according to the prescribed data validation procedures. The end result of the data validation was four possible situations: 1) the data was rejected by either laboratory or data validation personnel and considered unusable (R), 2) the compound was analyzed for but was not detected (U), 3) the data was an estimated value (J), or 4) the data was unqualified and acceptable. Data that was not detected by the laboratory (U) and was assigned a J by the data validator, was considered to be a non-detect for the risk assessment (UJ).

6.2.2.5 Chemicals in Blanks

Blanks are QC samples analyzed in the same manner as environmental samples, and provided a means of identifying possible contamination of environmental samples. Sources of contamination include the laboratory, the sampling environment, and the sampling equipment. To address contamination, three types of blanks were analyzed: method blanks, trip blanks, and equipment rinseates.

Method blanks consisted of laboratory reagent water or pre-purified and extracted sand taken through the same analytical process as environmental samples. Trip blanks, which were prepared in the field, consisted of distilled water poured into a 40-milliliter glass vial and sealed with a Teflon septum. The trip blanks accompanied sample bottles to the field during sample collection. Trip blanks were not opened during sample collection. Equipment rinseates consisted of deionized water poured into or pumped through sampling devices and then transferred to sample bottles.

According to the data validation guidelines, if the blank contained detectable levels of a common laboratory contaminant, then the sample results are considered positive results (unqualified hit) only if the concentration in the sample exceeds ten times the maximum amount detected in any blank. If the concentration in the sample is less than ten times the maximum amount detected in the blank, it is concluded that the chemical was not detected. Common laboratory contaminants are acetone, 2-butanone, methylene chloride, toluene, and phthalate esters. If the blank contains detectable levels of a chemical that is not a common laboratory contaminant, then the sample results are considered positive results (unqualified hit) only if the concentration in the sample exceeds five times the maximum amount detected in any blank. If the concentration in the sample is less than five times the maximum amount detected in the blank, it is concluded that the chemical was not detected. This procedure was performed as part of the data validation.

6.2.2.6 Precision

The term precision is used to describe the reproducibility of results. It can be defined as the agreement between the numerical values of two or more measurements resulting from the same process. In the case of chemical analyses, precision is determined through the analyses of duplicate environmental samples. Duplicate sample analyses include matrix spikes, matrix spike duplicates, blank spikes, blind field duplicates, and replicate instrumental analyses of individual environmental samples.

Matrix spikes involve the introduction of, method prescribed, compounds or elements to samples of known concentrations. The assumption is that these introduced compounds will be recovered from environmental samples to the same degree as the unspiked sample. Blank spikes involve the introduction of compounds or elements to laboratory reagent water or pre-purified and extracted sand. Blank spikes eliminate the possibility of matrix interferences or contributions, thereby monitoring analytical performance from sample preparation to analysis. Blind field duplicates are samples labeled with a fictitious sample ID taken from an existing sampling location. They are collected simultaneously with a properly labeled sample and provide the most legitimate means of assessing precision.

Precision estimates were obtained using the relative percent difference (RPD) between duplicate analyses. Overall precision, as well as precision control limits, were estimated using a weighted combination of RPDs from spikes and duplicate analyses. Overall, the project precision and RPD results were acceptable. Unacceptable precision results have been considered and the data qualified during the data validation process.

6.2.2.7 Accuracy

Accuracy is the degree to which a measurement represents the true value of that parameter. Estimates of accuracy are more difficult to obtain than precision since accuracy requires knowledge of the quantity desired. In the case of chemical analyses, accuracy is determined through the introduction of compounds or elements to samples of known concentrations, or analytical spikes. The assumption is that compounds introduced to the environmental samples will be recovered from the environmental samples to the same degree as the unspiked samples.

Two types of compounds were added to environmental samples for assessing accuracy: surrogate compounds and matrix spike compounds. Surrogates are compounds that closely approximate target analytes in structure, but are not target analytes. They are typically radio labeled compounds or chemicals that are of the same class of compounds but not normally found in environmental samples. Surrogate compounds generally are added to samples in the preparation stages and monitor the effectiveness of the preparation process. Matrix spike compounds are actual target analytes that are added based upon expectations of matrix interferences, which may impede analyte detection. Laboratory method blank samples were spiked with surrogate compounds, per analysis day, as an additional means of estimating accuracy.

The accuracy of chemical analyses was estimated using the percent recovery (PR) of compounds or elements that were added to analytical spikes. Accuracy and PR were considered acceptable. Unacceptable results have been considered and the data was qualified based upon these results during the data validation process.

6.2.2.8 Representativeness

Representativeness expresses the extent to which sample data characterize the population or environmental media. Factors influencing representativeness include sample collection, selection of sampling locations representative of site conditions, and use of appropriate chemical methods for sample analyses. Chemical methods are addressed in Section 6.2.2.2. Sampling from locations representative of site conditions was achieved through implementation of the approved field sampling plan.

Blind field duplicates were collected and analyzed in order to assess the influence of sample collection on representativeness. Approximately 10 percent of field samples were collected in duplicate. Representativeness was estimated using the RPD between blind field duplicates, and was acceptable.

6.2.2.9 Comparability

Comparability is a data characteristic that measures the ability to compare data from a laboratory with data from others. Comparability factors include the use of standard analytical methodologies, data reported in standard or consistent units, appropriate frequency of applicable QC analyses, and laboratory participation in appropriate performance evaluation studies. All data were reported in appropriate and acceptable units. The laboratory performing the CLP inorganic and organic analyses participated in the quarterly USEPA blind performance evaluation program and the U.S. Army Missouri River Division (MRD) performance evaluation program. Their performance in these program was deemed to be acceptable. Split samples were collected and analyzed using identical methods with the USEPA and MRD. The results from these split samples were considered acceptable.

6.2.2.10 Completeness

Completeness measures the amount of usable data relative to the amount of samples collected and analyzed. The completeness goal in the project workplan was 90 percent. Completeness was acceptable.

6.2.2.11 Tentatively Identified Compounds (TICs)

TICs were grouped into two major classes: identified compounds and unknown compounds. The following sections contain the classes as well as the criteria used in classifying TICs.

Identified Compounds

Chromatographic peaks identified by the mass spectrograph as a known compound in the spectrographic computer libray were categorized. The classification was performed to give a general overview of the types of compounds present. Each uniquely identified compound was categorized into a more general class of chemical compounds. The classes were developed based on chemical structure, aromaticity, and functional groupings. The classes have inherent differences in the way representative compounds interact and affect the environment.

Unknown Compounds

Chromatographic peaks that failed absolute identification through mass spectral library searches also were categorized into general classes such as alkanes. Reasons for performing this classification were to provide an indication of the types of other chemical compounds present. Chemical classes such as alkanes or hydrocarbons imply that oils or other petroleum product may be present. This information is useful in understanding the conditions at the site which may not be accounted for with the analytical methodologies utilized.

Since only a few TICs were present compared to the TAL and TCL chemicals and there is no historical evidence that a particular TIC may be present at the site, they are not included in the risk assessment but are listed in the Appendix.

6.2.3 Site-specific Data Evaluation Considerations

The first step in evaluating the data from the OB grounds RI consisted of the creation of four separate databases, one for each media sampled; soil, groundwater, surface water, and sediments. Data for each of the four media was evaluated for use in the risk assessment separately.

The data used in the quantitative risk assessment was validated as described previously in Section 6.2.2.4. The initial reduction in the list of analytes consisted of eliminating the compounds in a medium that were not detected in any sample in that medium. This procedure is consistent with the RAGS that states "generally eliminate those chemicals that have not been detected in any samples of a particular medium" (EPA, 1989b). Table 6-1 lists the chemicals that were analyzed for but not detected in any sample and were eliminated from further consideration in the risk analysis. A compound was determined to be non-detected if the data qualifier was a U or a UJ. Data qualified with an R were eliminated from the database and were not considered in this evaluation.

An intermediate step, consistent with the requirements of the RAGS, did not eliminate a particular analyte from the database but did reduce the number of data points was also performed. As a result of the need to dilute a sample in order to detect the presence of a particular compound, the detection limit of all other analytes, that were not detected, were increased by the dilution factor. This is an unavoidable artifact of the analytical protocols. If this was not corrected then the result would have "caused the calculated exposure concentration to exceed the maximum detected concentration" (EPA, 1989b). This procedure is discussed in Section 6.2.2.3and was used to eliminate samples that had quantitation limits that were unusually high.

Since computer spreadsheets used to compute the risk, can only consider numerical values, all the qualifiers were then eliminated from the database. Any result with either no qualifier or a J qualifier was considered at full numerical value. Any non-detect (U or UJ qualifier) was taken at half of the detection limit. The resulting database contained only numerical values. The average, standard deviation, and coefficient of variance (CV) was calculated for each analyte in each of the four media. The CV is the ratio of the standard deviation to the mean. A CV greater than one means that the database is non-normally distributed.

The second step in the reduction of the analyte list was a statistical comparison to background. This analysis applied only to inorganics in soil and groundwater. The Student's *t*-Test is the statistical method that was used to compare the on-site soil and groundwater datasets to the background datasets to determine the significance of change between background and subsequent parameter values. Guidance is currently not available for performing the data set comparison between background and site soils, however, guidance is available for groundwater datasets. The basis for this statistical comparison was obtained from the EPA Guidance document *Groundwater Monitoring Guidance for Owners and Operators of Interim Status Facilities* (EPA, 1983). The first step in this statistical comparison was to determine if the datasets were normally distributed, as the *t*-Test assumes a normal data distribution. The CV was calculated for the on-site dataset. If the CV was greater than 1, the data for that compound was considered to be non-normally distributed and assumed to be lognormally distributed. Thirteen compounds in soil and thirteen compounds in groundwater were determined to be lognormally distributed in the on-site population. In

TABLE 6-1

HUMAN HEALTH RISK ASSESSMENT LIST OF CHEMICALS ANALYZED FOR BUT NOT DETECTED IN SOIL SAMPLES

SENECA ARMY DEPOT OB GROUNDS

Volatile Organic Compounds

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Carbon Disulfide
1,1-Dichloroethene
1,1-Dichloroethane
1,2-Dichloroethane
Vinyl Acetate
Bromodichloromethane
1,2-Dichloropropane
cis-1,3-Dichloropropene
Dibromochloromethane
1,1,2-Trichloroethene
trans-1,3-Dichloropropene
Bromoform
4-Methyl-2-Pentanone
2-Hexanone
1,1,2,2-Tetrachloroethane
Ethylbenzene
Styrene

Semivolatiles

bis(2-Chloroethyl) ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl Alcohol
1,2-Dichlorobenzene
2,2'-oxybis(1-Chloropropane)
N-Nitroso-di-n-propylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
bis(2-Chloroethoxy) methane
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-methylphenol
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
Dimethylphthalate
2,4-Dinitrophenol
4-Nitrophenol
4-Chlorophenyl-phenylether
4-Nitroaniline
4,6-Dinitro-2-methylphenol
4-Bromophenyl-phenylether
3,3'-Dichlorobenzidine

Pesticides/PCBs

alpha-BHC
Methoxychlor
Endrin ketone
gamma-Chlordane
Toxaphene
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248

Explosives

None

Metals

None

TABLE 6-1

HUMAN HEALTH RISK ASSESSMENT
LIST OF CHEMICALS ANALYZED FOR BUT NOT DETECTED IN GROUNDWATER SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Volatile Organic Compounds

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Methylene Chloride
Carbon Disulfide
1,1-Dichloroethene
1,1-Dichloroethane
trans-1,2-Dichloroethene
cis-1,2-Dichloroethene
1,2-Dichloroethene (total)
Chloroform
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon Tetrachloride
Vinyl Acetate
Bromodichloromethane
1,2-Dichloropropane
cis-1,3-Dichloropropene
Trichloroethene
Dibromochloromethane
1,1,2-Trichloroethane
Benzene
trans-1,3-Dichloropropene
Bromoform
4-Methyl-2-Pentanone
2-Hexanone
Tetrachloroethene
1,1,2,2-Tetrachloroethane
Toluene
Chlorobenzene
Ethylbenzene
Styrene
Xylene (total)
Dichlorodifluoromethane
Trichlorofluoromethane
2,2-Dichloropropane
Bromochloromethane
1,1-Dichloropropene
Dibromomethane
1,3-Dichloropropane
1,2-Dibromoethane
1,1,1,2-Tetrachloroethane
Isopropylbenzene
Bromobenzene
1,2,3-Trichloropropane
n-Propylbenzene
2-Chlorotoluene
4-Chlorotoluene
1,3,5-Trimethylbenzene
tert-Butylbenzene
1,2,4-Trimethylbenzene
sec-Butylbenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
p-Isopropyltoluene
1,2-Dichlorobenzene
n-Butylbenzene
1,2-Dibromo-3-Chloropropane
1,2,4-Trichlorobenzene
Hexachlorobutadiene
Naphthalene
1,2,3-Trichlorobenzene

Semivolatiles

Phenol
bis(2-Chloroethyl) ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl Alcohol
1,2-Dichlorobenzene
2-Methylphenol
2,2'-oxybis(1-Chloropropane)
4-Methylphenol
N-Nitroso-di-n-propylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
Benzoic acid
bis(2-Chloroethoxy) methane
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-methylphenol
2-Methylnaphthalene
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Dimethylphthalate
Acenaphthylene
2,6-Dinitrotoluene
3-Nitroaniline
Acenaphthene
2,4-Dinitrophenol
4-Nitrophenol
Dibenzofuran
2,4-Dinitrotoluene
4-Chlorophenyl-phenylether
Fluorene
4-Nitroaniline
4,6-Dinitro-2-methylphenol
N-Nitrosodiphenylamine
4-Bromophenyl-phenylether
Hexachlorobenzene
Pentachlorophenol
Phenanthrene
Anthracene
Carbazole
Fluoranthene
Pyrene
Butylbenzylphthalate
3,3'-Dichlorobenzidine
Benzo(a)anthracene
Chrysene
bis(2-Ethylhexyl)phthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene

Pesticides/PCBs

alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (Lindane)
Heptachlor
Aldrin
Heptachlor epoxide
Endosulfan I
Dieldrin
4,4'-DDE
Endrin
Endosulfan II
4,4'-DDD
Endosulfan sulfate
4,4'-DDT
Methoxychlor
Endrin ketone
Endrin aldehyde
alpha-Chlordane
gamma-Chlordane
Toxaphene
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

Explosives

HMX
1,3,5-Trinitrobenzene
1,3-Dinitrobenzene
Tetryl
4-amino-2,6-Dinitrotoluene
2-amino-4,6-Dinitrotoluene
2,4-Dinitrotoluene

Metals

Thallium

TABLE 6-1

HUMAN HEALTH RISK ASSESSMENT
LIST OF CHEMICALS ANALYZED FOR BUT NOT DETECTED IN SURFACE WATER SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Volatile Organic Compounds

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
1,1-Dichloroethene
1,1-Dichloroethane
1,2-Dichloroethene (total)
Chloroform
2-Butanone
1,1,1-Trichloroethane
Carbon Tetrachloride
Vinyl Acetate
Bromodichloromethane
1,2-Dichloropropane
cis-1,3-Dichloropropene
Dibromochloromethane
1,1,2-Trichloroethene
Benzene
trans-1,3-Dichloropropene
Bromoform
4-Methyl-2-Pentanone
2-Hexanone
Tetrachloroethene
1,1,2,2-Tetrachloroethane
Toluene
Chlorobenzene
Ethylbenzene
Styrene
Xylene (total)

Semivolatiles

Phenol
bis(2-Chloroethyl) ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl Alcohol
1,2-Dichlorobenzene
2-Methylphenol
2,2'-oxybis(1-Chloropropane)
4-Methylphenol
N-Nitroso-di-n-propylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
Benzoic acid
bis(2-Chloroethoxy) methane
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-methylphenol
2-Methylnaphthalene
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Dimethylphthalate
Acenaphthylene
2,6-Dinitrotoluene
3-Nitroaniline
Acenaphthene
2,4-Dinitrophenol
4-Nitrophenol
Dibenzofuran
2,4-Dinitrotoluene
Diethylphthalate
4-Chlorophenyl-phenylether
Fluorene
4-Nitroaniline
4,6-Dinitro-2-methylphenol
N-Nitrosodiphenylamine (1)
4-Bromophenyl-phenylether
Hexachlorobenzene
Pentachlorophenol
Phenanthrene
Anthracene
Carbazole
Di-n-butylphthalate
Fluoranthene
Pyrene
Butylbenzylphthalate
3,3'-Dichlorobenzidine
Benzo(a)anthracene
Chrysene
Di-n-octylphthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene

Pesticides/PCBs

alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (Lindane)
Heptachlor
Aldrin
Heptachlor epoxide
Endosulfan I
Dieldrin
4,4'-DDE
Endrin
Endosulfan II
4,4'-DDD
Endosulfan sulfate
4,4'-DDT
Methoxychlor
Endrin ketone
Endrin aldehyde
alpha-Chlordane
gamma-Chlordane
Toxaphene
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

Explosives

HMX
1,3,5-Trinitrobenzene
1,3-Dinitrobenzene
2,4,6-Trinitrotoluene
4-amino-2,6-Dinitrotoluene
2-amino-4,6-Dinitrotoluene
2,6-Dinitrotoluene
2,4-Dinitrotoluene

Metals

Antimony
Cadmium
Cobalt
Silver
Thallium

TABLE 6-1

HUMAN HEALTH RISK ASSESSMENT
LIST OF CHEMICALS ANALYZED FOR BUT NOT DETECTED IN SEDIMENT SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Volatile Organic Compounds

Chloromethane
Bromomethane
Vinyl Chloride
Chloroethane
Methylene Chloride
1,1-Dichloroethene
1,1-Dichloroethane
1,2-Dichloroethene (total)
1,2-Dichloroethane
2-Butanone
1,1,1-Trichloroethane
Carbon Tetrachloride
Vinyl Acetate
Bromodichloromethane
1,2-Dichloropropane
cis-1,3-Dichloropropene
Dibromochloromethane
1,1,2-Trichloroethene
Benzene
trans-1,3-Dichloropropene
Bromoform
4-Methyl-2-Pentanone
2-Hexanone
Tetrachloroethene
1,1,2,2-Tetrachloroethane
Toluene
Chlorobenzene
Ethylbenzene
Styrene
Xylene (total)

Semivolatiles

Phenol
bis(2-Chloroethyl) ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl Alcohol
1,2-Dichlorobenzene
2-Methylphenol
2,2'-oxybis(1-Chloropropane)
N-Nitroso-di-n-propylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
Benzoic acid
bis(2-Chloroethoxy) methane
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-methylphenol
Hexachlorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Dimethylphthalate
Acenaphthylene
3-Nitroaniline
Acenaphthene
2,4-Dinitrophenol
4-Nitrophenol
Dibenzofuran
Diethylphthalate
4-Chlorophenyl-phenylether
Fluorene
4-Nitroaniline
4,6-Dinitro-2-methylphenol
4-Bromophenyl-phenylether
Hexachlorobenzene
Pentachlorophenol
Butylbenzylphthalate
3,3'-Dichlorobenzidine
Di-n-octylphthalate
Dibenz(a,h)anthracene
Benzo(g,h,i)perylene

Pesticides/PCBs

alpha-BHC
beta-BHC
delta-BHC
gamma-BHC (Lindane)
Heptachlor
Aldrin
Heptachlor epoxide
Endosulfan I
Dieldrin
Endrin
Endosulfan II
4,4'-DDD
Endosulfan sulfate
Methoxychlor
Endrin ketone
Endrin aldehyde
alpha-Chlordane
gamma-Chlordane
Toxaphene
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

Explosives

1,3,5-Trinitrobenzene
1,3-Dinitrobenzene
Tetryl
2,6-Dinitrotoluene

Metals

Thallium

order to use the *t*-Test, the non-normal data was first log transformed, for both the on-site and background datasets.

The Student's *t*-test was calculated by the formula:

$$t* = \frac{\overline{x}_{(m)} - \overline{x}_{(b)}}{\sqrt{\frac{s_{(m)}^2}{n_{(m)}} + \frac{s_{(b)}^2}{n_{(b)}}}}$$

where:

t^* = calculated t-statistic
$n_{(m)}$ = number of samples in the population
$\overline{x}_{(m)}$ = mean of the population
$S_{(m)}$ = standard deviation of the population
$n_{(b)}$ = number of samples in the background
$\overline{x}_{(b)}$ = background mean
$S_{(b)}$ = background standard deviation

The analysis involved the calculation of the t-statistic (t^*) followed by a comparison of this value with the t-statistic (t_c) for a given confidence interval and degrees of freedom. From a comparison between the two t-statistics it was determined if there was a statistically significant change between the on-site data set and the background dataset. The t-statistic used for comparison (t_c) with the calculated t-statistic was obtained for the 95% confidence interval. The degrees of freedom are the number of measurements minus one. Using these two parameters, a comparison t-statistic (t_c) was obtained from a statistics reference table. For soil, the number of measurements was large (between 140 and 250), and because of this the comparison t-statistic did not change significantly over this range of measurements. For simplicity, a t-statistic of 1.645 was used for comparison with all of the calculated t-values. If the calculated t-value was less than 1.645, it was concluded that there was no statistically significant difference, at the 95% confidence level, between the on-site dataset and the background dataset and that particular constituent was eliminated from further consideration in the risk analysis. For groundwater the comparision t-statistic (t_c) varied from 1.703 to 1.943. Of the metals analyzed twelve were not eliminated from the baseline risk assessment for soils. They are barium, cadmium, chromium, copper, lead, mercury, potassium, selenium, sodium, thallium, zinc and cyanide. For groundwater, only three metals were not eliminated from the baseline risk assessment. They are calcium, magnesium and sodium. Table 6-2 presents the results of this statistical analysis for metals in soils and metals in groundwater. Section 5.7 of RAGS indicates that "If inorganic chemicals are present at the site at naturally accurring levels, they may be eliminated from the quantitative risk assessment". Table 6-3 summarizes the results of these first two steps.

Table 6-3 lists the chemicals of potential concern for the baseline human health and ecological risk assessments in all on-site soils, in surface soils (0 to 2 feet) only, in surface water, in sediments, and in on-site monitoring wells. This table presents the number of analyses in the database, the maximum detected concentration, the 95th UCL of the mean, the true mean, the standard deviation, the coefficient of variation, whether the data is normally or lognormally distributed and the resulting exposure point concentration value. When the data were normally distributed the 95th UCL was calculated using the t-statistic as described in Section 6.2.2.3. When the data were lognormally distributed, the data were log transformed and the 95th UCL calculated using the following equation:

$$95th\ UCL = e\left(\bar{x} + 0.5S^2 + \frac{HS}{\sqrt{n-1}}\right)$$

where:

$\bar{x}$ = the mean of the log transformed data
s = the standard deviation of the log transformed data
n = the number of data points
H = the H-statistic at the 95th confidence level

Values for the H-statistic were obtained from Gilbert (1987) and vary as a function of both n and s. When the calculated 95th UCL was less than the maximum detected concentration, the exposure point concentration was taken as the 95th UCL. However, when the calculated 95th UCL was greater than the maximum detected concentration, the exposure point concentration was taken as the maximum detected concentration.

TABLE 6-2

HUMAN HEALTH RISK ASSESSMENT
STATISTICAL COMPARISON OF METALS IN SOILS TO BACKGROUND

SENECA ARMY DEPOT
OB GROUNDS

METALS	BACKGROUND			POPULATION(EXCLUDING BACKGROUND)			t(statistic)(a)	t(calc)	ELIMINATED IN RISK ASSESSMENT
	N COUNT	X AVERAGE	S STD. DEV.	N COUNT	X AVERAGE	S STD. DEV.			
Aluminum	15	15,796.00	3,771.19	243	16,448.60	4,212.21	1.645	0.646	yes
Antimony (b)	15	1.50	0.26	171	1.50	0.66	1.645	0.000	yes
Arsenic	15	5.08	1.87	230	5.60	2.90	1.645	1.004	yes
Barium (b)	15	4.40	0.38	222	5.70	1.50	1.645	9.248	no
Beryllium	15	0.89	0.23	142	0.74	0.18	1.645	-2.439	yes
Cadmium (b)	15	-0.40	1.31	243	0.30	1.53	1.645	1.988	no
Calcium (b)	15	9.40	1.54	242	9.40	1.10	1.645	0.000	yes
Chromium (b)	15	3.15	0.28	227	3.30	0.44	1.645	1.924	no
Cobalt	15	13.75	3.36	243	12.62	3.72	1.645	-1.253	yes
Copper (b)	15	3.06	0.21	232	4.80	1.64	1.645	14.433	no
Iron	15	29,886.67	6,209.77	243	29,678.20	7,927.04	1.645	-0.124	yes
Lead (b)	15	2.44	0.37	231	5.30	2.07	1.645	17.192	no
Magnesium	15	7,555.33	3,348.83	243	6,951.80	3,176.40	1.645	-0.679	yes
Manganese	15	855.40	464.80	243	584.40	243.28	1.645	-2.239	yes
Mercury (b)	14	-2.97	0.65	190	-0.26	0.97	1.645	14.459	no
Nickel	15	36.63	10.35	243	38.59	11.99	1.645	0.705	yes
Potassium	15	1,371.67	348.81	243	1,708.50	598.83	1.645	3.440	no
Selenium (b)	15	-1.86	0.79	233	-1.30	0.93	1.645	2.631	no
Silver (b)	15	-0.99	0.71	222	-0.90	0.85	1.645	0.469	yes
Sodium (b)	15	4.05	0.45	226	4.40	0.88	1.645	2.690	no
Thallium (b)	15	-1.43	0.19	243	-1.30	0.48	1.645	2.244	no
Vanadium	15	23.17	5.12	239	24.71	5.55	1.645	1.131	yes
Zinc (b)	15	4.36	0.24	243	5.50	1.34	1.645	10.758	no
Cyanide	15	0.33	0.04	241	0.36	0.22	1.645	1.764	no

Notes: a) The t-Statistic represents a confidence level of 95% as the criteria to eliminate a chemical from the Risk Assessment.

b) The data set for this metal was determined to have a CV greater than 1and was log tranformed in order to normalize the data set prior to calculating the "t" statistic.

TABLE 6-2

HUMAN HEALTH RISK ASSESSMENT
STATISTICAL COMPARISON OF METALS IN GROUNDWATER TO BACKGROUND

SENECA ARMY DEPOT
OB GROUNDS

	BACKGROUND			POPULATION(EXCLUDING BACKGROUND)					
METALS	N COUNT	X AVERAGE	S STD. DEV.	N COUNT	X AVERAGE	S STD. DEV.	t(statistic)(a)	t(calc)	ELIMINATED IN RISK ASSESSMENT
Aluminum	6	6.44	2.16	27	6.64	1.60	1.703	0.216	yes
Antimony (b)	6	26.97	0.07	27	26.93	0.08	1.703	-1.288	yes
Arsenic	6	0.06	0.55	27	-0.08	0.43	1.703	-0.594	yes
Barium (b)	6	72.70	23.92	27	78.69	61.08	1.703	0.392	yes
Beryllium	6	-1.60	0.73	27	-1.66	0.65	1.703	-0.197	yes
Cadmium (b)	6	1.55	0.00	27	1.55	0.00	1.703	0.000	yes
Calcium (b)	6	96,950.00	12,162.36	27	136,137.04	58,878.28	1.703	3.168	no
Chromium (b)	5	0.77	1.33	26	0.66	1.04	1.706	-0.174	yes
Cobalt	6	1.16	0.61	27	1.04	0.48	1.703	-0.486	yes
Copper (b)	4	0.72	1.55	18	0.85	1.26	1.734	0.157	yes
Iron	5	7.19	1.82	24	7.03	1.71	1.711	-0.185	yes
Lead (b)	6	0.08	1.02	27	0.34	1.41	1.703	0.520	yes
Magnesium	6	15,800.00	5,228.38	27	33,682.96	20,920.72	1.703	3.924	no
Manganese	6	4.18	1.26	27	3.89	1.31	1.703	-0.509	yes
Mercury (b)	3	0.03	0.00	23	0.04	0.03	1.714	1.000	yes
Nickel	6	1.18	1.15	27	1.41	0.97	1.703	0.449	yes
Potassium	6	7.39	0.41	27	7.36	1.08	1.703	-0.142	yes
Selenium (b)	6	0.66	0.27	27	0.76	0.45	1.703	0.769	yes
Silver (b)	6	1.60	0.00	27	1.60	0.00	1.703	0.000	yes
Sodium (b)	6	10,721.67	7,045.92	27	20,711.85	17,878.38	1.703	2.228	no
Thallium (b)	6	1.30	0.00	27	1.30	0.00	1.703	0.000	yes
Vanadium	5	0.82	1.28	25	0.95	1.04	1.708	0.210	yes
Zinc (b)	3	4.41	0.07	6	4.16	1.13	1.943	-0.543	yes
Cyanide	6	5.00	0.00	27	6.37	5.53	1.703	1.287	yes

Notes: a) The t-Statistic represents a confidence level of 95% as the criteria to eliminate a chemical from the Risk Assessment.

b) The data set for this metal was determined to have a CV greater than 1and was log tranformed in order to normalize the data set prior to calculating the "t" statistic.

TABLE 6-3

SOIL DATA - ALL DEPTHS
SUMMARY OF VALIDATED RESULTS (PHASE I AND II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Methylene Chloride	ug/kg	238	21.00	4.87	4.7	1.8566946	0.40	NORMAL	4.87
Acetone	ug/kg	237	230.00	7.07	7.8	16.076129	2.07	LOGNORMAL	7.07
1,2-Dichloroethene (total)	ug/kg	238	8.00	4.70	4.5	1.5929019	0.35	NORMAL	4.70
Chloroform	ug/kg	239	10.00	4.85	4.7	1.7336335	0.37	NORMAL	4.85
2-Butanone	ug/kg	238	22.00	6.19	6.1	1.198724	0.20	NORMAL	6.19
1,1,1-Trichloroethane	ug/kg	238	8.00	4.71	4.5	1.5829668	0.35	NORMAL	4.71
Carbon Tetrachloride	ug/kg	238	8.00	4.71	4.5	1.5805781	0.35	NORMAL	4.71
Trichloroethene	ug/kg	238	100.00	5.09	5.2	7.9544076	1.52	LOGNORMAL	5.09
Benzene	ug/kg	238	8.00	4.71	4.5	1.5917064	0.35	NORMAL	4.71
Tetrachloroethene	ug/kg	238	110.00	5.23	5.3	8.1774697	1.54	LOGNORMAL	5.23
Toluene	ug/kg	238	8.00	4.62	4.4	1.6749162	0.38	NORMAL	4.62
Chlorobenzene	ug/kg	238	8.00	4.72	4.5	1.5747136	0.35	NORMAL	4.72
Xylene (total)	ug/kg	238	11.00	4.75	4.6	1.6449795	0.36	NORMAL	4.75
Semivolatiles									
Phenol	ug/kg	223	425.00	292.90	282.9	90.438257	0.32	NORMAL	292.90
2-Methylphenol	ug/kg	223	760.00	296.91	286.0	98.732918	0.35	NORMAL	296.91
4-Methylphenol	ug/kg	226	1300.00	306.18	292.4	125.72651	0.43	NORMAL	306.18
2,4-Dimethylphenol	ug/kg	223	630.00	293.40	283.0	93.742903	0.33	NORMAL	293.40
Benzoic acid	ug/kg	111	2200.00	1834.61	1786.8	304.74936	0.17	NORMAL	1834.61
Naphthalene	ug/kg	227	570.00	284.98	273.2	107.845	0.39	NORMAL	284.98
2-Methylnaphthalene	ug/kg	234	4700.00	328.24	298.6	322.41076	1.08	LOGNORMAL	328.24
2-Chloronaphthalene	ug/kg	225	435.00	292.61	282.4	92.79414	0.33	NORMAL	292.61
2-Nitroaniline	ug/kg	232	2200.00	1220.92	1146.9	684.32845	0.60	NORMAL	1220.92
Acenaphthylene	ug/kg	225	540.00	294.84	284.5	94.319984	0.33	NORMAL	294.84
2,6-Dinitrotoluene	ug/kg	231	2000.00	305.06	288.2	155.84462	0.54	NORMAL	305.06
3-Nitroaniline	ug/kg	232	2200.00	1221.64	1147.7	682.83971	0.59	NORMAL	1221.64
Acenaphthene	ug/kg	227	480.00	292.73	282.4	94.027817	0.33	NORMAL	292.73
Dibenzofuran	ug/kg	226	435.00	291.82	281.4	94.612751	0.34	NORMAL	291.82
2,4-Dinitrotoluene	ug/kg	239	33000.00	641.88	796.8	2462.1106	3.09	LOGNORMAL	641.88
Diethylphthalate	ug/kg	229	450.00	285.64	273.5	111.2184	0.41	NORMAL	285.64
Fluorene	ug/kg	228	710.00	295.47	284.9	96.480443	0.34	NORMAL	295.47
N-Nitrosodiphenylamine	ug/kg	235	7000.00	340.24	339.2	472.75071	1.39	LOGNORMAL	340.24
Hexachlorobenzene	ug/kg	227	440.00	291.88	281.1	98.10754	0.35	NORMAL	291.88
Pentachlorophenol	ug/kg	233	2200.00	1216.19	1142.1	686.48274	0.60	NORMAL	1216.19
Phenanthrene	ug/kg	236	2600.00	316.96	291.0	241.82989	0.83	NORMAL	316.96
Anthracene	ug/kg	228	700.00	294.68	283.5	101.95024	0.36	NORMAL	294.68
Carbazole	ug/kg	118	1200.00	234.58	216.4	119.24639	0.55	NORMAL	234.58
Di-n-butylphthalate	ug/kg	236	5800.00	428.96	344.9	465.76458	1.35	LOGNORMAL	428.96
Fluoranthene	ug/kg	234	4400.00	349.33	304.8	366.0667	1.20	LOGNORMAL	349.33
Pyrene	ug/kg	236	5600.00	356.78	308.4	435.88216	1.41	LOGNORMAL	356.78
Butylbenzylphthalate	ug/kg	226	435.00	292.14	281.9	93.551359	0.33	NORMAL	292.14
Benzo(a)anthracene	ug/kg	232	3900.00	338.11	306.5	292.3493	0.95	NORMAL	338.11
Chrysene	ug/kg	234	8900.00	337.81	330.1	594.12403	1.80	LOGNORMAL	337.81
bis(2-Ethylhexyl)phthalate	ug/kg	237	1450.00	346.69	326.1	191.99346	0.59	NORMAL	346.69
Di-n-octylphthalate	ug/kg	224	425.00	290.53	280.4	92.394483	0.33	NORMAL	290.53
Benzo(b)fluoranthene	ug/kg	232	11000.00	339.12	341.4	749.27804	2.19	LOGNORMAL	339.12
benzo(k)fluoranthene	ug/kg	232	4500.00	322.83	310.2	337.40547	1.09	LOGNORMAL	322.83
Benzo(a)pyrene	ug/kg	232	3700.00	339.44	307.4	296.00167	0.96	NORMAL	339.44
Indeno(1,2,3-cd)pyrene	ug/kg	231	2300.00	319.06	298.9	185.48053	0.62	NORMAL	319.06
Dibenz(a,h)anthracene	ug/kg	226	670.00	295.07	284.6	95.735869	0.34	NORMAL	295.07
Benzo(g,h,i)perylene	ug/kg	227	960.00	299.94	287.9	110.44489	0.38	NORMAL	299.94

TABLE 6-3

SOIL DATA - ALL DEPTHS
SUMMARY OF VALIDATED RESULTS (PHASE I AND II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Pesticides/PCBs									
beta-BHC	ug/kg	232	11.50	5.53	5.1	4.1302182	0.81	NORMAL	5.53
delta-BHC	ug/kg	232	15.00	5.59	5.1	4.1721812	0.81	NORMAL	5.59
gamma-BHC (Lindane)	ug/kg	232	11.50	5.52	5.1	4.1351832	0.81	NORMAL	5.52
Heptachlor	ug/kg	232	32.00	5.68	5.2	4.4965656	0.87	NORMAL	5.68
Aldrin	ug/kg	232	11.50	5.58	5.1	4.0899339	0.80	NORMAL	5.58
Heptachlor epoxide	ug/kg	232	11.50	5.52	5.1	4.1340943	0.81	NORMAL	5.52
Endosulfan I	ug/kg	232	11.50	5.55	5.1	4.115075	0.81	NORMAL	5.55
Dieldrin	ug/kg	234	50.00	11.29	10.4	8.6964893	0.84	NORMAL	11.29
4,4'-DDE	ug/kg	237	830.00	16.42	15.5	54.965888	3.54	LOGNORMAL	16.42
Endrin	ug/kg	234	50.00	11.40	10.4	8.8962286	0.85	NORMAL	11.40
Endosulfan II	ug/kg	235	480.00	14.67	12.8	32.467469	2.53	LOGNORMAL	14.67
4,4'-DDD	ug/kg	232	23.50	11.04	10.2	8.2586882	0.81	NORMAL	11.04
Endosulfan sulfate	ug/kg	232	23.50	11.05	10.2	8.2719695	0.81	NORMAL	11.05
4,4'-DDT	ug/kg	238	2800.00	16.97	24.4	182.12914	7.46	LOGNORMAL	16.97
Endrin aldehyde	ug/kg	123	20.50	2.60	2.6	2.7827342	1.06	LOGNORMAL	2.60
alpha-Chlordane	ug/kg	233	270.00	179.13	45.7	48.121347	1.05	LOGNORMAL	179.13
Aroclor-1254	ug/kg	232	430.00	112.11	102.9	85.554649	0.83	NORMAL	112.11
Aroclor-1260	ug/kg	232	240.00	110.27	101.3	83.199949	0.82	NORMAL	110.27
Explosives									
HMX	ug/kg	236	1300.00	294.85	269.9	232.85142	0.86	NORMAL	294.85
RDX	ug/kg	236	4800.00	87.47	115.2	379.53279	3.30	LOGNORMAL	87.47
1,3,5-Trinitrobenzene	ug/kg	236	7800.00	106.05	164.3	712.88281	4.34	LOGNORMAL	106.05
1,3-Dinitrobenzene	ug/kg	235	440.00	68.86	65.4	31.945964	0.49	NORMAL	68.86
Tetryl	ug/kg	236	1000.00	146.66	135.6	103.33477	0.76	NORMAL	146.66
2,4,6-Trinitrotoluene	ug/kg	236	80000.00	123.58	564.0	5452.0533	9.67	LOGNORMAL	123.58
4-amino-2,6-Dinitrotoluene	ug/kg	236	8900.00	123.28	172.2	638.4514	3.71	LOGNORMAL	123.28
2-amino-4,6-Dinitrotoluene	ug/kg	236	11000.00	135.26	201.2	789.02543	3.92	LOGNORMAL	135.26
2,6-Dinitrotoluene	ug/kg	235	125.00	60.76	60.3	4.2627087	0.07	NORMAL	60.76
2,4-Dinitrotoluene	ug/kg	236	5100.00	323.36	372.4	811.73021	2.18	LOGNORMAL	323.36
Metals									
Barium	mg/kg	218	34400.00	1295.88	1364.7	3901.714	2.86	LOGNORMAL	1295.88
Cadmium	mg/kg	239	28.20	5.53	3.3	4.6008835	1.38	LOGNORMAL	5.53
Chromium	mg/kg	223	1430.00	31.58	35.5	96.172231	2.71	LOGNORMAL	31.58
Copper	mg/kg	228	38100.00	632.74	769.2	3073.3166	4.00	LOGNORMAL	632.74
Lead	mg/kg	227	56700.00	2710.66	1819.2	5799.7898	3.19	LOGNORMAL	2710.66
Mercury	mg/kg	186	1.10	0.14	0.1	0.1743399	1.38	LOGNORMAL	0.14
Potassium	mg/kg	239	3570.00	1781.84	1718.0	598.5553	0.35	NORMAL	1781.84
Selenium	mg/kg	229	3.30	0.45	0.4	0.4695091	1.16	LOGNORMAL	0.45
Sodium	mg/kg	222	618.00	904254.83	117.3	104.6704	0.89	NORMAL	618.00
Thallium	mg/kg	239	38.00	0.31	0.4	2.4426316	5.62	LOGNORMAL	0.31
Zinc	mg/kg	239	127000.00	772.09	1201.9	8289.7694	6.90	LOGNORMAL	772.09
Cyanide	mg/kg	238	2.60	0.38	0.4	0.2264266	0.63	NORMAL	0.38

TABLE 6-3

SOIL DATA - SURFACE SOILS
SUMMARY OF VALIDATED RESULTS (PHASE I AND II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Methylene Chloride	ug/kg	195	21.00	4.95	4.7	1.9324777	0.41	NORMAL	4.95
Acetone	ug/kg	193	230.00	6.79	7.4	16.172431	2.19	LOGNORMAL	6.79
1,2-Dichloroethene (total)	ug/kg	195	8.00	4.73	4.5	1.6221113	0.36	NORMAL	4.73
Chloroform	ug/kg	196	10.00	4.88	4.7	1.749985	0.37	NORMAL	4.88
2-Butanone	ug/kg	195	11.00	6.12	6.0	0.640492	0.11	NORMAL	6.12
1,1,1-Trichloroethane	ug/kg	195	8.00	4.75	4.6	1.6100193	0.35	NORMAL	4.75
Carbon Tetrachloride	ug/kg	195	8.00	4.75	4.6	1.607123	0.35	NORMAL	4.75
Trichloroethene	ug/kg	195	100.00	5.01	5.0	7.0256225	1.40	LOGNORMAL	5.01
Benzene	ug/kg	195	8.00	4.74	4.6	1.6168963	0.36	NORMAL	4.74
Tetrachloroethene	ug/kg	195	110.00	5.72	5.5	9.001718	1.64	LOGNORMAL	5.72
Toluene	ug/kg	195	8.00	4.70	4.5	1.6967221	0.38	NORMAL	4.70
Chlorobenzene	ug/kg	195	8.00	4.76	4.6	1.5999893	0.35	NORMAL	4.76
Xylene (total)	ug/kg	195	8.00	4.77	4.6	1.620856	0.35	NORMAL	4.77
Semivolatiles									
Phenol	ug/kg	180	425.00	296.14	285.1	90.187559	0.32	NORMAL	296.14
2-Methylphenol	ug/kg	180	425.00	296.14	285.1	90.187559	0.32	NORMAL	296.14
4-Methylphenol	ug/kg	183	440.00	298.70	287.5	91.501319	0.32	NORMAL	298.70
2,4-Dimethylphenol	ug/kg	180	425.00	296.14	285.1	90.187559	0.32	NORMAL	296.14
Benzoic acid	ug/kg	92	2200.00	1839.41	1781.9	333.39992	0.19	NORMAL	1839.41
Naphthalene	ug/kg	184	440.00	290.27	277.2	107.36947	0.39	NORMAL	290.27
2-Methylnaphthalene	ug/kg	191	1300.00	298.84	280.9	149.99969	0.53	NORMAL	298.84
2-Chloronaphthalene	ug/kg	182	435.00	295.52	284.2	92.883134	0.33	NORMAL	295.52
2-Nitroaniline	ug/kg	189	2200.00	1247.31	1164.9	687.19102	0.59	NORMAL	1247.31
Acenaphthylene	ug/kg	182	540.00	298.29	286.7	94.712101	0.33	NORMAL	298.29
2,6-Dinitrotoluene	ug/kg	188	2000.00	313.39	293.3	166.67321	0.57	NORMAL	313.39
3-Nitroaniline	ug/kg	189	2200.00	1248.18	1166.0	685.34014	0.59	NORMAL	1248.18
Acenaphthene	ug/kg	184	435.00	295.25	283.9	92.986818	0.33	NORMAL	295.25
Dibenzofuran	ug/kg	183	435.00	295.04	283.5	94.295577	0.33	NORMAL	295.04
2,4-Dinitrotoluene	ug/kg	196	33000.00	736.13	893.1	2695.693	3.02	LOGNORMAL	736.13
Diethylphthalate	ug/kg	186	450.00	291.49	278.5	107.09976	0.38	NORMAL	291.49
Fluorene	ug/kg	185	440.00	296.33	285.1	92.5528	0.32	NORMAL	296.33
N-Nitrosodiphenylamine	ug/kg	192	7000.00	347.89	346.5	515.24946	1.49	LOGNORMAL	347.89
Hexachlorobenzene	ug/kg	184	440.00	294.67	282.6	99.422287	0.35	NORMAL	294.67
Pentachlorophenol	ug/kg	190	2200.00	1243.01	1160.7	687.68761	0.59	NORMAL	1243.01
Phenanthrene	ug/kg	193	2600.00	316.94	288.4	240.76205	0.83	NORMAL	316.94
Anthracene	ug/kg	185	700.00	298.85	286.4	102.61734	0.36	NORMAL	298.85
Carbazole	ug/kg	94	1200.00	243.90	221.4	132.02803	0.60	NORMAL	243.90
Di-n-butylphthalate	ug/kg	193	5800.00	459.09	362.9	502.10447	1.38	LOGNORMAL	459.09
Fluoranthene	ug/kg	191	4400.00	369.35	312.2	402.36885	1.29	LOGNORMAL	369.35
Pyrene	ug/kg	193	5600.00	378.57	315.9	479.93782	1.52	LOGNORMAL	378.57
Butylbenzylphthalate	ug/kg	183	435.00	295.56	284.3	92.587288	0.33	NORMAL	295.56
Benzo(a)anthracene	ug/kg	189	3900.00	325.07	313.6	320.6253	1.02	LOGNORMAL	325.07
Chrysene	ug/kg	191	8900.00	352.91	342.5	655.8283	1.92	LOGNORMAL	352.91
bis(2-Ethylhexyl)phthalate	ug/kg	194	1450.00	348.28	324.6	199.96125	0.62	NORMAL	348.28
Di-n-octylphthalate	ug/kg	181	425.00	293.75	282.7	90.508657	0.32	NORMAL	293.75
Benzo(b)fluoranthene	ug/kg	189	11000.00	353.74	356.5	828.64407	2.32	LOGNORMAL	353.74
benzo(k)fluoranthene	ug/kg	189	4500.00	333.80	318.1	370.93928	1.17	LOGNORMAL	333.80
Benzo(a)pyrene	ug/kg	189	3700.00	334.89	314.8	324.69091	1.03	LOGNORMAL	334.89
Indeno(1,2,3-cd)pyrene	ug/kg	188	2300.00	328.54	304.4	200.50812	0.66	NORMAL	328.54
Dibenz(a,h)anthracene	ug/kg	183	670.00	298.59	286.8	96.447515	0.34	NORMAL	298.59
Benzo(g,h,i)perylene	ug/kg	184	960.00	304.73	290.9	114.12904	0.39	NORMAL	304.73

TABLE 6-3

SOIL DATA - SURFACE SOILS
SUMMARY OF VALIDATED RESULTS (PHASE I AND II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Pesticides/PCBs									
beta-BHC	ug/kg	189	11.50	5.69	5.2	4.1444217	0.80	NORMAL	5.69
delta-BHC	ug/kg	189	15.00	5.78	5.3	4.1935056	0.80	NORMAL	5.78
gamma-BHC (Lindane)	ug/kg	189	11.50	5.69	5.2	4.1506663	0.80	NORMAL	5.69
Heptachlor	ug/kg	189	32.00	5.89	5.3	4.5850753	0.86	NORMAL	5.89
Aldrin	ug/kg	189	11.50	5.75	5.3	4.0999591	0.78	NORMAL	5.75
Heptachlor epoxide	ug/kg	189	11.50	5.69	5.2	4.1493258	0.80	NORMAL	5.69
Endosulfan I	ug/kg	189	11.50	5.72	5.2	4.1251415	0.79	NORMAL	5.72
Dieldrin	ug/kg	191	50.00	11.70	10.6	8.8077178	0.83	NORMAL	11.70
4,4'-DDE	ug/kg	194	830.00	18.29	17.0	60.569536	3.57	LOGNORMAL	18.29
Endrin	ug/kg	191	50.00	11.84	10.8	9.0453292	0.84	NORMAL	11.84
Endosulfan II	ug/kg	192	480.00	16.04	13.7	35.678267	2.61	LOGNORMAL	16.04
4,4'-DDD	ug/kg	189	23.50	11.39	10.4	8.2832291	0.80	NORMAL	11.39
Endosulfan sulfate	ug/kg	189	23.50	11.40	10.4	8.2992978	0.80	NORMAL	11.40
4,4'-DDT	ug/kg	195	2800.00	18.63	27.8	201.10961	7.23	LOGNORMAL	18.63
Endrin aldehyde	ug/kg	99	20.50	2.79	2.8	3.079473	1.11	LOGNORMAL	2.79
alpha-Chlordane	ug/kg	190	270.00	194.95	46.8	48.803927	1.04	LOGNORMAL	194.95
Aroclor-1254	ug/kg	189	430.00	116.00	105.6	86.4034	0.82	NORMAL	116.00
Aroclor-1260	ug/kg	189	240.00	113.71	103.7	83.591395	0.81	NORMAL	113.71
Explosives									
HMX	ug/kg	195	1300.00	308.30	280.4	235.99465	0.84	NORMAL	308.30
RDX	ug/kg	195	4800.00	93.54	125.9	416.80965	3.31	LOGNORMAL	93.54
1,3,5-Trinitrobenzene	ug/kg	195	7800.00	117.01	185.4	782.88084	4.22	LOGNORMAL	117.01
1,3-Dinitrobenzene	ug/kg	194	440.00	70.72	66.6	35.068068	0.53	NORMAL	70.72
Tetryl	ug/kg	195	1000.00	153.67	140.8	108.7942	0.77	NORMAL	153.67
2,4,6-Trinitrotoluene	ug/kg	195	80000.00	141.67	668.8	5995.2608	8.96	LOGNORMAL	141.67
4-amino-2,6-Dinitrotoluene	ug/kg	195	8900.00	140.03	194.7	700.43675	3.60	LOGNORMAL	140.03
2-amino-4,6-Dinitrotoluene	ug/kg	195	11000.00	155.67	228.5	865.28408	3.79	LOGNORMAL	155.67
2,6-Dinitrotoluene	ug/kg	194	125.00	60.93	60.4	4.6911218	0.08	NORMAL	60.93
2,4-Dinitrotoluene	ug/kg	195	5100.00	413.29	433.0	880.63033	2.03	LOGNORMAL	413.29
Metals									
Barium	mg/kg	175	34400.00	1693.38	1610.5	4295.824	2.67	LOGNORMAL	1693.38
Cadmium	mg/kg	195	28.20	6.13	3.6	4.7752175	1.33	LOGNORMAL	6.13
Chromium	mg/kg	179	1430.00	32.43	37.2	106.86871	2.87	LOGNORMAL	32.43
Copper	mg/kg	189	38100.00	762.13	856.2	3331.3782	3.89	LOGNORMAL	762.13
Lead	mg/kg	186	56700.00	3185.22	2049.4	6269.2031	3.06	LOGNORMAL	3185.22
Mercury	mg/kg	149	1.10	0.17	0.1	0.1884558	1.28	LOGNORMAL	0.17
Potassium	mg/kg	195	3570.00	1820.27	1749.7	597.46044	0.34	NORMAL	1820.27
Selenium	mg/kg	185	3.30	0.50	0.4	0.4999114	1.12	LOGNORMAL	0.50
Sodium	mg/kg	178	618.00	132.00	118.0	110.20207	0.93	NORMAL	132.00
Thallium	mg/kg	195	38.00	0.33	0.5	2.7035033	5.69	LOGNORMAL	0.33
Zinc	mg/kg	195	127000.00	987.43	1430.1	9165.6982	6.41	LOGNORMAL	987.43
Cyanide	mg/kg	194	2.20	0.38	0.4	0.1906461	0.54	NORMAL	0.38

TABLE 6-3

GROUNDWATER DATA
SUMMARY OF VALIDATED RESULTS (PHASE II only)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95 th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Acetone	ug/L	28	15.00	3.68	2.95	2.36	0.8	NORMAL	3.68
Semivolatiles									
Diethylphthalate	ug/L	27	5.00	5.10	4.85	0.77	0.2	NORMAL	5.00
Di-n-butylphthalate	ug/L	27	5.00	5.05	4.72	1.02	0.2	NORMAL	5.00
Di-n-octylphthalate	ug/L	27	5.00	5.10	4.85	0.79	0.2	NORMAL	5.00
Explosives									
RDX	ug/L	27	0.06	0.06	0.06	0.00	0.0	NORMAL	0.06
2,4,6-Trinitrotoluene	ug/L	27	0.06	0.06	0.06	0.00	0.0	NORMAL	0.06
2,6-Dinitrotoluene	ug/L	27	0.06	0.06	0.06	0.00	0.0	NORMAL	0.06
Metals									
Calcium	ug/L	27	295,000.00	154,776.75	136,137.04	58,878.28	0.4	NORMAL	154,776.75
Magnesium	ug/L	27	80,300.00	40,306.05	33,682.96	20,920.72	0.6	NORMAL	40,306.05
Sodium	ug/L	27	80,100.00	26,371.80	20,711.85	17,878.38	0.9	NORMAL	26,371.80

TABLE 6-3

SURFACE WATER DATA - ALL LOCATIONS
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Methylene Chloride	ug/L	30	8.00	4.13	3.68	1.48	0.4	NORMAL	4.13
Acetone	ug/L	30	35.00	8.15	6.50	5.50	0.8	NORMAL	8.15
Carbon Disulfide	ug/L	30	5.00	3.97	3.60	1.25	0.3	NORMAL	3.97
1,2-Dichloroethane	ug/L	30	5.00	3.95	3.57	1.28	0.4	NORMAL	3.95
Trichloroethene	ug/L	30	17.00	4.81	3.98	2.75	0.7	NORMAL	4.81
Semivolatiles									
bis(2-Ethylhexyl)phthalate	ug/L	31	71.00	7.61	7.40	11.85	1.6	LOGNORMAL	7.61
Explosives									
RDX	ug/L	31	9.40	0.63	0.62	1.83	3.0	LOGNORMAL	0.63
Tetryl	ug/L	31	0.52	0.15	0.12	0.10	0.8	NORMAL	0.15
Metals									
Aluminum	ug/L	22	5,220.00	1,500.65	559.45	1,186.24	2.1	LOGNORMAL	1,500.65
Arsenic	ug/L	30	4.40	1.71	1.40	1.03	0.7	NORMAL	1.71
Barium	ug/L	27	523.00	137.33	105.16	101.60	1.0	NORMAL	137.33
Beryllium	ug/L	23	1.40	0.57	0.43	0.40	0.9	NORMAL	0.57
Calcium	ug/L	30	183,000.00	105,103.32	94,433.33	35,527.01	0.4	NORMAL	105,103.32
Chromium	ug/L	30	8.60	3.33	2.76	1.89	0.7	NORMAL	3.33
Copper	ug/L	30	59.80	33.23	12.25	13.51	1.1	LOGNORMAL	33.23
Iron	ug/L	22	8,550.00	4,480.04	1,583.90	2,294.88	1.4	LOGNORMAL	4,480.04
Lead	ug/L	30	74.20	14.53	7.03	15.47	2.2	LOGNORMAL	14.53
Magnesium	ug/L	30	59,900.00	22,446.56	18,722.33	12,400.26	0.7	NORMAL	22,446.56
Manganese	ug/L	26	1,080.00	361.68	156.18	234.29	1.5	LOGNORMAL	361.68
Mercury	ug/L	30	0.17	0.05	0.04	0.03	0.7	NORMAL	0.05
Nickel	ug/L	30	17.60	9.41	7.55	6.18	0.8	NORMAL	9.41
Potassium	ug/L	17	6,050.00	4,154.42	3,529.35	1,566.70	0.4	NORMAL	4,154.42
Selenium	ug/L	30	3.20	1.50	1.28	0.73	0.6	NORMAL	1.50
Sodium	ug/L	30	59,100.00	18,056.42	14,292.10	12,533.77	0.9	NORMAL	18,056.42
Vanadium	ug/L	30	39.20	31.13	10.76	11.07	1.0	LOGNORMAL	31.13
Zinc	ug/L	11	13.40	8.22	6.83	2.80	0.4	NORMAL	8.22
Cyanide	ug/L	30	14.90	6.10	5.50	2.00	0.4	NORMAL	6.10

TABLE 6-3

SURFACE WATER DATA FOR REEDER CREEK
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Methylene Chloride	ug/L	11	8.00	4.35	3.45	1.81	0.5	NORMAL	4.35
Acetone	ug/L	11	10.00	6.20	5.45	1.51	0.3	NORMAL	6.20
Carbon Disulfide	ug/L	11	5.00	3.76	3.18	1.17	0.4	NORMAL	3.76
1,2-Dichloroethane	ug/L	11	5.00	3.73	3.14	1.21	0.4	NORMAL	3.73
Trichloroethene	ug/L	11	5.00	3.76	3.18	1.17	0.4	NORMAL	3.76
Semivolatiles									
bis(2-Ethylhexyl)phthalate	ug/L	12	10.50	6.44	5.67	1.63	0.3	NORMAL	6.44
Explosives									
RDX	ug/L	12	0.67	0.17	0.12	0.17	1.5	LOGNORMAL	0.17
Tetryl	ug/L	12	0.20	0.13	0.10	0.06	0.7	NORMAL	0.13
Metals									
Aluminum	ug/L	9	300.00	139.41	93.23	84.22	0.9	NORMAL	139.41
Arsenic	ug/L	11	1.85	1.44	1.23	0.42	0.3	NORMAL	1.44
Barium	ug/L	11	66.60	57.50	52.15	10.78	0.2	NORMAL	57.50
Beryllium	ug/L	5	1.40	6.71	0.49	0.54	1.1	LOGNORMAL	1.40
Calcium	ug/L	11	121,000.00	101,720.78	94,363.64	14,833.36	0.2	NORMAL	101,720.78
Chromium	ug/L	11	4.80	4.27	3.43	1.70	0.5	NORMAL	4.27
Copper	ug/L	11	9.85	8.90	6.93	3.97	0.6	NORMAL	8.90
Iron	ug/L	8	737.00	545.46	376.21	291.00	0.8	NORMAL	545.46
Lead	ug/L	11	2.20	0.99	0.70	0.57	0.8	NORMAL	0.99
Magnesium	ug/L	11	18,700.00	15,763.98	14,443.64	2,662.06	0.2	NORMAL	15,763.98
Manganese	ug/L	10	236.00	130.42	88.02	81.51	0.9	NORMAL	130.42
Mercury	ug/L	11	0.11	0.05	0.04	0.02	0.5	NORMAL	0.05
Nickel	ug/L	11	17.60	15.10	11.49	7.28	0.6	NORMAL	15.10
Potassium	ug/L	8	3,800.00	3,453.38	2,913.63	928.06	0.3	NORMAL	3,453.38
Selenium	ug/L	11	1.60	1.12	0.97	0.31	0.3	NORMAL	1.12
Sodium	ug/L	11	59,100.00	29,193.12	22,377.27	13,742.00	0.6	NORMAL	29,193.12
Vanadium	ug/L	11	39.20	18.95	13.63	10.72	0.8	NORMAL	18.95
Zinc	ug/L	6	13.40	9.70	7.88	2.70	0.3	NORMAL	9.70
Cyanide	ug/L	11	14.90	7.95	6.35	3.21	0.5	NORMAL	7.95

TABLE 6-3

SURFACE WATER DATA FOR ONSITE WETLANDS
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Methylene Chloride	ug/L	19	5.00	4.30	3.82	1.28	0.3	NORMAL	4.30
Acetone	ug/L	19	35.00	9.68	7.11	6.82	1.0	NORMAL	9.68
Carbon Disulfide	ug/L	19	5.00	4.32	3.84	1.26	0.3	NORMAL	4.32
1,2-Dichloroethane	ug/L	19	5.00	4.30	3.82	1.28	0.3	NORMAL	4.30
Trichloroethene	ug/L	19	17.00	5.69	4.45	3.29	0.7	NORMAL	5.69
Semivolatiles									
bis(2-Ethylhexyl)phthalate	ug/L	19	71.00	10.39	8.50	15.14	1.8	LOGNORMAL	10.39
Explosives									
RDX	ug/L	19	9.40	1.93	0.93	2.30	2.5	LOGNORMAL	1.93
Tetryl	ug/L	19	0.52	0.18	0.14	0.12	0.8	NORMAL	0.18
Metals									
Aluminum	ug/L	13	5,220.00	18,766.22	882.22	1,477.14	1.7	LOGNORMAL	5,220.00
Arsenic	ug/L	19	4.40	1.97	1.50	1.26	0.8	NORMAL	1.97
Barium	ug/L	16	523.00	190.85	141.61	119.74	0.8	NORMAL	190.85
Beryllium	ug/L	18	1.30	0.56	0.41	0.36	0.9	NORMAL	0.56
Calcium	ug/L	19	183,000.00	110,972.32	94,473.68	43,717.86	0.5	NORMAL	110,972.32
Chromium	ug/L	19	8.60	3.10	2.37	1.93	0.8	NORMAL	3.10
Copper	ug/L	19	59.80	70.79	15.33	16.06	1.0	LOGNORMAL	59.80
Iron	ug/L	14	8,550.00	8,559.80	2,274.00	2,655.45	1.2	LOGNORMAL	8,550.00
Lead	ug/L	19	74.20	53.03	10.70	18.63	1.7	LOGNORMAL	53.03
Magnesium	ug/L	19	59,900.00	26,874.54	21,199.47	15,037.71	0.7	NORMAL	26,874.54
Manganese	ug/L	16	1,080.00	1,090.08	198.79	287.16	1.4	LOGNORMAL	1,080.00
Mercury	ug/L	19	0.17	0.06	0.04	0.03	0.7	NORMAL	0.06
Nickel	ug/L	19	17.50	6.83	5.27	4.14	0.8	NORMAL	6.83
Potassium	ug/L	9	6,050.00	5,093.57	4,076.67	1,854.54	0.5	NORMAL	5,093.57
Selenium	ug/L	19	3.20	1.78	1.46	0.84	0.6	NORMAL	1.78
Sodium	ug/L	19	34,200.00	13,092.80	9,611.21	9,225.47	1.0	NORMAL	13,092.80
Vanadium	ug/L	19	37.20	32.41	9.10	11.20	1.2	LOGNORMAL	32.41
Zinc	ug/L	5	6.75	7.48	5.56	2.61	0.5	NORMAL	6.75
Cyanide	ug/L	19	5.00	5.00	5.00	0.00	0.0	NORMAL	5.00

TABLE 6-3

SEDIMENT DATA - ALL LOCATIONS
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	units	COUNT	MAXIMUM	95 th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Acetone	ug/kg	30	34.00	10.24	8.72	5.06	0.6	NORMAL	10.24
Carbon Disulfide	ug/kg	32	7.00	5.51	5.09	1.42	0.3	NORMAL	5.51
Chloroform	ug/kg	32	20.00	6.79	5.88	3.13	0.5	NORMAL	6.79
Trichloroethene	ug/kg	32	18.00	6.37	5.61	2.62	0.5	NORMAL	6.37
Semivolatiles									
4-Methylphenol	ug/kg	25	500.00	354.20	314.20	121.57	0.4	NORMAL	354.20
Naphthalene	ug/kg	25	500.00	351.38	304.68	141.93	0.5	NORMAL	351.38
2-Methylnaphthalene	ug/kg	25	500.00	356.05	313.08	130.61	0.4	NORMAL	356.05
2,6-Dinitrotoluene	ug/kg	25	500.00	355.88	315.20	123.66	0.4	NORMAL	355.88
2,4-Dinitrotoluene	ug/kg	28	1,600.00	472.72	385.79	279.64	0.7	NORMAL	472.72
N-Nitrosodiphenylamine	ug/kg	26	500.00	356.64	312.31	137.43	0.4	NORMAL	356.64
Phenanthrene	ug/kg	28	600.00	368.99	313.29	179.20	0.6	NORMAL	368.99
Anthracene	ug/kg	26	500.00	361.46	320.08	128.28	0.4	NORMAL	361.46
Carbazole	ug/kg	14	270.00	232.90	208.00	56.64	0.3	NORMAL	232.90
Di-n-butylphthalate	ug/kg	26	510.00	375.52	330.58	139.30	0.4	NORMAL	375.52
Fluoranthene	ug/kg	26	500.00	353.91	306.58	146.71	0.5	NORMAL	353.91
Pyrene	ug/kg	26	500.00	344.28	294.85	153.22	0.5	NORMAL	344.28
Benzo(a)anthracene	ug/kg	26	500.00	361.09	318.96	130.58	0.4	NORMAL	361.09
Chrysene	ug/kg	26	500.00	357.13	311.54	141.31	0.5	NORMAL	357.13
bis(2-Ethylhexyl)phthalate	ug/kg	28	600.00	325.62	256.46	222.47	0.9	NORMAL	325.62
Benzo(b)fluoranthene	ug/kg	26	500.00	361.14	319.12	130.25	0.4	NORMAL	361.14
benzo(k)fluoranthene	ug/kg	26	500.00	361.16	319.19	130.09	0.4	NORMAL	361.16
Benzo(a)pyrene	ug/kg	26	500.00	360.98	318.58	131.42	0.4	NORMAL	360.98
Indeno(1,2,3-cd)pyrene	ug/kg	26	500.00	360.96	318.54	131.51	0.4	NORMAL	360.96
Pesticides/PCBs									
4,4'-DDE	ug/kg	29	29.50	16.14	12.97	10.38	0.8	NORMAL	16.14
4,4'-DDT	ug/kg	29	29.50	16.22	13.04	10.40	0.8	NORMAL	16.22
Explosives									
HMX	ug/kg	31	500.00	298.06	234.52	215.06	0.9	NORMAL	298.06
RDX	ug/kg	31	500.00	78.59	74.19	79.03	1.1	LOGNORM	78.59
2,4,6-Trinitrotoluene	ug/kg	31	100.00	63.41	61.29	7.18	0.1	NORMAL	63.41
4-amino-2,6-Dinitrotoluene	ug/kg	31	160.00	68.53	63.23	17.96	0.3	NORMAL	68.53
2-amino-4,6-Dinitrotoluene	ug/kg	31	180.00	71.14	64.68	21.87	0.3	NORMAL	71.14
2,4-Dinitrotoluene	ug/kg	31	98.00	66.04	63.13	9.84	0.2	NORMAL	66.04
Metals									
Aluminum	mg/kg	32	25,800.00	15,842.99	14,492.03	4,645.69	0.3	NORMAL	15,842.99
Antimony	mg/kg	16	28.30	8.83	6.37	5.99	0.9	NORMAL	8.83
Arsenic	mg/kg	25	9.50	5.61	4.96	1.99	0.4	NORMAL	5.61
Barium	mg/kg	25	1,780.00	318.01	218.07	350.59	1.6	LOGNORM	318.01
Beryllium	mg/kg	23	1.60	0.98	0.87	0.34	0.4	NORMAL	0.98
Cadmium	mg/kg	32	9.70	2.88	2.29	2.02	0.9	NORMAL	2.88
Calcium	mg/kg	32	104,000.00	35,025.15	21,409.38	24,951.77	1.2	LOGNORM	35,025.15
Chromium	mg/kg	25	41.80	25.09	23.01	6.32	0.3	NORMAL	25.09
Cobalt	mg/kg	25	17.70	11.81	10.77	3.16	0.3	NORMAL	11.81
Copper	mg/kg	32	3,790.00	400.76	280.06	765.78	2.7	LOGNORM	400.76
Iron	mg/kg	32	40,900.00	31,352.56	29,831.25	5,231.51	0.2	NORMAL	31,352.56
Lead	mg/kg	32	7,400.00	652.31	391.11	1,302.89	3.3	LOGNORM	652.31
Magnesium	mg/kg	32	12,000.00	7,029.59	6,430.63	2,059.73	0.3	NORMAL	7,029.59
Manganese	mg/kg	32	1,520.00	542.94	476.41	228.81	0.5	NORMAL	542.94
Mercury	mg/kg	27	2.00	0.57	0.29	0.46	1.6	LOGNORM	0.57
Nickel	mg/kg	25	64.40	38.25	34.89	10.20	0.3	NORMAL	38.25
Potassium	mg/kg	32	3,530.00	1,891.70	1,664.53	781.19	0.5	NORMAL	1,891.70
Selenium	mg/kg	24	1.80	0.86	0.71	0.54	0.8	NORMAL	0.86
Silver	mg/kg	17	1.90	0.74	0.57	0.44	0.8	NORMAL	0.74
Sodium	mg/kg	30	191.00	90.57	77.40	43.84	0.6	NORMAL	90.57
Vanadium	mg/kg	25	37.90	24.86	22.51	7.13	0.3	NORMAL	24.86
Zinc	mg/kg	27	1,200.00	391.17	245.44	261.97	1.1	LOGNORM	391.17
Cyanide	mg/kg	26	0.77	0.42	0.39	0.11	0.3	NORMAL	0.42

TABLE 6-3

SEDIMENT DATA FOR REEDER CREEK
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	units	COUNT	MAXIMUM	95 th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Acetone	ug/kg	11	11.50	9.98	8.95	2.07	0.2	NORMAL	9.98
Carbon Disulfide	ug/kg	11	6.50	5.44	4.86	1.16	0.2	NORMAL	5.44
Chloroform	ug/kg	11	20.00	9.32	6.91	4.85	0.7	NORMAL	9.32
Trichloroethene	ug/kg	11	6.50	5.44	4.86	1.16	0.2	NORMAL	5.44
Semivolatiles									
4-Methylphenol	ug/kg	8	490.00	393.07	318.13	128.87	0.4	NORMAL	393.07
Naphthalene	ug/kg	8	490.00	396.53	288.38	185.97	0.6	NORMAL	396.53
2-Methylnaphthalene	ug/kg	8	490.00	405.55	314.63	156.35	0.5	NORMAL	405.55
2,6-Dinitrotoluene	ug/kg	8	490.00	403.14	336.25	115.01	0.3	NORMAL	403.14
2,4-Dinitrotoluene	ug/kg	8	490.00	404.57	318.38	148.20	0.5	NORMAL	404.57
N-Nitrosodiphenylamine	ug/kg	8	490.00	403.23	325.63	133.43	0.4	NORMAL	403.23
Phenanthrene	ug/kg	8	490.00	388.53	269.38	204.87	0.8	NORMAL	388.53
Anthracene	ug/kg	8	490.00	403.14	336.25	115.01	0.3	NORMAL	403.14
Carbazole	ug/kg	3	225.00	222.53	203.33	20.21	0.1	NORMAL	222.53
Di-n-butylphthalate	ug/kg	8	490.00	384.59	317.50	115.36	0.4	NORMAL	384.59
Fluoranthene	ug/kg	8	490.00	402.33	311.75	155.75	0.5	NORMAL	402.33
Pyrene	ug/kg	8	490.00	402.55	310.75	157.84	0.5	NORMAL	402.55
Benzo(a)anthracene	ug/kg	8	490.00	403.14	336.25	115.01	0.3	NORMAL	403.14
Chrysene	ug/kg	8	490.00	402.63	310.38	158.63	0.5	NORMAL	402.63
bis(2-Ethylhexyl)phthalate	ug/kg	8	490.00	388.63	269.75	204.40	0.8	NORMAL	388.63
Benzo(b)fluoranthene	ug/kg	8	490.00	403.14	336.25	115.01	0.3	NORMAL	403.14
benzo(k)fluoranthene	ug/kg	8	490.00	403.14	336.25	115.01	0.3	NORMAL	403.14
Benzo(a)pyrene	ug/kg	8	490.00	403.14	336.25	115.01	0.3	NORMAL	403.14
Indeno(1,2,3-cd)pyrene	ug/kg	8	490.00	403.14	336.25	115.01	0.3	NORMAL	403.14
Pesticides/PCBs									
4,4'-DDE	ug/kg	9	21.50	18.56	13.72	8.83	0.6	NORMAL	18.56
4,4'-DDT	ug/kg	9	21.50	18.56	13.72	8.83	0.6	NORMAL	18.56
Explosives									
HMX	ug/kg	9	500.00	382.71	255.56	231.90	0.9	NORMAL	382.71
RDX	ug/kg	9	60.00	60.00	60.00	0.00	0.0	NORMAL	60.00
2,4,6-Trinitrotoluene	ug/kg	9	60.00	60.00	60.00	0.00	0.0	NORMAL	60.00
4-amino-2,6-Dinitrotoluene	ug/kg	9	60.00	60.00	60.00	0.00	0.0	NORMAL	60.00
2-amino-4,6-Dinitrotoluene	ug/kg	9	60.00	60.00	60.00	0.00	0.0	NORMAL	60.00
2,4-Dinitrotoluene	ug/kg	9	60.00	60.00	60.00	0.00	0.0	NORMAL	60.00
Metals									
Aluminum	mg/kg	10	15,600.00	12,095.21	10,104.50	3,826.86	0.4	NORMAL	12,095.21
Antimony	mg/kg	4	4.05	4.01	3.71	0.36	0.1	NORMAL	4.01
Arsenic	mg/kg	6	7.40	6.54	5.28	1.87	0.4	NORMAL	6.54
Barium	mg/kg	6	94.80	64.59	47.33	25.70	0.5	NORMAL	64.59
Beryllium	mg/kg	5	0.71	0.63	0.47	0.22	0.5	NORMAL	0.63
Cadmium	mg/kg	10	3.40	2.24	1.71	1.01	0.6	NORMAL	2.24
Calcium	mg/kg	10	104,000.00	45,908.57	32,490.00	25,795.28	0.8	NORMAL	45,908.57
Chromium	mg/kg	6	24.50	22.43	18.08	6.48	0.4	NORMAL	22.43
Cobalt	mg/kg	6	11.20	10.04	8.03	3.00	0.4	NORMAL	10.04
Copper	mg/kg	10	2,380.00	1,032.68	262.51	744.09	2.8	LOGNORM	1,032.68
Iron	mg/kg	10	38,500.00	32,120.19	29,060.00	5,882.78	0.2	NORMAL	32,120.19
Lead	mg/kg	10	332.00	418.55	94.17	123.54	1.3	LOGNORM	332.00
Magnesium	mg/kg	10	12,000.00	7,845.24	6,642.00	2,313.05	0.3	NORMAL	7,845.24
Manganese	mg/kg	10	596.00	471.82	420.00	99.61	0.2	NORMAL	471.82
Mercury	mg/kg	7	0.69	1.22	0.20	0.23	1.2	LOGNORM	0.69
Nickel	mg/kg	6	42.30	37.25	29.62	11.35	0.4	NORMAL	37.25
Potassium	mg/kg	10	1,750.00	1,276.01	1,081.50	373.91	0.3	NORMAL	1,276.01
Selenium	mg/kg	6	1.40	0.99	0.62	0.55	0.9	NORMAL	0.99
Silver	mg/kg	5	0.68	0.63	0.50	0.17	0.3	NORMAL	0.63
Sodium	mg/kg	9	112.00	90.89	78.81	22.03	0.3	NORMAL	90.89
Vanadium	mg/kg	6	20.10	17.66	13.90	5.61	0.4	NORMAL	17.66
Zinc	mg/kg	6	497.00	899.80	148.22	174.46	1.2	LOGNORM	497.00
Cyanide	mg/kg	10	0.77	0.50	0.42	0.16	0.4	NORMAL	0.50

TABLE 6-3

SEDIMENT DATA FOR ON-SITE WETLANDS
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
POTENTIAL CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	units	COUNT	MAXIMUM	95 th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Volatile Organics									
Acetone	ug/kg	19	34.00	10.93	8.58	6.24	0.7	NORMAL	10.93
Carbon Disulfide	ug/kg	21	7.00	5.77	5.21	1.55	0.3	NORMAL	5.77
Chloroform	ug/kg	21	7.00	5.91	5.33	1.60	0.3	NORMAL	5.91
Trichloroethene	ug/kg	21	18.00	7.10	6.00	3.08	0.5	NORMAL	7.10
Semivolatiles									
4-Methylphenol	ug/kg	17	500.00	361.04	312.35	122.03	0.4	NORMAL	361.04
Naphthalene	ug/kg	17	500.00	361.04	312.35	122.03	0.4	NORMAL	361.04
2-Methylnaphthalene	ug/kg	17	500.00	361.04	312.35	122.03	0.4	NORMAL	361.04
2,6-Dinitrotoluene	ug/kg	17	500.00	357.04	305.29	129.70	0.4	NORMAL	357.04
2,4-Dinitrotoluene	ug/kg	20	1,600.00	529.28	412.75	316.79	0.8	NORMAL	529.28
N-Nitrosodiphenylamine	ug/kg	18	500.00	361.66	306.39	142.56	0.5	NORMAL	361.66
Phenanthrene	ug/kg	20	600.00	393.53	330.85	170.39	0.5	NORMAL	393.53
Anthracene	ug/kg	18	500.00	365.73	312.89	136.29	0.4	NORMAL	365.73
Carbazole	ug/kg	11	270.00	240.96	209.27	63.88	0.3	NORMAL	240.96
Di-n-butylphthalate	ug/kg	18	510.00	395.12	336.39	151.46	0.5	NORMAL	395.12
Fluoranthene	ug/kg	18	500.00	361.32	304.28	147.13	0.5	NORMAL	361.32
Pyrene	ug/kg	18	500.00	347.96	287.78	155.22	0.5	NORMAL	347.96
Benzo(a)anthracene	ug/kg	18	500.00	365.32	311.28	139.38	0.4	NORMAL	365.32
Chrysene	ug/kg	18	500.00	365.50	312.06	137.85	0.4	NORMAL	365.50
bis(2-Ethylhexyl)phthalate	ug/kg	20	600.00	337.28	251.15	234.17	0.9	NORMAL	337.28
Benzo(b)fluoranthene	ug/kg	18	500.00	365.37	311.50	138.93	0.4	NORMAL	365.37
benzo(k)fluoranthene	ug/kg	18	500.00	365.40	311.61	138.72	0.4	NORMAL	365.40
Benzo(a)pyrene	ug/kg	18	500.00	365.20	310.72	140.50	0.5	NORMAL	365.20
Indeno(1,2,3-cd)pyrene	ug/kg	18	500.00	365.19	310.67	140.62	0.5	NORMAL	365.19
Pesticides/PCBs									
4,4'-DDE	ug/kg	20	29.50	16.76	12.64	11.20	0.9	NORMAL	16.76
4,4'-DDT	ug/kg	20	29.50	16.87	12.74	11.23	0.9	NORMAL	16.87
Explosives									
HMX	ug/kg	22	500.00	300.57	225.91	212.89	0.9	NORMAL	300.57
RDX	ug/kg	22	500.00	89.04	80.00	93.81	1.2	LOGNORM	89.04
2,4,6-Trinitrotoluene	ug/kg	22	100.00	64.81	61.82	8.53	0.1	NORMAL	64.81
4-amino-2,6-Dinitrotoluene	ug/kg	22	160.00	72.02	64.55	21.32	0.3	NORMAL	72.02
2-amino-4,6-Dinitrotoluene	ug/kg	22	180.00	75.67	66.59	25.88	0.4	NORMAL	75.67
2,4-Dinitrotoluene	ug/kg	22	98.00	68.45	64.41	11.51	0.2	NORMAL	68.45
Metals									
Aluminum	mg/kg	22	25,800.00	17,713.86	16,486.36	3,499.97	0.2	NORMAL	17,713.86
Antimony	mg/kg	12	28.30	10.46	7.25	6.75	0.9	NORMAL	10.46
Arsenic	mg/kg	19	9.50	5.63	4.85	2.07	0.4	NORMAL	5.63
Barium	mg/kg	19	1,780.00	366.08	271.98	388.48	1.4	LOGNORM	366.08
Beryllium	mg/kg	18	1.60	1.09	0.98	0.29	0.3	NORMAL	1.09
Cadmium	mg/kg	22	9.70	3.36	2.55	2.31	0.9	NORMAL	3.36
Calcium	mg/kg	22	85,500.00	27,698.71	16,372.73	23,427.55	1.4	LOGNORM	27,698.71
Chromium	mg/kg	19	41.80	26.66	24.56	5.56	0.2	NORMAL	26.66
Cobalt	mg/kg	19	17.70	12.67	11.64	2.74	0.2	NORMAL	12.67
Copper	mg/kg	22	3,790.00	489.13	288.04	792.57	2.8	LOGNORM	489.13
Iron	mg/kg	22	40,900.00	31,940.92	30,181.82	5,015.75	0.2	NORMAL	31,940.92
Lead	mg/kg	22	7,400.00	1,674.71	526.09	1,561.49	3.0	LOGNORM	1,674.71
Magnesium	mg/kg	22	10,800.00	7,030.59	6,334.55	1,984.65	0.3	NORMAL	7,030.59
Manganese	mg/kg	22	1,520.00	595.38	502.05	266.13	0.5	NORMAL	595.38
Mercury	mg/kg	20	2.00	0.93	0.32	0.51	1.6	LOGNORM	0.93
Nickel	mg/kg	19	64.40	40.15	36.55	9.54	0.3	NORMAL	40.15
Potassium	mg/kg	22	3,530.00	2,202.45	1,929.55	778.14	0.4	NORMAL	2,202.45
Selenium	mg/kg	18	1.80	0.91	0.73	0.54	0.7	NORMAL	0.91
Silver	mg/kg	12	1.90	0.84	0.59	0.52	0.9	NORMAL	0.84
Sodium	mg/kg	21	191.00	95.07	76.80	50.91	0.7	NORMAL	95.07
Vanadium	mg/kg	19	37.90	27.17	25.23	5.14	0.2	NORMAL	27.17
Zinc	mg/kg	21	1,200.00	446.88	273.22	279.21	1.0	LOGNORM	446.88
Cyanide	mg/kg	16	0.44	0.39	0.37	0.05	0.1	NORMAL	0.39

Additional screening was performed to further reduce the list of chemicals included in the human health baseline risk assessment. If a chemical was detected in less than 5% of all analyses for a given media, the maximum detected value was compared to an ARAR or a TBC. If the maximum value was less than the ARAR or the TBC and the chemical was not detected in any other media, then it was eliminated from the baseline human health risk assessment. The results of this screening are presented in Table 6-4. Six volatile organic compounds, 9 semivolatiles and 15 pesticide/PCB's in soils were eliminated. No chemicals from groundwater, surface water or sediment were eliminated.

Next the five chemicals that are essential human nutrients were eliminated from all media. These are calcium, iron, magnesium, potassium, and sodium.

The final step was a concentration-toxicity screen in which the maximum detected concentration of each analyte in each media was multiplied by the RfD or the carcinogenic slope factor to arrive at a concentration-toxicity value. These values were then summed and the percentage contribution of each analyte calculated. Any analyte that contributed less than 1% of the total concentration-toxicity value was eliminated from the baseline risk assessment. If an analyte did not have a RfD or carcinogenic slope factor, it was retained in the baseline risk assessment. These compounds were generally considered in a qualitative discussion, though when available the data was evaluated with an agency-approved method. An example is lead, which was evaluated with an EPA approved biokinetic uptake model. The results of the concentration-toxicity screening are presented on Table 6-5. For soil, following this final screen no volatile organics were retained, 12 semi-volatiles were retained, 3 pesticides were retained, 6 explosives were retained and 7 metals were retained. For groundwater, 1 VOC was retained, 2 semi-volatiles were retained and 3 explosives were retained. No metals were retained. For surface water, 2 VOCs were retained, 1 semi-volatile was retained, 2 explosives were retained and 10 metals were retained. For sediment, no VOCs were retained, 7 semi-volatiles were retained, no pesticides/PCBs were retained, 2 explosives were retained and 15 metals were retained.

Table 6-6 identifies the compounds remaining after this screening process that will be quantified in the baseline human health risk assessment.

TABLE 6-4

HUMAN HEALTH RISK ASSESSMENT CHEMICALS DETECTED IN LESS THAN 5% OF SURFACE SOIL SAMPLES

SENECA ARMY DEPOT OB GROUNDS

Compound	Number of Samples	Number of Detections	Frequency of Detection	Maximum Value Detected	TAGM(a)	Detected In Other Media (b)	Passed Screening
Volatile Organics-ug/kg							
Methylene Chloride	195	7	3.6%	21.0	100	SW	yes
Acetone	193	3	1.6%	230.0	200	GW,SW,SD	yes
1,2-Dichloroethene (total)	195	1	0.5%	8.0	300	none	no
2-Butanone	196	4	2.0%	11.0	300	none	no
1,1,1-Trichloroethane	195	1	0.5%	8.0	800	none	no
Carbon Tetrachloride	195	2	1.0%	8.0	600	none	no
Trichloroethene	195	8	4.1%	100.0	700	SW,SD	yes
Benzene	195	4	2.1%	8.0	60	none	yes(c)
Chlorobenzene	195	1	0.5%	8.0	1,700	none	no
Xylene (total)	195	3	1.5%	8.0	1,200	none	no
Semivolatiles-ug/kg							
Phenol	180	2	1.1%	425.0	30	none	yes
2-Methylphenol	180	2	1.1%	425.0	100	none	yes
4-Methylphenol	183	2	1.1%	440.0	900	SD	yes
2,4-Dimethylphenol	180	2	1.1%	425.0	-	none	no
Benzoic acid	92	2	2.2%	2,200.0	-	none	no
2-Chloronaphthalene	182	2	1.1%	435.0	-	none	no
2-Nitroaniline	189	1	0.5%	2,200.0	430	none	yes
Acenaphthylene	182	3	1.6%	540.0	41,000	none	no
3-Nitroaniline	189	1	0.5%	2,500.0	500	none	yes
Acenaphthene	184	8	4.3%	435.0	50,000	none	no
Dibenzofuran	183	4	2.2%	435.0	6,200	none	no
Fluorene	185	7	3.8%	440.0	50,000	none	no
Hexachlorobenzene	184	5	2.7%	440.0	410	none	yes
Pentachlorophenol	190	2	1.1%	2,200.0	1,000	none	no
Anthracene	185	9	4.9%	700.0	50,000	SD	yes
Carbazole	94	5	5.3%	1,200.0	-	SD	yes
Butylbenzylphthalate	183	4	2.2%	435.0	50,000	none	no
Di-n-octylphthalate	181	4	2.2%	425.0	50,000	GW	yes
Indeno(1,2,3-cd)pyrene	188	10	5.3%	2,300.0	3,200	SD	yes
Dibenz(a,h)anthracene	183	4	2.2%	670.0	14	none	yes
Pesticides/PCBs-ug/kg							
beta-BHC	189	1	0.5%	11.5	200	none	no
delta-BHC	189	4	2.1%	15.0	300	none	no
gamma-BHC (Lindane)	189	1	0.5%	11.5	60	none	no
Heptachlor	189	1	0.5%	32.0	100	none	no
Aldrin	189	9	4.8%	11.5	41	none	no
Heptachlor epoxide	189	1	0.5%	11.5	20	none	no
Endosulfan I	189	6	3.2%	11.5	900	none	no
Dieldrin	191	1	0.5%	50.0	44	none	yes
Endrin	191	5	2.6%	50.0	100	none	no
Endosulfan II	192	6	3.1%	480.0	900	none	no
4,4'-DDD	189	9	4.8%	23.5	2,900	none	no
Endosulfan sulfate	189	5	2.6%	23.5	1,000	none	no
Endrin aldehyde	99	1	1.0%	20.5	-	none	no
alpha-Chlordane	190	7	3.7%	270.0	-	none	no
Aroclor-1254	189	1	0.5%	430.0	1,000	none	no
Aroclor-1260	189	2	1.1%	240.0	1,000	none	no
Explosives-ug/kg							
HMX	195	6	3.1%	1,300.0	-	SD	yes
1,3-Dinitrobenzene	194	9	4.6%	440.0	-	none	yes
Tetryl	195	8	4.1%	1,000.0	-	SW	yes
2,6-Dinitrotoluene	194	1	0.5%	125.0	-	GW	yes

Notes: a) TAGM = New York recommended soil cleanup objectives from Appendix A, Table 1 from TAGM dated Nov. 16, 1992

b) SW = Surface water, SD = Sediment, GW = Groundwater

c) Benzene passed screening since it is a Class A carcinogen.

TABLE 6-4

HUMAN HEALTH RISK ASSESSMENT CHEMICALS DETECTED IN LESS THAN 5% OF SURFACE WATER SAMPLES

SENECA ARMY DEPOT OB GROUNDS

Compound	Number of Samples	Number of Detections	Frequency of Detection	Maximum Value Detected	ARAR (a)	Detected In Other Media (b)	Passed Screening
Volatile Organics-ug/L							
Methylene Chloride	30	1	3.3%	8.0	4.7	S	yes
Carbon Disulfide	30	1	3.3%	5.0	-	SD	yes
1,2-Dichloroethane	30	1	3.3%	5.0	0.38	none	yes
Trichloroethene	30	1	3.3%	17.0	2.7	S,SD	yes
Semivolatiles-ug/L							
bis(2-Ethylhexyl)phthalate	31	1	3.2%	71.0	0.6(c)	S,SD	yes
Explosives-ug/L							
Tetryl	31	1	3.2%	0.5	-	S	yes
Metals-ug/L							
Chromium	30	1	3.3%	8.6	644	GW,S,SD	yes
Nickel	30	1	3.3%	17.6	259.1	GW,S,SD	yes

Notes: a) ARAR = The most stringent limit in the New York and Federal ambient water quality criteria.
b) SD = Sediment, GW = Groundwater, S = Soil
c) ARAR = Nov. 15, 1991 New York guidance value.

TABLE 6-4

HUMAN HEALTH RISK ASSESSMENT
CHEMICALS DETECTED IN LESS THAN 5% OF SEDIMENT SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Compound	Number of Samples	Number of Detections	Frequency of Detection	Maximum Value Detected	ARAR (a)	Detected In Other Media (b)	Passed Screening
Volatile Organics-ug/kg							
Trichloroethene	32	1	3.1%	18	20	SW, S	yes
Semivolatiles-ug/kg							
2-Methylnaphthalene	25	1	4.0%	500	-	S	yes
2,6-Dinitrotoluene	25	1	4.0%	500	1	GW,S	yes
N-Nitrosodiphenylamine	26	1	3.8%	500	-	S	yes
Anthracene	26	1	3.8%	500	-	S	yes
Benzo(a)anthracene	26	1	3.8%	500	13	S	yes
Benzo(b)fluoranthene	26	1	3.8%	500	13	S	yes
benzo(k)fluoranthene	26	1	3.8%	500	13	S	yes
Benzo(a)pyrene	26	1	3.8%	500	13	S	yes
Indeno(1,2,3-cd)pyrene	26	1	3.8%	500	13	S	yes
Explosives-ug/kg							
RDX	31	1	3.2%	500	-	GW,SW,S	yes
2,4,6-Trinitrotoluene	31	1	3.2%	100	-	GW,S	yes
4-amino-2,6-Dinitrotoluene	31	1	3.2%	160	-	S	yes

Notes: a) ARAR =NYSDEC 1989 Guidelines for Sediment, lowest value of Aquatic Toxicity, Human Health, and Wildlife Residue basis.

b) SW = Surface water, GW = Groundwater, S = Soils

TABLE 6-5

HUMAN HEALTH RISK ASSESSMENT
CONCENTRATION-TOXICITY SCREENING OF SURFACE SOIL SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Max. Conc.	RfD mg/kg/day	Rank Wt. of Evidence	Carc. Slope Oral mg/kg/day-1	Carc. Slope Inh mg/kg/day-1	Conc.-Tox Value (Non-Carc.)	Conc.-Tox Value (Carcinogenic)	Conc.-Tox % (Non-Carc.)	Conc.-Tox % (Carcinogenic)	Passed Screening
Volatile Organics-ug/kg										
Methylene Chloride	21.00	6.00E-02	B2	7.50E-03	1.65E-03	3.5E+02	1.6E-01	0.0000%	0.0003%	no
Acetone	230.00	1.00E-01	D	NA	NA	2.3E+03		0.0001%		no
Chloroform	10.00	1.00E-02	B2	6.10E-03	8.05E-02	1.0E+03	8.1E-01	0.0000%	0.0014%	no
Trichloroethene	100.00	NA	-	1.10E-02	6.00E-03		1.1E+00		0.0019%	no
Benzene	8.00	NA	A	2.90E-02	2.91E-02		2.3E-01		0.0004%	no
Tetrachloroethene	110.00	1.00E-02	-	5.00E-02	2.00E-03	1.1E+04	5.5E+00	0.0004%	0.0093%	no
Toluene	8.00	2.00E-01	D	NA	NA	4.0E+01		0.0000%		no
Total Voc's						**1.5E+04**	**7.8E+00**			
Semi-volatiles-ug/kg										
Phenol	425.00	6.00E-01	D	NA	NA	7.1E+02		0.0000%		no
Methylphenol, 2-	425.00	5.00E-02	C	NA	NA	8.5E+03		0.0003%		no
Methylphenol, 4-	440.00	5.00E-03	C	NA	NA	8.8E+04		0.0029%		no
Naphthalene	440.00	4.00E-02	D	NA	NA	1.1E+04		0.0004%		no
Methylnaphthalene, 2-	1,300.00	NA	-	NA	NA					yes
Nitroaniline, 2-	2,500.00	2.00E-04	-	NA	NA	1.3E+07		0.4170%		no
Dinitrotoluene, 2,6-	2,000.00	1.00E-03	-	NA	NA	2.0E+06		0.0667%		no
Nitroaniline, 3-	2,500.00	NA	-	NA	NA					yes
Dinitrotoluene, 2,4-	33,000.00	2.00E-03	-	NA	NA	1.7E+07		**0.5505%**		yes
Diethylphthalate	450.00	8.00E+00	-	NA	NA	5.6E+01		0.0000%		no
N-Nitrosodiphenylamine	7,000.00	NA	B2	4.90E-03	NA		3.4E+01		0.0578%	no
Hexachlorobenzene	440.00	3.00E-04	-	NA	NA	1.5E+06		0.0489%		no
Phenanthrene	2,600.00	NA	-	NA	NA					yes
Anthracene	700.00	3.00E-01	D	NA	NA	2.3E+03		0.0001%		no
Carbazole	1,200.00	NA	B2	2.00E-02	NA		2.4E+01		0.0404%	no
Di-n-butylphthalate	5,800.00	1.00E-01	D	NA	NA	5.8E+04		0.0019%		no
Fluoranthene	4,400.00	4.00E-02	D	NA	NA	1.1E+05		0.0037%		no
Pyrene	5,600.00	3.00E-02	-	NA	NA	1.9E+05		0.0062%		no
Benzo(a)anthracene	3,900.00	NA	B2	1.06E+00	NA		4.1E+03		**6.9614%**	yes
Chrysene	8,900.00	NA	B2	3.21E-02	NA		2.9E+02		**0.4811%**	yes
bis(2-Ethylhexyl)phthalate	16,000.00	2.00E-02	B2	1.40E-02	NA	8.0E+05	2.2E+02	0.0267%	0.3772%	no
Di-n-octylphthalate	425.00	2.00E-02	-	NA	NA	2.1E+04		0.0007%		no
Benzo(b)fluoranthene	11,000.00	NA	B2	1.02E+00	NA		1.1E+04		**18.8937%**	yes
Benzo(k)fluoranthene	4,500.00	NA	B2	4.82E-01	NA		2.2E+03		**3.6524%**	yes
Benzo(a)pyrene	3,700.00	NA	B2	7.30E+00	NA		2.7E+04		**45.4829%**	yes
Indeno(1,2,3-cd)pyrene	2,300.00	NA	B2	1.69E+00	NA		3.9E+03		**6.5454%**	yes
Dibenz(a,h)anthracene	670.00	NA	B2	8.10E+00	NA		5.4E+03		**9.1387%**	yes
Benzo(g,h,i)perylene	960.00	NA	-	NA	NA					yes
Total Semi-Voa's						**3.4E+07**	**5.4E+04**			
Pesticides/PCB's-ug/kg										
Dieldrin	50.00	5.00E-05	B2	1.60E+01	1.61E+01	1.0E+06	8.0E+02	0.0334%	**1.3471%**	yes
DDE, 4,4'-	830.00	NA	B2	3.40E-01	3.40E-01		2.8E+02		**0.4752%**	yes
DDT, 4,4'-	2,800.00	5.00E-04	B2	3.40E-01	3.40E-01	5.6E+06	9.5E+02	0.1868%	**1.6031%**	yes
Total Pesticides						**6.6E+06**	**2.0E+03**			
Explosives-ug/kg										
HMX	1,300.00	5.00E-02	D	NA	NA	2.6E+04		0.0009%		no
RDX	4,800.00	3.00E-03	C	1.10E-01	NA	1.6E+06	5.3E+02	0.0534%	**0.8891%**	yes
Trinitrobenzene, 1,3,5-	7,800.00	5.00E-05	-	NA	NA	1.6E+08		**5.2045%**		yes
Dinitrobenzene, 1,3-	440.00	1.00E-03	-	NA	NA	4.4E+05		0.0147%		no
Tetryl	1,000.00	NA	-	NA	NA					yes
Trinitrotoluene, 2,4,6-	80,000.00	5.00E-04	C	3.00E-02	NA	1.6E+08	2.4E+03	**5.3379%**	**4.0414%**	yes
Dinitrotoluene, 2,6-, 4-amino-	8,900.00	NA	-	NA	NA					yes
Dinitrotoluene, 4,6-, 2-amino-	11,000.00	NA	-	NA	NA					yes
Dinitrotoluene, 2,6-	125.00	1.00E-03	-	NA	NA	1.3E+05		0.0042%		no
Dinitrotoluene, 2,4-	5,100.00	2.00E-03	-	NA	NA	2.6E+06		0.0851%		no
Total Explosives						**3.2E+08**	**2.9E+03**			
Metals-mg/kg										
Barium	34,400.00	7.00E-02	-	NA	NA	4.9E+08		**16.3950%**		yes
Cadmium	28.20	5.00E-04	B1	NA	6.30E+00	5.6E+07		**1.8816%**		yes
Chromium	1,430.00	5.00E-03	-	NA	4.20E+01	2.9E+08		**9.5415%**		yes
Copper	38,100.00	4.00E-02	D	NA	NA	9.5E+08		**31.7772%**		yes
Lead	56,700.00	NA	B2	NA	NA					yes
Mercury	1.10	3.00E-04	-	NA	NA	3.7E+06		0.1223%		no
Selenium	3.30	5.00E-03	-	NA	NA	6.6E+05		0.0220%		no
Thallium	38.00	9.00E-05	-	NA	NA	4.2E+08		**14.0861%**		yes
Zinc	127,000.00	3.00E-01	D	NA	NA	4.2E+08		**14.1232%**		yes
Cyanide	2.20	2.00E-02	D	NA	NA	1.1E+05		0.0037%		no
Total Metals						**2.6E+09**	**0.0E+00**			
Total Compounds						**3.0E+09**	**5.9E+04**	**100.00%**	**100.00%**	

TABLE 6-5

HUMAN HEALTH RISK ASSESSMENT
CONCENTRATION-TOXICITY SCREENING OF GROUNDWATER SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Analyte	**Max. Conc.**	**RfD** mg/kg/day	**Rank** Weight of Evidence	**Carc. Slope**		**Conc.-Tox Value** (Non-Carc.)	**Conc.-Tox Value** (Carcinogenic)	**Conc.-Tox %** (Non-Carc.)	**Conc.-Tox %** (Carcinogenic)	**Passed Screening**
				Oral mg/kg/day-1	Inh mg/kg/day-1					
Volatile Organics-ug/L										
Acetone	15.00	1.00E-01	D	NA	NA	1.5E+02		**23.0548%**		yes
Total Voc's						**1.5E+02**	**0.0E+00**			
Semi-volatiles-ug/L										
Diethylphthalate	5.00	8.00E+00	-	NA	NA	6.3E-01		0.0961%		no
Di-n-butylphthalate	5.00	1.00E-01	D	NA	NA	5.0E+01		**7.6849%**		yes
Di-n-octylphthalate	5.00	2.00E-02	-	NA	NA	2.5E+02		**38.4246%**		yes
Total Semi-Voa's						**3.0E+02**	**0.0E+00**			
Explosives-ug/L										
RDX	0.06	3.00E-03	C	1.10E-01	NA	2.0E+01	6.6E-03	**3.0740%**	**78.5714%**	yes
Trinitrotoluene, 2,4,6-	0.06	5.00E-04	C	3.00E-02	NA	1.2E+02	1.8E-03	**18.4438%**	**21.4286%**	yes
Dinitrotoluene, 2,6-	0.06	1.00E-03	-	NA	NA	6.0E+01		**9.2219%**		yes
Total Explosives						**2.0E+02**	**8.4E-03**			
Total Compounds						**6.5E+02**	**8.4E-03**	**100.0%**	**100.0%**	

TABLE 6-5

HUMAN HEALTH RISK ASSESSMENT
CONCENTRATION-TOXICITY SCREENING OF SURFACE WATER SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Analyte	**Max. Conc.**	**RfD** mg/kg/day	**Rank** Weight of Evidence	**Carc. Slope**		**Conc.-Tox Value** (Non-Carc.)	**Conc.-Tox Value** (Carcinogenic)	**Conc.-Tox %** (Non-Carc.)	**Conc.-Tox %** (Carcinogenic)	**Passed Screening**
				Oral mg/kg/day-1	Inh mg/kg/day-1					
Volatile Organics-ug/L										
Methylene Chloride	8.00	6.00E-02	B2	7.50E-03	1.65E-03	1.3E+02	6.0E-02	0.0520%	0.3647%	no
Acetone	35.00	1.00E-01	D	NA	NA	3.5E+02		0.1365%		no
Carbon Disulfide	5.00	1.00E-01	-	NA	NA	5.0E+01		0.0195%		no
Dichloroethane, 1,2-	5.00	NA	B2	9.10E-02	9.10E-02		4.6E-01		**2.7660%**	yes
Trichloroethene	17.00	NA	D	1.10E-02	6.00E-03		1.9E-01		**1.1368%**	yes
Total VOC 's						**5.3E+02**	**7.0E-01**			
Semi-volatiles-ug/L										
bis(2-Ethylhexyl)phthalate	71.00	2.00E-02	B2	1.40E-02	NA	3.6E+03	9.9E-01	**1.3843%**	**6.0426%**	yes
Total Semi-Voa's						**3.6E+03**	**9.9E-01**			
Explosives-ug/L										
RDX	9.40	3.00E-03	C	1.10E-01	NA	3.1E+03	1.0E+00	**1.2218%**	**6.2857%**	yes
Tetryl	0.52	NA	-	NA	NA					yes
Total Explosives						**3.1E+03**	**1.0E+00**			
Metals-ug/L										
Aluminum	5,220.00	NA	-	NA	NA					yes
Arsenic	4.40	3.00E-04	A	1.75E+00	1.51E+01	1.5E+04	7.7E+00	**5.7192%**	**46.8085%**	yes
Barium	523.00	7.00E-02	-	NA	NA	7.5E+03		**2.9134%**		yes
Beryllium	1.40	5.00E-03	B2	4.30E+00	8.40E+00	2.8E+02	6.0E+00	0.1092%	**36.5957%**	yes
Chromium	8.60	5.00E-03	-	NA	4.20E+01	1.7E+03		**0.6707%**		yes
Copper	59.80	4.00E-02	D	NA	NA	1.5E+03		**0.5830%**		yes
Lead	74.20	NA	B2	NA	NA					yes
Manganese	1,080.00	5.00E-03	D	NA	NA	2.2E+05		**84.2282%**		yes
Mercury	0.17	3.00E-04	-	NA	NA	5.7E+02		0.2210%		no
Nickel	17.60	NA	-	NA	8.40E-01					yes
Selenium	3.20	5.00E-03	-	NA	NA	6.4E+02		0.2496%		no
Vanadium	39.20	7.00E-03	-	NA	NA	5.6E+03		**2.1837%**		yes
Zinc	13.40	3.00E-01	D	NA	NA	4.5E+01		0.0174%		no
Cyanide	14.90	2.00E-02	D	NA	NA	7.5E+02		0.2905%		no
Total Metals						**2.5E+05**	**1.4E+01**			
Total Compounds						**2.6E+05**	**1.6E+01**	**100.0%**	**100.0%**	

TABLE 6-5

HUMAN HEALTH RISK ASSESSMENT
CONCENTRATION-TOXICITY SCREENING OF SEDIMENT SAMPLES

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Max. Conc.	RfD mg/kg/day	Rank Weight of Evidence	Carc. Slope		Conc.-Tox Value (Non-Carc.)	Conc.-Tox Value (Carcinogenic)	Conc.-Tox % (Non-Carc.)	Conc.-Tox % (Carcinogenic)	Passed Screening
				Oral mg/kg/day-	Inh mg/kg/day-1					
Volatile Organics-ug/kg										
Acetone	34.00	1.00E-01	D	NA	NA	3.4E+02		0.0001%		no
Chloroform	20.00	1.00E-02	B2	6.10E-03	8.05E-02	2.0E+03	1.6E+00	0.0003%	0.0055%	no
Carbon Disulfide	7.00	1.00E-01	-	NA	NA	7.0E+01		0.0000%		no
Trichloroethene	18.00	NA	-	1.10E-02	6.00E-03		2.0E-01		0.0007%	no
Total VOC 's						**2.4E+03**	**1.8E+00**			
Semi-volatiles-ug/kg										
Methylphenol, 4-	500.00	5.00E-03	C	NA	NA	1.0E+05		0.0174%		no
Naphthalene	500.00	4.00E-02	D	NA	NA	1.3E+04		0.0022%		no
Methylnaphthalene, 2-	500.00	NA	-	NA	NA					yes
Dinitrotoluene, 2,6-	500.00	1.00E-03	-	NA	NA	5.0E+05		0.0872%		no
Dinitrotoluene, 2,4-	1,600.00	2.00E-03	-	NA	NA	8.0E+05		0.1395%		no
N-Nitrosodiphenylamine	500.00	NA	B2	4.90E-03	NA		2.5E+00		0.0083%	no
Phenanthrene	600.00	NA	-	NA	NA					yes
Anthracene	500.00	3.00E-01	D	NA	NA	1.7E+03		0.0003%		no
Carbazole	270.00	NA	-	2.00E-02	NA		5.4E+00		0.0184%	no
Di-n-butylphthalate	510.00	1.00E-01	D	NA	NA	5.1E+03		0.0009%		no
Fluoranthene	500.00	4.00E-02	D	NA	NA	1.3E+04		0.0022%		no
Pyrene	500.00	3.00E-02	-	NA	NA	1.7E+04		0.0029%		no
Benzo(a)anthracene	500.00	NA	B2	1.06E+00	NA		5.3E+02		**1.8031%**	yes
Chrysene	500.00	NA	-	3.21E-02	NA		1.6E+01		0.0546%	no
bis(2-Ethylhexyl)phthalate	600.00	2.00E-02	B2	1.40E-02	NA	3.0E+04	8.4E+00	0.0052%	0.0286%	no
Benzo(b)fluoranthene	500.00	NA	B2	1.02E+00	NA		5.1E+02		**1.7351%**	yes
Benzo(k)fluoranthene	500.00	NA	B2	4.82E-01	NA		2.4E+02		**0.8199%**	yes
Benzo(a)pyrene	500.00	NA	B2	7.30E+00	NA		3.7E+03		**12.4179%**	yes
Indeno(1,2,3-cd)pyrene	500.00	NA	B2	1.69E+00	NA		8.5E+02		**2.8748%**	yes
Total Semi-Voa's						**1.5E+06**	**5.8E+03**			
Pesticides/PCB's-ug/kg										
DDE, 4,4'-	29.50	NA	B2	3.40E-01	3.40E-01		1.0E+01		0.0341%	no
DDT, 4,4'-	29.50	5.00E-04	B2	3.40E-01	3.40E-01	5.9E+04	1.0E+01	0.0103%	0.0341%	no
Total Pesticides						**5.9E+04**	**2.0E+01**			
Explosives-ug/kg										
HMX	500.00	5.00E-02	D	NA	NA	1.0E+04		0.0017%		no
RDX	500.00	3.00E-03	C	1.10E-01	NA	1.7E+05	5.5E+01	0.0291%	0.1871%	no
Trinitrotoluene, 2,4,6-	100.00	5.00E-04	C	3.00E-02	NA	2.0E+05	3.0E+00	0.0349%	0.0102%	no
Dinitrotoluene, 2,6-, 4-amino-	160.00	NA	-	NA	NA					yes
Dinitrotoluene, 4,6-, 2-amino-	180.00	NA	-	NA	NA					yes
Dinitrotoluene, 2,4-	98.00	2.00E-03	-	NA	NA	4.9E+04		0.0085%		no
Total Explosives						**4.3E+05**	**5.8E+01**			
Metals-mg/kg										
Aluminum	25,800.00	NA	-	NA	NA					yes
Antimony	28.30	4.00E-04	-	NA	NA	7.1E+07		**12.3365%**		yes
Arsenic	9.50	3.00E-04	A	1.75E+00	1.51E+01	3.2E+07	1.7E+04	**5.5216%**	**56.5608%**	yes
Barium	1,780.00	7.00E-02	-	NA	NA	2.5E+07		**4.4339%**		yes
Beryllium	1.60	5.00E-03	B2	4.30E+00	8.40E+00	3.2E+05	6.9E+03	0.0558%	**23.4068%**	yes
Cadmium	9.70	5.00E-04	B1	NA	6.30E+00	1.9E+07		**3.3827%**		yes
Chromium	41.80	5.00E-03	-	NA	4.20E+01	8.4E+06		**1.4577%**		yes
Cobalt	17.70	NA	-	NA	NA					yes
Copper	3,790.00	4.00E-02	D	NA	NA	9.5E+07		**16.5214%**		yes
Lead	7,400.00	NA	B2	NA	NA					yes
Manganese	1,520.00	5.00E-03	D	NA	NA	3.0E+08		**53.0078%**		yes
Mercury	2.00	3.00E-04	-	NA	NA	6.7E+06		**1.1625%**		yes
Nickel	64.40	NA	-	NA	8.40E-01					yes
Selenium	1.80	5.00E-03	-	NA	NA	3.6E+05		0.0628%		no
Silver	1.90	5.00E-03	-	NA	NA	3.8E+05		0.0663%		no
Vanadium	37.90	7.00E-03	-	NA	NA	5.4E+06		**0.9441%**		yes
Zinc	1,200.00	3.00E-01	D	NA	NA	4.0E+06		**0.6975%**		yes
Cyanide	0.77	2.00E-02	D	NA	NA	3.9E+04		0.0067%		no
Total Metals						**5.7E+08**	**2.4E+04**			
Total Compounds						**5.7E+08**	**2.9E+04**	**100.0%**	**100.0%**	

6.3 EXPOSURE ASSESSMENT

6.3.1 Overview and Characterization of Exposure Setting

The objective of the exposure assessment is to estimate the type and magnitude of exposures to the chemicals of potential concern that are present at, or migrating from, the site. A completed exposure pathway has the following four elements:

- a source and mechanism for chemical release,
- an environmental transport medium,
- an exposure point, and
- a human receptor and a feasible route of exposure at the exposure point.

A pathway cannot be completed unless each of these elements is present.

An exposure point concentration is the concentration of chemical(s) in a given medium to which an actual or hypothetical receptor may be exposed at a specific location, known as the "exposure point." Exposure point concentrations can be based on analytical data obtained from on-site sampling, estimated through modeling, or based on a combination of the two.

For purposes of this baseline risk assessment, three types of potentially exposed populations are considered. Under the current land-use scenario, the exposed population includes off-site child and adult residents, and an adult on-site worker. Under the future land-use scenario, child and adult residents are considered to live on the site and represent the hypothetical exposed population. In both land-use scenarios, the child and adult are considered the same individual for the 30-year residential duration. For each land-use scenario, the calculated 30-year residential exposure is equal to the weighted average of six years of child exposure and 24 years of adult exposure.

The exposure assessment is the determination or estimation of the magnitude, duration, frequency, and route of exposure. This component of the risk assessment can be performed on either a qualitative or quantitative basis with the quantitative being the more preferred method given the availability of the toxicity factors necessary to characterize a compound of concern (quantitatively).

TABLE 6-6

LIST OF CHEMICALS QUANTIFIED IN HUMAN HEALTH RISK ASSESSMENT

SENECA ARMY DEPOT
OB GROUNDS

ANALYTE	SURFACE SOILS	GROUNDWATER	SURFACE WATER	SEDIMENT
Volatile Organics				
Acetone		X		
Dichloroethane,1,2-			X	
Trichloroethene			X	
Semivolatiles				
Methylnaphthalene, 2-	X			X
Nitroaniline, 3-	X			
Dinitrotoluene, 2,4-	X			
Phenanthrene	X			X
Di-n-butylphthalate		X		
Benzo(a)anthracene	X			X
Chrysene	X			
bis(2-Ethylhexyl)phthalate			X	
Di-n-octylphthalate		X		
Benzo(b)fluoranthene	X			X
Benzo(k)fluoranthene	X			X
Benzo(a)pyrene	X			X
Indeno(1,2,3-cd)pyrene	X			X
Dibenz(a,h)anthracene	X			
Benzo(g,h,i)perylene	X			
Pesticides/PCB's				
Dieldrin	X			
DDE, 4,4'-	X			
DDT, 4,4'-	X			
Explosives				
RDX	X	X	X	
Trinitrobenzene, 1,3,5-	X			
Tetryl	X		X	
Trinitrotoluene, 2,4,6-	X	X		
Dinitrotoluene, 2,6-, 4-amino-	X			X
Dinitrotoluene, 4,6-, 2-amino-	X			X
Dinitrotoluene, 2,6-		X		
Metals				
Aluminum			X	X
Antimony				X
Arsenic			X	X
Barium	X		X	X
Beryllium			X	X
Cadmium	X			X
Chromium	X		X	X
Cobalt				X
Copper	X		X	X
Lead	X		X	X
Manganese			X	X
Mercury				X
Nickel			X	X
Thallium	X			
Vanadium			X	X
Zinc	X			X

The exposure assessment consists of three steps (USEPA, 1989a):

1). **Characterize Exposure Setting:** Contained within this step is general information concerning the physical characteristics of the site as it pertains to potential considerations affecting exposure. The physical setting involves climate, vegetation, soil characteristics, surface and groundwater hydrology. All potentially exposed populations and subpopulations therein (receptors) are assessed relative to their potential for exposure. Additionally, locations relative to the site along with the current and potential future land use of the site are considered. This step is a qualitative one aimed at providing a general site perspective and offering insight on the surrounding population.

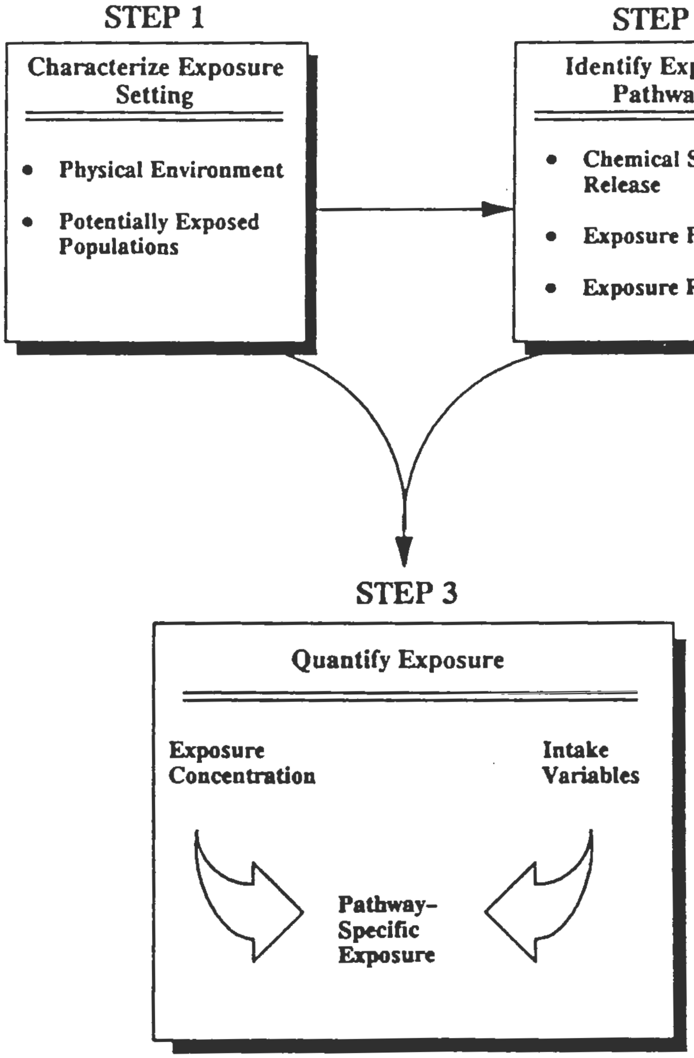
2). **Identify Exposure Pathways:** All exposure pathways represent ways in which receptors can be exposed to contaminants that originate from the source and are reviewed in this step. Chemical source and mechanisms for release along with its subsequent fate and transport are investigated. Exposure points of human contact and exposure routes are discussed before quantifying the exposure pathways in step 3.

3). **Quantify Exposure:** In this final process, the exposure concentrations for the various exposure pathways are calculated using the *Standard Default Exposure Factors* (USEPA, 1991), as a guideline for all assumptions and projections inclusive of intake variables for each pathway-specific exposure.

A graphical description of this process is shown in Figure 6-2.

6.3.2 Physical Setting

The OB grounds comprise an area of approximately 30 acres within the northern section of the SEDA. There are no permanent structures within the OB grounds other than small concrete bunkers and access to the site is limited to a locked gate near the southern portion of the site. Access to and across the site is provided by a group of looping crushed shale roads that allow access to the individual burning pads. Located within the OB grounds are 9 seperate burning pads upon which munitions waste were open burned up to 1987.



Source:EPA, 1989a

ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT.	ENVIRONMENTAL ENGINEERING	NO.	720446-01000

FIGURE 6-2

THE EXPOSURE ASSESSMENT PROCESS

SCALE

Subsequent to 1987, munitions have been destroyed by burning within a steel encased structure to minimize the impact of the burning on the environment. These structures will not be addressed.

The burn pads at the site are built up upon the natural soils. Each burn pad has from 0.5 to 2 feet of broken shale at the surface. Below that is a section of the natural soils and glacial till. A berm, composed of soils, glacial till, and burn wastes surrounds each burn pad on three sides. There are a total of 9 burn pads located within the OB grounds and these range in size from approximately 100 by 100 feet for Pad D to 300 by 800 feet for the largest burning pad, Pad G. In general, each of the burning pad surfaces are approximately 2 to 3 feet above the surrounding land surface.

6.3.2.1 Climate

Detailed climate data is presented in Section 3. As discussed, the data derive from several sources. Precipitation and temperature measurements were obtained from the Aurora Research Farm, located approximately 11 miles east of the site. The remainder of the data reported in Table 3-1 have been taken from isoplethic drawings from a climatic atlas, or from data collected at Syracuse, New York, 40 miles northeast of the SEDA. Meteorological data collected from 1965 to 1974 at Hancock International Airport in Syracuse, New York, were used to prepare the wind rose. The airport is located approximately 60 miles northeast of SEDA, and the data can be considered representative of wind patterns at SEDA.

A cool climate exists in the locality of SEDA with temperatures ranging from an average of 23°F in January to 69°F in July. Marked temperature differences are found between daytime highs and nighttime lows during the summer and portions of the transitional seasons. Precipitation is uncommonly well-distributed, averaging approximately 3 inches per month. The annual average snowfall is approximately 100 inches. Wind velocities are moderate, but during the winter months, there are numerous days with sufficient winds to cause blowing and drifting snow.

Daily precipitation data measured at the Aurora Research Farm in Aurora, New York for the period (1957-1991) were obtained from the Northeast Regional Climate Center at Cornell University. The maximum 24-hour precipitation measured at this station during this period was 3.91 inches on September 26, 1975. Values of 35 inches mean annual pan evaporation and 28 inches for annual lake evaporation were reported. An independent value of 27 inches for mean annual evaporation from open water surfaces was estimated from an isoplethic figure found in "*Water Atlas of the United States*" (Water Information Center, 1973).

SEDA is located in the Genessee-Finger Lakes Air Quality Control Region (AQCR). The AQCR is designated as non-attainment for ozone and attainment or unclassified for all other criteria pollutants. Data for existing air quality in the immediate area surrounding the SEDA, however, can not be obtained since the nearest state air quality stations are 40 to 50 miles away from the army depot.

6.3.2.2 Vegetation

The major vegetative communities in the 0.5 mile RI study area are primarily upland cover types. Some freshwater wetlands occur, principally on the OB grounds and along Reeder Creek. Reeder Creek, and another small unnamed tributary of Seneca Lake in the southwestern corner of the study area form the only aquatic environments.

The upland cover types in the study area include old field vegetative types, shrubland, deciduous forests and agricultural fields. Old field vegetative types and shrublands are the dominate cover types. Old field vegetative types, are prevalent on the OB grounds and adjacent environs, as well as the ammunition storage area to the east and an area in the southern section of the study area. These old field vegetative types are comprised of a mixture of herbaceous and shrub plant species with some small trees. Queen Anne's lace, panic grass, teasel, goldenrods, asters and field thistle are the most abundant species in these fields. Shrublands and old field vegetative types dominate much of the remaining SEDA land surrounding the OB grounds. Shrublands are comprised primarily of shrubs and small trees with some herbaceous species. Gray-stemmed dogweed, raspberry and blackberry vines, multiflora rose, buckhorn, black locust, sumacs and wild grape are the most common shrubs and vines in this cover type. Prior to becoming part of the SEDA in 1941, most of the old fields and shrublands were active farmland. When they became part of the SEDA and left fallow, these croplands succeeded to old fields and shrubland.

Agricultural fields are the next most prevalent cover type, but all occur on the privately owned farms in the western section. Crops typically grown in these cropfields surrounding the SEDA include corn, wheat, soybeans, and various hay mixtures. Deciduous forests comprise a relatively minor cover type in the study area and occur as woodlots and tree rows which line the fields, roads and the two streams. Various oaks, sugar maple, hickory, black locust, black cherry and aspens are the major overstory trees in these woodlots and tree rows.

Several small freshwater wetlands are located on the OB grounds. Most of these emergent wetlands were created by soil excavation operations for the construction of the nine burn pad mounds. Several drainage ditches were also constructed to catch surface water run-off from the OB grounds and dirt roads. These ditches are also vegetated with emergent wetland plants. Narrow-leaved cattail is the most abundant and widely distributed emergent plant species in these areas. Rush and sphagnum moss also have wide distribution, but are not as abundant.

6.3.2.3 Geologic Setting and Soil Classification

Four distinct geologic units have been identified at the OB grounds. These include artificial fill, glacial till, weathered shale and competent shale. With the exception of the artificial fill these units are distributed across the entire site.

Artificial fill is present at the individual burning pad surfaces and within the berms that surround each burning pad. At each pad surface the fill is composed of crushed and broken shale. The thickness of the fill ranges from 6 inches to as much as 2 feet. Within the berms surrounding each pad, the fill is composed of local soils, glacial till, crushed and broken shale, and munitions waste that remains after each burn event. These berms range in height from as little as 3 feet to as much as 8 feet.

The predominant surficial geologic unit present at the site is the glacially derived till. The till is distributed across the entire site and ranges in thickness from less than 2 feet to as much as 10 feet. The thickest section of glacial till was encountered in well MW-30 while the thinnest till section was found at MW-32. Grain size analyses performed by Metcalf & Eddy on glacial till sediments collected during the installation of monitoring wells MW-8 through MW-17 show a wide distribution of sediment sizes. These tills have a high percentage of silt and clay with trace amounts of fine gravel. Test pits conducted during the geophysical investigation showed the till to vary from a silty, claying till to till with trace amounts of gravel and boulders.

Below the glacial till unit is weathered bedrock which was encountered at all of the monitoring well locations. The weathered bedrock is composed of clay with thin, laminar pieces of unweathered shale present within a primarily clay matrix. The thickness of the weathered bedrock layer ranges from less than 1 foot to as much as 14 feet. Within the central portion of the site, in the vicinity of burning pads G and F, the weathered shale unit is less than 2 feet thick. East of burning pads C and D, the thickness of the weathered shale increases appreciably, to 9 feet at MW-18. East of MW-18 the weathered layer decreases, while the thickest section of weathered bedrock was identified northeast of Pad A, at MW-22 measuring 14 feet.

The bedrock underlying the site is composed of the upper member of the Devonian age Hamilton Group Shale. Three predominant joint directions, N60°E, N30°W, and N20°E are present within this unit. These joints are primarily vertical. The Hamilton Group Shale is a gray, black, sandy shale that is fissile and shows partings along bedding planes. The bedding plane partings are from 1 inch to 8 inches apart based upon rock cores collected by Metcalf & Eddy in 1989.

6.3.2.4 Surface Water Hydrology

Reeder Creek is a small, second order perennial stream that originates on the SEDA. Reeder Creek flows in a northwesterly direction past the OB grounds before turning sharply to the west after leaving the SEDA property where it discharges into Seneca Lake. The total drainage basin of Reeder Creek is 3,211 acres (5.02 square miles). Approximately 71 percent (of the drainage basin) is within the confines of the SEDA. The drainage area upgradient of the OB grounds is approximately 1,503 acres. The 29 acre OB grounds comprises 0.9 percent of the total Reeder Creek drainage basin. The normal width of Reeder Creek is from 4 to 10 feet, and typical maximum depths range from 1 to 7 inches. Width and depth of sections of the stream influenced by beaver dams is up to 15 feet wide by 3 feet deep. During high flow events width and depth increase, although the steep banks along much of the stream adjacent to the OB grounds limits the width of the flood plain.

The substrate of Reeder Creek is heavily influenced by the occurrence of shale near and at the surface. Most of the stream bottom consists of coarse, angular gravel as well as angular cobbles. There is some deposition of interstitial silt and also a small amount of sand. In some places, the stream bed consists of exposed bedrock. Nearly all components of the substrate are dark grey. The average depth of sediment, including gravel, is approximately 3 inches. In general, the stream bottom which usually comes in contact with the stream water of Reeder Creek is characteristic of mountain streams with loose cobbles. Such streams usually have Manning's N values (a measure of "stream resistence") of 0.040 to 0.050 (Milhouse, Wegner, Waddle, 1984).

The velocity of water in a stream is a function of width, depth, and gradient. The minimum depth at which velocity measurements could be obtained with the Marsh-McBirney flowmeter was approximately 3 inches, so velocity in shallow, riffle areas could not be determined. Transects where stream velocity was measured were chosen because stream flow was laminar. The highest water velocity measured at any transect was 0.11 feet per second (fps) at Station SW-196. The lowest stream velocity of 0.03 fps was measured at the widest transect SW-130. Average stream velocities ranged from 0.02 fps at SW-130 to 0.06 fps at SW-140.

The surface water elevation of Reeder Creek showed little variability during field studies near the OB grounds. The maximum change in surface water elevations that was directly measured at any station was 2.90 inches at Station SW-150. Since the drainage area upstream of the OB grounds is relatively small (1,503 acres or 2.35 square miles), Reeder Creek is likely to return to base flow conditions shortly after any precipitation event.

The surface water qualities of Reeder Creek suggest that it is neutral to slightly basic with pH readings ranging from 7.3 to 8.6 based on field data from surface water sampling locations along the creek. The conductivity of Reeder Creek ranged between 263 and 495 umhos/cm taken at the same locations as the pH.

Currently, there is no industrial use of surface water by the SEDA workers at the OB grounds. Therefore, assessment of current industrial land uses of surface water is deemed inappropriate and only current and future residential land uses such as swimming will be considered.

6.3.2.5 Groundwater Hydrology

During the RI, the goals of the groundwater investigations conducted at the OB grounds were to confirm the direction of groundwater flow at the site, evaluate the degree of hydraulic communication between the glacial till and the weathered shale, determine the interrelationship between groundwater and surface water, and evaluate the presence and extent of contaminants within the groundwater. Six rounds of water level measurements were taken at the site. Groundwater flow directions within the weathered shale, as with the glacial till, are primarily from southwest to northeast towards Reeder Creek. A detailed groundwater discussion is in Section 3.

The average linear velocity of groundwater flowing through the aquifer has been calculated. Velocities have been determined based upon average hydraulic conductivities of 6.6×10^{-4}

cm/sec in glacial till and 1.3 x 10^{-3} cm/sec in the weathered shale. Using Darcy's Law, the average linear velocity of groundwater flow, based upon the hydraulic conductivity, the assumed porosity, and the horizontal gradient of the groundwater surface was obtained. The velocities were 22.8 ft/year in the till and 51.8 ft/year in the weathered shale. The overall velocity was 32.8 ft/year. These calculated velocities are considered slow and reflect the fine grained nature and associated low hydraulic conductivities of both the glacial till and weathered shale units. These low velocities also suggest that contaminants present within the groundwater are, on average, moving at slow rates, eastward towards Reeder Creek.

There is no current use of groundwater on the OB grounds. Potential OB groundwater use will be considered only as a future onsite residential exposure.

6.3.3 Potentially Exposed Populations and Subpopulations

6.3.3.1 Offsite Receptors (Romulus & Varick Townships)

The area surrounding SEDA is sparsely populated farmland. The population density in the two towns which surround the SEDA facility, Romulus and Varick, is 67 people per square mile based on the 1990 U.S. Census. There are two areas within one mile of the site where the population density is slightly higher: residences on the western boundary of SEDA along Route 96A, and residences within SEDA boundaries at the McGrane Road entrance. Any recreators such as swimmers and waders who may use downstream portions of Reeder Creek on a seasonal basis are potential offsite receptors. The nearest sensitive subgroup (receptor) location is the Central School in Romulus Village, approximately 3.5 miles southeast of the OB grounds. Additionally, recreational activities take place at Sampson State Park approximately 4 radial miles from the OB grounds. The park has a boat landing and waterfront access to Seneca Lake. Typically, picnics, outdoor exercise, and other summer activities take place here but is not considered to be affected by the OB ground operations.

Residential communities surrounding the Depot use potable water wells for drinking water supplies, which, however unlikely, could be a possible route of exposure to any contaminants released as a result of the OB Ground activities.

These potential potable well water supplies are more than likely bedrock wells rather than overburden wells. If so, this would further reduce the already low potential for future contamination from OB ground activities.

6.3.3.2 Onsite Receptors

Depot personnel who work on the OB grounds (i.e. OB site workers), being in such close proximity to the potential contaminant source, are considered to be the highest exposure subgroup. Civilian guard staff on duty patrolling the main Depot roads are potentially exposed to windborne fugitive dust emissions. These two subgroups comprise the human onsite receptors which present the greatest potential for exposure. Other base residents and facility workers are considered to be low potential receptors due to the location of the facility buildings relative to the OB grounds.

6.3.3.3 Current Land Use

The SEDA is situated between Seneca Lake and Cayuga Lake and encompasses portions of Romulus Township and Varick Township. Land use in this region of New York is largely agricultural, with some forestry and public land (Romulus Central School and Sampson State Park). The most recent land use report is that issued by Cornell University. This report classifies in further detail land uses and environments of this region (Cornell, 1967). Agricultural land use is categorized as inactive and active use. Inactive agricultural land consists of land committed to eventual forest regeneration, land waiting to be developed, or land presently under construction. Active agricultural land surrounding SEDA consists of largely cropland and cropland pasture. The U.S. Geologic Survey (USGS) quadrangle maps for the Towns of Ovid and Dresden, New York (1970), New York State Department of Transportation (DOT) quadrangles for Romulus, New York (1978) do not indicate land designated for dairy production in the vicinity of SEDA.

The SEDA is a government-owned installation under the jurisdiction of the U.S. Army Materiel Command (AMC). The total area of SEDA is 10,587 acres, of which 8,382 are designated storage areas for ammunition, storage and warehouse, and open storage and warehouse. On-post family housing is in two parcels, a 54-acre development adjacent to Route 96 and another 69 acres situated along Seneca Lake. Additionally, troop housing is available for 270 enlisted men (Building 703, 704, and 708). Bachelor officer quarters are located in Building 702, which is designated for 18 men. Due to the scaling back of troop support staff and other personnel, these housing areas are not in full use. Other internal land uses include administration, community services, and an airfield. SEDA has a swimming pool at the north end of the facility, along with tennis courts, gymnasium and a modern sports field complex. Picnic and playground areas are found on the installation at Hancock Park, the

Lake Area and the Family Housing Area. There is also a skeet and trap range at the field. There are no recreational facilities located within 1,000 feet of the OB grounds.

The OB grounds are situated in the northwest corner of the depot with the closest outer boundary being about 2,500 feet away. Land use adjacent to and off-site of the northwestern corner of SEDA is sparse residential areas with some farmland. Forestland adjacent to SEDA is primarily under regeneration with sporadic occurrence of mature forestry. Public and semi-public land use surrounding and within the vicinity of SEDA is Sampson State Park, Willard Psychiatric Center, and Romulus Central School. Sampson State Park entails approximately 1,853 acres of land and includes a boat ramp on Seneca Lake.

Historically, Varick and Romulus Townships within Seneca County has developed as an agricultural center supporting a rural population. However, increased population occurred in 1941 due to the opening of SEDA. Population has progressed since then largely due to the increased emphasis on promoting tourism an recreation in this area. Records provided by the Town of Varick show approximately 11 residences adjacent to the northwestern borders of SEDA which are within one mile of the OB grounds. These residences all obtain drinking water from private water wells as described earlier. However, detailed information regarding construction of these wells was not available.

6.3.3.4 Potential Future Land Uses

EPA guidance for determining future land uses recommends that, if available, master plans, which include future land uses, Bureau of Census projections and established land use trends in the general area should be utilized to establish future land use trends. Since the OB grounds is located in Romulus, the Romulus Town Clerk was contacted to determine if any master plans exist for this area or if any land use restrictions could apply to the future use of the OB grounds. No zoning maps or master plans were found to exist for the site or surrounding areas in the town of Romulus. Consequently, the use of this area for light industrial or residential uses is not restricted by local zoning laws and either use could be permitted. The existing land use surrounding the OB grounds is generally agricultural with sparse housing. Large tracts of undeveloped land are widely available for future development. The area is not experiencing a high degree of growth nor is it expected to. There is no pressure to develop land in this area, nor will there likely be the need to develop the OB grounds for residential purposes. Section 6.2.2of RAGS discusses future land uses and states: "If the site is industrial and is located in a very rural area with a low population density and projected low growth, future residential use would probably be unlikely. In this case, a more likely alternate future land use may be recreational. At some sites, it may be most reasonable to assume that the land use will not change in the future."

The intended future use of the OB grounds is as a munitions destruction facility. The army has no plans to change the use of this facility or to transfer the ownership. If the property is to change ownership, CERCLA, Section 120 (h)(1),(2) and (3), requires that the prospective owner must be notified that hazardous substances were stored on the parcel. This will include the quantity and type of the substances that were stored. The content of the deed must also include a covenant warranting that all remedial actions necessary to protect human health and the environment with respect to any such hazardous substances remaining of the property have been taken before the date of the transfer. If a property transfer is contemplated by the Army, this information, under penalty of the law, must be supplied to the prospective owner. Should the actual future use of the parcel be residential, then the Army will perform any additional remedial activities to ensure that human health and the environment, under residential scenario, are protected.

In this human health assessment, for the purposes of worst case considerations, the future land use of the OB grounds, was considered to be residential. The possibility of this actually occurring is small since the Army intends to continue using this parcel for munitions destruction. Although the risk due to future residential land use will be calculated in this BRA the decision to perform a remedial action will be based upon an intended (current) land use scenario. At such time when the property is intended to be transferred, in accordance with CERCLA, the Army will notify all appropriate regulatory agencies and will perform any additional investigations and remedial actions to assure that any changes in the intended use is protective of human health and the environment. Further Army Regulation 200-1, paragraph 12-5, Real Property Transactions, requires the Army to perform an Environmental Baseline Study (EBS) prior to a transfer of Army Property. The EBS is an inventory and a comprehensive evaluation of the existing environmental conditions. The EBS consists of phases: scope definition, survey, sampling, investigative and risk assessment.

6.3.4 Identification of Exposure Pathways

Within each exposure pathway, a clear identification of all the possibilities of human exposure at the OB grounds is identified. "The focus lies in relationships between the sources, locations, and types of environmental releases of contamination given the surrounding population and subsequent activity patterns of that population" (USEPA, 1989b). In this light, the targeted exposures and ideal scenarios are assembled for quantitative assessment of lifetime human health risk.

The exposure pathways usually consist of four components:

1. source and mechanism of release,
2. transport medium,
3. exposure points (potential point of human contact with contamination), and
4. exposure route (e.g., inhalation, ingestion, dermal contact).

In some cases the transport medium is negligible due to the fact that the source of contamination acts as an exposure point and no transport medium is taken into consideration (e.g, open drum).

6.3.4.1 Sources and Receiving Media

The contaminant source areas involved in the assessment of the OB grounds are at the burn pads once used to render military ammunitions harmless. Controlled burns in all nine pads were conducted by the Army since the early 1940's. As evidenced by the RI data, this source area has since spread to include surface soil, and sediment, in the surrounding area. The soil and sediment may serve as both a release source and an exposure point. Activities associated with burn pad maintenance and construction also increased the possibility of residual materials being dispersed. The levels of the residuals in the berms and low lying areas constitute the most significant area for pollutant accumulation (source area), as shown by the data.

Although the possibility existed for dispersal during burn activities, precautions were taken to minimize the dispersion of munitions. Planning for burns included consideration of environmental factors. These requirements would tend to reduce the possibility of materials leaving the disposal site. The requirements included burning during very low wind conditions and during times of no precipitation. These restrictions reduced the risk of materials escaping the area of concern during burn operations, via wind or surface runoff. Additionally, enclosed cages were used to minimize the risk of projectiles being ejected from burn sites. Propellent burns were policed to recover unburned material which was collected and disposed of in subsequent burns. The result of these precautions were to limit migration of residuals.

6.3.4.2 Fate and Transport in Release Media

The environmental fate associated with constituents used and burned at the OB grounds is discussed in detail in Section 5. The expected behavior of the residuals which remain following the burning of propellants, explosives and pyrotechnics (PEP's) are of particular concern due to their presence at the site. Information identifying specific chemical/physical properties of the organic explosives have been incorporated into this fate assessment. The focus of fate and transport analysis is explosives and heavy metals.

6.3.4.2.1 Explosives

The major explosives detected at the OB grounds are:

1. HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7 tetrazocine)
2. RDX (Hexahydo-1,3,5-trinitro-1,3,5-triazine)
3. Tetryl (N-methyl-2,4,6-trinitrophenylnitramine)
4. TNT (1,3,5-Trinitrotoluene)
5. 2,4-DNT (2,4-Dinitrotoluene)
6. 2,6-DNT (2,6-Dinitrotoluene)

Chemical and physical properties of the explosives, are detailed in Section 5 (Table 5-3). In general, these compounds are characerized by low volatility, low to moderate solubilities, and moderate to high organic-carbon sorption coeficients. These compounds are expected to exhibit low mobility in natural environments.

6.3.4.2.2 Heavy Metals

The behavior of heavy metals in soil is unlike organic compounds in many aspects. For example, volatilization of metals from soil not considered a realistic mechanism for pollutant migration and will not be considered. However, leaching and sorption were considered in the fate and transport evaluation (Section 5).

Leaching of heavy metals from soil is controlled by numerous factors. Most importantly is its chemical form (base metal or cation) in the soil. The leaching of metals from soils is substantial if the metal exists as a soluble salt. The use of metallic salts has been identified as a component of such items as tracer ammunition, ignitor compositions, incendiary ammunition, flares, colored smoke and primer explosive compositions. In particular, barium nitrate, lead styphnate, lead azide, and mercury fulminate are heavy metal salts or complexes that are found in the munitions deactivated at this site. During the process of deactivation, it is likely that these inorganic salts or complexes were oxidized to metallic oxides. Upon contact with surface water or precipitation, the heavy metals, either as metal oxides or some small amounts of unburned metal salts, could be solubilized, eventually leaching to the groundwater.

Heavy metals may also exist in the base metallic form as a component of the projectile itself. Bullets are composed mainly of lead, which may contain trace amounts of cadmium and selenium. Metals which exist in metallic form, i.e., as bullets or projectiles, will tend to dissolve more slowly versus the metallic salts.

6.3.4.3 Exposure Points

The exposure point describes and attempts to highlight that specific point of interface between an organism, in this case a human receptor, and a contaminant (physical agent) at its source or via a transport medium. The exposure points that may exist at the OB grounds are listed below:

1. The berms may serve as a potential exposure point between contaminated surface soil or surface water run-off and an on-site worker.

2. The prevailing wind pattern could establish an exposure point (via the air pathway) at the nearest receptor on-site. This receptor may be a security patrolmen or a site worker.

3. The groundwater supply to the residences adjacent to the Depot's northwestern and northeastern perimeter who rely on potable well water may be an exposure point at the interface between the sink or shower and the human receptor. These potential exposure point locations have been described in more detail in an earlier section on human receptors.

4. Reeder Creek, the main surface water body onsite, may serve not only as a receiving and transport medium but also as an exposure point to any swimmer or wader downstream.

5. The on-site wetlands may serve as an exposure pathway to waders.

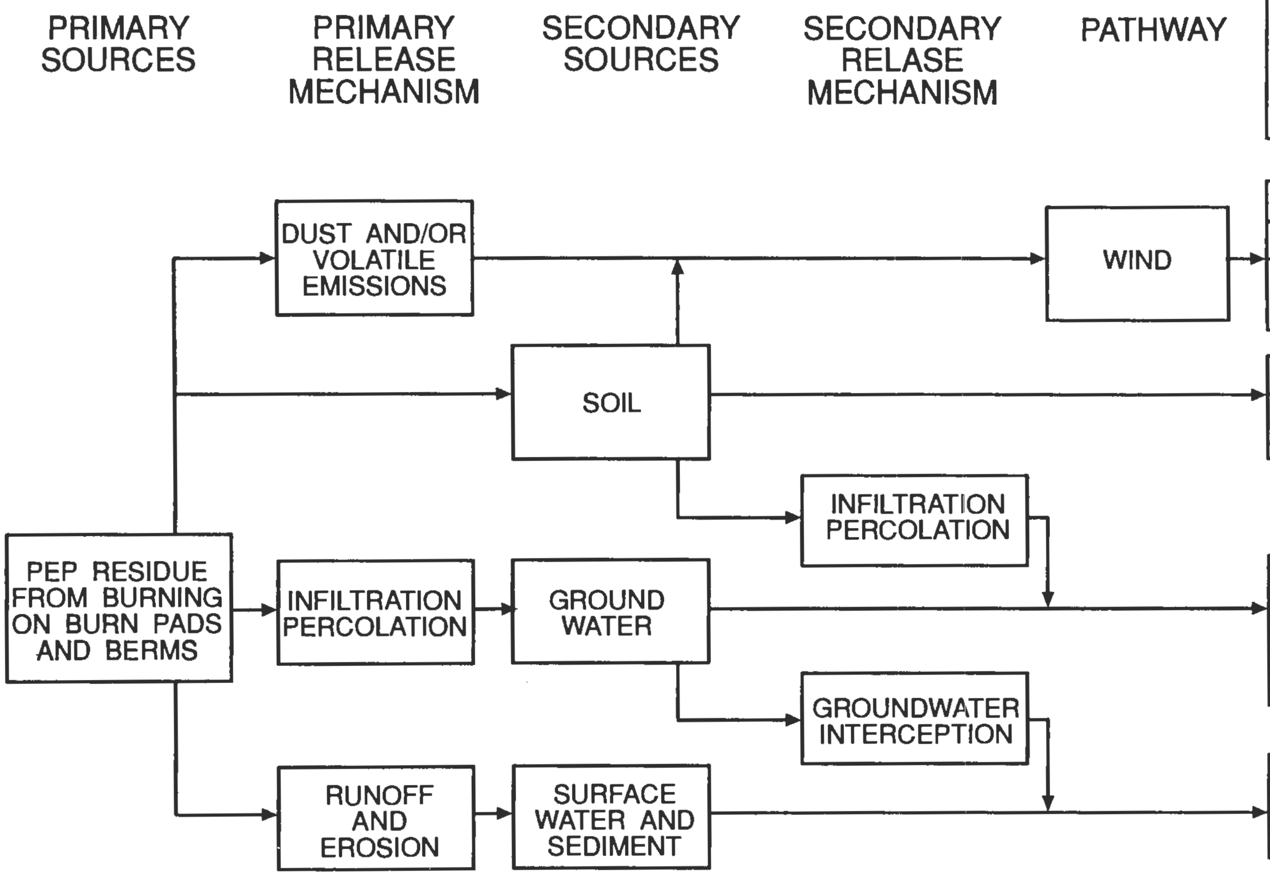
6.3.4.4 Exposure Routes

The exposure route attempts to classify the means in which the contaminate comes in contact with a organism, in this case, a human or biologic receptor. Not all exposure routes will exist at every site. Exposure pathways which will be evaluated at the OB grounds are discussed below.

6.3.4.5 Integration of Exposure Pathways

In this section, the final assembly of the components required to accurately construct an exposure pathway is performed. As described earlier, the proper framework of an exposure pathway involves a source, transport medium, exposure point, and an exposure route. The exposure pathways for the OB grounds are summarized in Figure 6-3. According to the RAGS (USEPA, 1989b), a pathway is considered incomplete if one or more of these components is not present with the exception of the transport medium, which may be absent in the case of direct exposures. Hence, the conclusion, if there is not a complete pathway, there can be no risk resulting from that theoretical pathway. For the purposes of this baseline risk assessment (BRA), twelve human exposure pathways have been selected for quantitative evaluation. (Ingestion and dermal contact with surface water and sediment are considered four pathways).

Three potentially complete pathways: ingestion of dust, dermal contact with dust, and inhalation of groundwater were not evaluated in detail. Ingestion of dust was not evaluated for several reasons. First, the quantity of contaminants ingested as dust would be insignificant when compared to the quantity ingested as soil or inhaled as dust. Dermal contact with dust was eliminated for many of the same reasons. Additionally, the contaminants associated with the dust are assumed to be present in adsorbed (organics) or insoluble (inorganics) forms. Contaminants in these states would tend to remain associated with the dust, and not be readily adsorbed by the skin. Inhalation of groundwater was also not evaluated in detail. A statistical test for significant differences between the on-site groundwater metals concentrations and the background metal concentrations indicated that there were no statistically significant differences at the 95 Confidence Interval and therefore these constituents were eliminated from further consideration. Only one volatile (Acetone) was detected in the groundwater, and was not considered a significant contaminant of concern



EXPOSURE ROUTE	RECEPTOR			
	HUMAN		BIOTA	
	CURRENT OR FUTURE RESIDENT	SITE WORKERS	TERR.	AQUATIC
INGESTION	X	X		
INHALATION	●	●		
DERMAL CONTACT	X	X		
INGESTION	●	●	●	
DERMAL CONTACT	●	●	●	
INGESTION	●	X		
INHALATION	X	X		
DERMAL CONTACT	●	X		
INGESTION	●	X	●	●
DERMAL CONTACT	●	●	●	●

● PATHWAY CONSIDERED IN RISK ASSESSMENT

X PATHWAY DISCOUNTED AS SIGNIFICANT RISK

ES
ENGINEERING-SCIENCE, INC.

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT
REMEDIAL INVESTIGATION / FEASIBILITY STUDY
OPEN BURNING GROUNDS

DEPT. ENVIRONMENTAL ENGINEERING
NO. 720446-01000

FIGURE 6-3

EXPOSURE PATHWAY SUMMARY

SCALE

since the presence of Acetone is likely due to laboratory or field blanks. This pathway was therefore not evaluated in detail.

6.3.4.6 Summary of Exposure Pathways to be Quantified

The pathways presented, reflect the current use and the projected future use of the OB grounds. In this section, a justification for selecting these exposure pathways is described.

6.3.4.6.1 Fugitive Dust Emissions

The inhalation of dust emissions has been considered based on the laboratory data suggesting the presence of metals, semivolatiles, and explosives in the surficial strata of the OB grounds. The OB grounds are kept relatively free of vegetation to reduce fire visits. This fact, coupled with the wind generated as a result of the Depot's relative position between Seneca Lake and Cayuga Lake, establishes a reasonable scenario for this exposure pathway to be completed. Using the diurnal wind pattern as a transport medium, the fugitive dusts can become liberated through wind erosion and travel some distance to provide an exposure point wherever a human receptor may be downwind of the prevailing wind direction. The most probable receptors are SEDA personnel who may be working at the OB grounds or other nearby areas. The strict controls on access to the SEDA facility make exposure of other people to fugitive dust emissions a remote possibility. This was also considered a viable mechanism for exposure in the potential future residential use of the Depot even though such future land use would most likely include vegetative cover, thereby reducing fugitive dust emissions.

Fugitive dusts are not expected to be transported in significant quantities beyond site boundaries, which are a minimum of one mile away from the OB grounds. Given the location of the Romulus Central School (sensitive subpopulation), the impact from this exposure pathway is insignificant.

6.3.4.6.2 Incidental Ingestion and Dermal Contact to Onsite Soils

The laboratory analysis of the OB ground soils show the presence of heavy metals, semivolatiles and explosive compounds. During the course of work activities conducted at the site, a SEDA worker may, on occasion, involuntarily ingest and/or make dermal contact with contaminated surficial soils. This exposure pathway assumes that during the course of a work day involuntary ingestion of the surficial soil occurs. The type of work, being industrial and intrusive, was evaluated using standard soil ingestion rates. The skin can be exposed in some way to the native soils which one may work with, and as such, constitutes another exposure pathway. Given the receptor (worker), the source (OB grounds), and the medium (onsite soils), these exposure pathways were quantitatively assessed under current land use conditions for both ingestion and dermal contact to onsite soils.

For dermal contact to soil (and sediment), EPA Region II recommends that only the chemicals cadmium, PCBs, and dioxins be considered since these are the only chemicals with recommended absorption factors. Of these 3 chemicals, only cadmium was detected at the OB grounds. Therefore, for all dermal exposure pathways involving soil or sediment, only cadmium will be considered.

Due to the projected future of the SEDA, the need for alternative land use has been considered. A quantitative assessment pathway for both dermal contact and soil ingestion was established for possible future residential exposures on the OB grounds land.

6.3.4.6.3 Ingestion of and Dermal Contact to Surface Water and Sediments (while swimming or wading)

Surface water and sediment exposures occur simultaneously because of the logistics involving both media. The distribution of contaminant to any available surface water body and surrounding sediment is assumed to be via surface runoff and sediment transport. During and subsequent to burning, residuals may have been dispersed into the environment, away from individual burning pads. The most likely receptor in this scenario would be a local resident offsite or a future resident onsite who makes contact with contaminated surface water and/or sediments after a rain incident through recreational swimming or wading or an on-site worker wading through an on-site wetland. Under current conditions, no other receptors have been identified using this exposure pathway with surface runoff as the transport mechanism for surficial contaminants.

6.3.4.6.4 Ingestion of Groundwater

The groundwater beneath the OB grounds is not currently used as a drinking water source and connection to potable groundwater aquifers has not been demonstrated. It is not anticipated that there is direct exposure to the groundwater from the site under current uses. Groundwater beneath the site flows generally toward Reeder Creek and may be recharging the creek. The potential groundwater contribution to this surface water body could result in the exposures identified for surface water and sediment exposure pathways. The mechanics of ingestion of groundwater pathway assumes a leachable plume from the OB grounds. Over time, some constituents may be able to leach towards adjacent resident potable drinking water wells over one mile away. A discernable continuous plume has not been detected at the OB grounds and therefore there is no data to suggest that a plume could impact any off-site drinking water wells. Further, the calculated groundwater flow velocity is approximately 36.8 feet/year. At this velocity, it would take over 100 years for the groundwater to migrate one mile to the nearest water well.

Assuming the worst case scenario, allowing for residential populations to use OB groundwater, this exposure pathway has been considered for future land use.

6.3.4.6.5 Dermal Contact with Groundwater while Showering/Bathing

The potential future residential population on the Depot neccessitates consideration of this pathway. Given a migrational pathway via groundwater, acting as a transport medium for the chemicals of concern, an exposure point between the human receptor and the pollutant occurs at the faucet and/or the bathtub. This scenario was considered as part of the future land use scenario and was calculated using the standard exposure assumptions described in RAGS (USEPA, 1989b).

6.3.5 Quantification of Exposure

All quantitative exposure assumptions are consistent with the *Standard Default Exposure Factors* (USEPA, 1991g) or RAGS, (USEPA, 1989b). The purpose of the guidance is "to encourage a consistent approach to assessing exposures when there is a lack of site-specific data or consensus on which parameter value to choose, given a range of possibilities. Accordingly, the exposure factors presented in these documents are generally considered most appropriate and should be used in baseline risk assessments unless alternate or site-specific values can be clearly justified by supporting data" (USEPA, 1991). Because the *Standard Default Exposure Factors* (SDEF) (USEPA, 1991g) document supersedes the *Exposure Factors Handbook* (USEPA, 1989c), the supporting data for the exposure parameters involved in this baseline risk assessment are specific to this reference and the *Exposure Factors Handbook* is only referenced if data is not available in the SDEF.

Exposure-point concentrations (EPCs) were estimated for all pathways selected for quantitative evaluation, and pathway-specific human intakes were quantified. EPCs were multiplied by human intake variables to obtain chronic daily intake values or absorbed doses. These concentrations are based on measured values or on modeling results. For this assessment, exposure concentrations for inhalation of fugitive dusts (both current industrial and future residential) are based on a soil erosion model due to air disturbances at the OB grounds. All other pathways used actual measured concentrations. Steady-state conditions were assumed. Therefore, current and future chemical concentrations were assumed to be identical. This assumption may tend to overestimate long-term exposure concentrations because chemical concentrations are likely to decrease over time from natural processes such as dispersion, attenuation and dilution occurring during migration to potential receptors.

Estimations of pathway-specific human intakes for each chemical involve making assumptions about patterns of human exposure to contaminated media. These assumptions are integrated with exposure-point concentrations to calculate intakes. Intakes are normally expressed as the amount of chemical at the exchange boundary in milligrams per kilogram of body weight per day (mg/kg-day), which represents an intake normalized for body weight over time. The total exposure is divided by the time period of interest to obtain an average exposure time. The averaging time is a function of the toxic endpoint: For noncarcinogenic effects, it is the exposure duration (usually 30 years), and for the carcinogenic effects, it is lifetime (70 years).

The emphasis in Superfund risk assessments is on chronic exposures unless specific conditions warrant a short-term or an acute assessment. In this evaluation, long-term exposure to relatively low chemical concentrations is the greatest concern. Short-term (i.e., subchronic) and acute exposures were not evaluated.

The exposure pathways to be quantified are set up in this section and supplemented by a mathematical table which follows each pathway-specific scenario through to calculate intake or absorbed dose associated with that specific exposure pathway. These doses are used in the Risk Characterization section to assess overall carcinogenic and non-carcinogenic risk. This comes in the form of a Hazard Quotient (Nc) or a Carcinogenic Risk (C) where an RfD or Slope Factor is used respectively to establish a risk estimate.

The Reasonable Maximum Exposure (RME), was calculated using conservative intake variables in each exposure pathway allowing for a reasonable estimate of the maximum exposure expected from each exposure pathway. For chemical exposure the lower of the 95th UCL and the maximum values were used in the intake calculations to best estimate the overall RME (USEPA, 1989b). For pathways involving only air inhalation of fugitive dust, surface water, sediments and groundwater, only adult receptors were used. It is assumed that the adult would be at greatest risk through these pathways. For pathways involving soils a combined child/adult receptor was used which corresponds to a 6 year/24 year breakdown over a 30 year exposure period. All these assumptions serve to provide the best estimate of the RME. Detailed intake calculations by media and exposure routes are presented in the following subsections.

Estimates of exposure concentration relative to the five media (air, surface water, sediment, groundwater, and soil), are established and discussed prior to quantification in the representative exposure pathways. Table 6-7 shows the maximum and 95th UCL concentrations for each component found on the OB grounds and the media that the component was sampled from. For the exposure pathways involving soil, only surface soil data from the 0 to 2 foot depth interval was used. In some instances, surficial soil was obtained from the 0-6" depth instead of the 0-2' depth. This was due to changes that occurred from Phase 1 to Phase 2. During Phase 1, surficial sampling was performed at 0-2' whereas during the Phase 2 follow-up this interval was changed to 0-6" because it was felt that 0-6" was more representative of surficial soil. Both datasets were combined and used to estimate the disk from exposure to surficial soils. In addition to the surface soils collected on-site from pad borings, grid borings, berm excavations and excavations from the low-lying hill, the surficial sediment samples collected from the on-site wetland areas were also included in the surficial soil database. The on-site wetland soils were added to this database because during a large portion of the year the on-site wetlands are dry and the soil/sediment is more like surficial soil than wetland sediment. For sediment and surface water, all data, including Reeder Creek and the on-site wetland areas were combined as a separate database to estimate exposure to surface water and/or sediments. As described previously for dermal exposure to soil and sediment only cadmium was considered. When the calculated 95th UCL for each media is less than the maximum detected concentration, then the 95th UCL was used as the EPC. However, when the 95th UCL exceeded the maximum detected value, then the maximum detected valve was used as the EPC.

6.3.5.1 Inhalation of Fugitive Dust (current and future land use)

This scenario is applicable to both current and future land use. Under the current use scenario, the receptor is assumed to be a site worker, while under the future scenario, residential use is assumed. It is also assumed that the surface soil concentrations will remain

TABLE 6-7

SURFACE SOIL/SEDIMENT SAMPLES
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	COUNT	MAXIMUM	95th UCL of the mean	MEAN	STD. DEV.	COEF. OF VARIANCE	NORMAL/ LOGNORMAL	EXPOSURE POINT CONC.
Semivolatiles									
2-Methylnaphthalene	ug/kg	208	1,300.00	300.38	283.51	147.91	0.52	NORMAL	300.38
3-Nitroaniline	ug/kg	209	2,950.00	1,269.92	1,187.99	719.99	0.61	NORMAL	1,269.92
2,4-Dinitrotoluene	ug/kg	216	33,000.00	698.13	848.61	2,572.77	3.03	LOGNORMAL	698.13
Phenanthrene	ug/kg	213	2,600.00	318.84	292.35	235.06	0.80	NORMAL	318.84
Benzo(a)anthracene	ug/kg	207	3,900.00	348.74	313.43	308.90	0.99	NORMAL	348.74
Chrysene	ug/kg	209	8,900.00	350.63	339.84	628.10	1.85	LOGNORMAL	350.63
Benzo(b)fluoranthene	ug/kg	207	11,000.00	352.57	352.59	792.72	2.25	LOGNORMAL	352.57
benzo(k)fluoranthene	ug/kg	207	4,500.00	333.52	317.58	356.60	1.12	LOGNORMAL	333.52
Benzo(a)pyrene	ug/kg	207	3,700.00	350.19	314.43	312.80	0.99	NORMAL	350.19
Indeno(1,2,3-cd)pyrene	ug/kg	206	2,300.00	327.40	304.97	195.75	0.64	NORMAL	327.40
Dibenz(a,h)anthracene	ug/kg	201	670.00	301.48	289.95	99.44	0.34	NORMAL	301.48
Benzo(g,h,i)perylene	ug/kg	202	960.00	301.77	293.60	115.13	0.39	NORMAL	301.77
Pesticides/PCBs									
Dieldrin	ug/kg	211	50.00	11.56	10.61	8.89	0.84	NORMAL	11.56
4,4'-DDE	ug/kg	214	830.00	17.97	16.55	57.77	3.49	LOGNORMAL	17.97
4,4'-DDT	ug/kg	215	2,800.00	18.66	26.41	191.56	7.25	LOGNORMAL	18.66
Explosives									
RDX	ug/kg	217	4,800.00	91.42	121.24	396.34	3.27	LOGNORMAL	91.42
1,3,5-Trinitrobenzene	ug/kg	217	7,800.00	110.19	172.72	742.91	4.30	LOGNORMAL	110.19
Tetryl	ug/kg	217	1,000.00	149.59	137.79	105.71	0.77	NORMAL	149.59
2,4,6-Trinitrotoluene	ug/kg	217	80,000.00	130.68	607.24	5,684.72	9.36	LOGNORMAL	130.68
4-amino-2,6-Dinitrotoluene	ug/kg	217	8,900.00	130.03	181.53	665.01	3.66	LOGNORMAL	130.03
2-amino-4,6-Dinitrotoluene	ug/kg	217	11,000.00	143.50	212.08	821.54	3.87	LOGNORMAL	143.50
Metals									
Barium	mg/kg	194	34,400.00	1,445.67	1,479.39	4,100.07	2.77	LOGNORMAL	1,445.67
Cadmium	mg/kg	217	28.20	5.74	3.49	4.59	1.32	LOGNORMAL	5.74
Chromium	mg/kg	198	1,430.00	31.62	35.98	101.67	2.83	LOGNORMAL	31.62
Copper	mg/kg	211	38,100.00	678.04	796.94	3,166.79	3.97	LOGNORMAL	678.04
Lead	mg/kg	208	56,700.00	2,836.27	1,888.27	5,966.04	3.16	LOGNORMAL	2,836.27
Thallium	mg/kg	214	38.00	0.32	0.46	2.58	5.62	LOGNORMAL	0.32
Zinc	mg/kg	216	127,000.00	884.31	1,317.65	8,713.76	6.61	LOGNORMAL	884.31

TABLE 6-7

GROUNDWATER SAMPLES
SUMMARY OF VALIDATED RESULTS (PHASE II)
CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	EXPOSURE POINT CONC.
Volatile Organics					
Acetone	ug/L	15.00	3.68	2.95	3.68
Semivolatiles					
Di-n-butylphthalate	ug/L	5.00	5.05	4.72	5.00
Di-n-octylphthalate	ug/L	5.00	5.10	4.85	5.00
Explosives					
RDX	ug/L	0.06	0.06	0.06	0.06
2,4,6-Trinitrotoluene	ug/L	0.06	0.06	0.06	0.06
2,6-Dinitrotoluene	ug/L	0.06	0.06	0.06	0.06

TABLE 6-7

SURFACE WATER DATA FOR REEDER CREEK
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	EXPOSURE POINT CONC.
Volatile Organics					
1,2-Dichloroethane	ug/L	5.00	3.73	3.14	3.73
Trichloroethene	ug/L	5.00	3.76	3.18	3.76
Semivolatiles					
bis(2-Ethylhexyl)phthalate	ug/L	10.50	6.44	5.67	6.44
Explosives					
RDX	ug/L	0.67	0.17	0.12	0.17
Tetryl	ug/L	0.20	0.13	0.10	0.13
Metals					
Aluminum	ug/L	300.00	139.41	93.23	139.41
Arsenic	ug/L	1.85	1.44	1.23	1.44
Barium	ug/L	66.60	57.50	52.15	57.50
Beryllium	ug/L	1.40	6.71	0.49	1.40
Chromium	ug/L	4.80	4.27	3.43	4.27
Copper	ug/L	9.85	8.90	6.93	8.90
Lead	ug/L	2.20	0.99	0.70	0.99
Manganese	ug/L	236.00	130.42	88.02	130.42
Nickel	ug/L	17.60	15.10	11.49	15.10
Vanadium	ug/L	39.20	18.95	13.63	18.95

TABLE 6-7

SURFACE WATER DATA FOR ON-SITE WETLANDS
SUMMARY OF VALIDATED RESULTS (PHASE I and II)
CHEMICALS OF CONCERN

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	EXPOSURE POINT CONC.
Volatile Organics					
1,2-Dichloroethane	ug/L	5.00	4.30	3.82	4.30
Trichloroethene	ug/L	17.00	5.69	4.45	5.69
Semivolatiles					
bis(2-Ethylhexyl)phthalate	ug/L	71.00	9.37	8.50	9.37
Explosives					
RDX	ug/L	9.40	1.93	0.93	1.93
Tetryl	ug/L	0.52	0.18	0.14	0.18
Metals					
Aluminum	ug/L	5,220.00	18,766.22	882.22	5,220.00
Arsenic	ug/L	4.40	1.97	1.50	1.97
Barium	ug/L	523.00	190.85	141.61	190.85
Beryllium	ug/L	1.30	0.56	0.41	0.56
Chromium	ug/L	8.60	3.10	2.37	3.10
Copper	ug/L	59.80	70.79	15.33	59.80
Lead	ug/L	74.20	53.03	10.70	53.03
Manganese	ug/L	1,080.00	1,090.08	198.79	1,080.00
Nickel	ug/L	17.50	6.83	5.27	6.83
Vanadium	ug/L	37.20	32.41	9.10	32.41

TABLE 6-7

SUMMARY OF VALIDATED RESULTS (PHASE I and II)
CHEMICALS OF CONCERN
SEDIMENT DATA FOR REEDER CREEK

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	EXPOSURE POINT CONC.
Semivolatiles					
2-Methylnaphthalene	ug/kg	490.00	411.83	314.63	411.83
Phenanthrene	ug/kg	490.00	396.75	269.38	396.75
Benzo(a)anthracene	ug/kg	490.00	407.76	336.25	407.76
Benzo(b)fluoranthene	ug/kg	490.00	407.76	336.25	407.76
benzo(k)fluoranthene	ug/kg	490.00	407.76	336.25	407.76
Benzo(a)pyrene	ug/kg	490.00	407.76	336.25	407.76
Indeno(1,2,3-cd)pyrene	ug/kg	490.00	407.76	336.25	407.76
Explosives					
4-amino-2,6-Dinitrotoluene	ug/kg	60.00	60.00	60.00	60.00
2-amino-4,6-Dinitrotoluene	ug/kg	60.00	60.00	60.00	60.00
Metals					
Aluminum	mg/kg	15,600.00	12,202.89	10,104.50	12,202.89
Antimony	mg/kg	4.05	4.06	3.71	4.05
Arsenic	mg/kg	7.40	6.66	5.28	6.66
Barium	mg/kg	94.80	66.24	47.33	66.24
Beryllium	mg/kg	0.71	0.65	0.47	0.65
Cadmium	mg/kg	3.40	2.27	1.71	2.27
Chromium	mg/kg	24.50	22.85	18.08	22.85
Cobalt	mg/kg	11.20	10.23	8.03	10.23
Copper	mg/kg	2,380.00	1,032.68	262.51	1,032.68
Lead	mg/kg	332.00	418.55	94.17	332.00
Manganese	mg/kg	596.00	474.62	420.00	474.62
Mercury	mg/kg	0.69	1.22	0.20	0.69
Nickel	mg/kg	42.30	37.97	29.62	37.97
Selenium	mg/kg	1.40	1.02	0.62	1.02
Vanadium	mg/kg	20.10	18.02	13.90	18.02
Zinc	mg/kg	497.00	899.80	148.22	497.00

TABLE 6-7

SUMMARY OF VALIDATED RESULTS (PHASE I and II)
CHEMICALS OF CONCERN
SEDIMENT DATA FOR ON-SITE WETLANDS

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	EXPOSURE POINT CONC.
Semivolatiles					
2-Methylnaphthalene	ug/kg	500.00	362.54	312.35	362.54
Phenanthrene	ug/kg	600.00	395.15	330.85	395.15
Benzo(a)anthracene	ug/kg	500.00	366.89	311.28	366.89
Benzo(b)fluoranthene	ug/kg	500.00	366.93	311.50	366.93
benzo(k)fluoranthene	ug/kg	500.00	366.95	311.61	366.95
Benzo(a)pyrene	ug/kg	500.00	366.78	310.72	366.78
Indeno(1,2,3-cd)pyrene	ug/kg	500.00	366.77	310.67	366.77
Explosives					
4-amino-2,6-Dinitrotoluene	ug/kg	160.00	72.20	64.55	72.20
2-amino-4,6-Dinitrotoluene	ug/kg	180.00	75.88	66.59	75.88
Metals					
Aluminum	mg/kg	25,800.00	17,742.74	16,486.36	17,742.74
Antimony	mg/kg	28.30	10.60	7.25	10.60
Arsenic	mg/kg	9.50	5.66	4.85	5.66
Barium	mg/kg	1,780.00	366.08	271.98	366.08
Beryllium	mg/kg	1.60	1.09	0.98	1.09
Cadmium	mg/kg	9.70	3.38	2.55	3.38
Chromium	mg/kg	41.80	26.72	24.56	26.72
Cobalt	mg/kg	17.70	12.70	11.64	12.70
Copper	mg/kg	3,790.00	489.13	288.04	489.13
Lead	mg/kg	7,400.00	1,674.71	526.09	1,674.71
Manganese	mg/kg	1,520.00	597.58	502.05	597.58
Mercury	mg/kg	2.00	0.93	0.32	0.93
Nickel	mg/kg	64.40	40.25	36.55	40.25
Selenium	mg/kg	1.80	0.91	0.73	0.91
Vanadium	mg/kg	37.90	27.22	25.23	27.22
Zinc	mg/kg	1,200.00	446.43	273.22	446.43

TABLE 6-7

SUMMARY OF MODELING RESULTS
CHEMICALS OF CONCERN
AMBIENT AIR DATA

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	EXPOSURE POINT CONC.
Semivolatile Organics					
2-Methylnaphthalene	ug/m3	2.22E-05	5.14E-06	4.85E-06	5.14E-06
Nitroaniline, 3-	ug/m3	5.05E-05	2.17E-05	2.03E-05	2.17E-05
Dinitrotoluene, 2,4-	ug/m3	5.65E-04	1.20E-05	1.45E-05	1.20E-05
Phenanthrene	ug/m3	4.45E-05	5.45E-06	5.00E-06	5.45E-06
Benzo(a)anthracene	ug/m3	6.67E-05	5.97E-06	5.36E-06	5.97E-06
Chrysene	ug/m3	1.52E-04	6.00E-06	5.81E-06	6.00E-06
Benzo(b)fluoranthene	ug/m3	1.88E-04	6.03E-06	6.03E-06	6.03E-06
Benzo(k)fluoranthene	ug/m3	7.70E-05	5.71E-06	5.43E-06	5.71E-06
Benzo(a)pyrene	ug/m3	6.33E-05	5.99E-06	5.38E-06	5.99E-06
Indeno(1,2,3-cd)pyrene	ug/m3	3.94E-05	5.60E-06	5.22E-06	5.60E-06
Dibenz(a,h)anthracene	ug/m3	1.15E-05	5.16E-06	4.96E-06	5.16E-06
Benzo(g,h,i)perylene	ug/m3	1.64E-05	5.16E-06	5.02E-06	5.16E-06
Pesticides/PCBs					
Dieldrin	ug/m3	8.55E-07	1.98E-07	1.82E-07	1.98E-07
4,4'-DDE	ug/m3	1.42E-05	3.08E-07	2.83E-07	3.08E-07
4,4'-DDT	ug/m3	4.79E-05	3.19E-07	4.52E-07	3.19E-07
Explosives					
RDX	ug/m3	8.21E-05	1.56E-06	2.07E-06	1.56E-06
1,3,5-Trinitrobenzene	ug/m3	1.33E-04	1.89E-06	2.96E-06	1.89E-06
Tetryl	ug/m3	1.71E-05	2.56E-06	2.36E-06	2.56E-06
2,4,6-Trinitrotoluene	ug/m3	1.37E-03	2.24E-06	1.04E-05	2.24E-06
4-amino-2,6-Dinitrotoluene	ug/m3	1.52E-04	2.22E-06	3.11E-06	2.22E-06
2-amino-4,6-Dinitrotoluene	ug/m3	1.88E-04	2.46E-06	3.63E-06	2.46E-06
Metals					
Barium	ug/m3	5.89E-01	2.47E-02	2.53E-02	2.47E-02
Cadmium	ug/m3	4.82E-04	1.20E-02	5.97E-05	4.82E-04
Chromium	ug/m3	2.45E-02	4.85E-02	6.16E-04	2.45E-02
Copper	ug/m3	6.52E-01	1.20E-02	1.36E-02	1.20E-02
Lead	ug/m3	9.70E-01	4.85E-02	3.23E-02	4.85E-02
Thallium	ug/m3	6.50E-04	5.53E-06	7.85E-06	5.53E-06
Zinc	ug/m3	2.17E+00	1.51E-02	2.25E-02	1.51E-02

the same over time, a conservative assumption, since these concentrations will likely decrease over time through a variety of dispersion/dilution mechanisms.

6.3.5.1.1 Exposure Concentrations for Fugitive Dust

The exposure concentrations for fugitive dust were derived from modeling results, as described in Section 5. The data input to the model used the 95th UCL concentrations in the surface soil samples.

6.3.5.1.2 Quantification of Exposure to Fugitive Dust

The quantification assessment of this exposure pathway includes both current and future land uses. The equation for the chronic daily intake is as follows: (USEPA, 1989b).

$$\text{Intake (mg/kg-day)} = \frac{CA \times IR \times EF \times ED}{BW \times AT}$$

Where:

CA = Chemical concentration in air (mg/m^3)
IR = Inhalation rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body Weight (Kg)
AT = Averaging Time (days)

The results of these calculations are shown in Tables 6-8 and 6-9. In calculating the intake, the following values were used in this equation. The chemical concentrations (CA) were described previously. The inhalation rate (IR) used was 20 m^3/day, the average adult inhalation rate (USEPA, 1989b). The exposure frequency (EF) was assumed to be 150 days/year in the current use industrial exposure analysis (Table 6-8). Since this represents a reasonable estimate of the maximum annual number of days site workers are at the OB grounds. The reason for this frequency has to do the conditions in which they can conduct work. Any rain, high wind, or other unsteady weather patterns and the workers will not conduct activities on the OB grounds. In the future residential use scenario, an EF of 350 days/year was used. The exposure duration (ED) was assumed to be 25 and 30 years, for the current and future uses, respectively (USEPA, 1989b). For body weight, (BW) a value of 70 kg was used, which reflects the average for an adult (USEPA, 1989b). The averaging time (AT) used for non-carcinogenic substances was 25 years (9,125 days) for the current use-industrial scenario and 30 years (10,950 days) for the future use-residential scenario. For carcinogenic substances, an AT of 70 years (25,550 days) was used for both scenarios.

6.3.5.2 Incidental Ingestion of Soil (current and future land use)

For the current land use scenario the ingestion of on-site soils is specifically limited to the site workers who work at the OB grounds. Due to the security of the Depot and the nature of the operations which are performed, no outside residential populations can be affected by this exposure scenario.

Future land use considerations have been considered as residential. This assumption is considered to be conservative.

6.3.5.2.1 Exposure Concentration for the Incidental Ingestion of Onsite Soil

The data collected from the Phase I and Phase II field operations of the RI were compiled and the exposure concentrations were calculated as the 95th UCL of the mean and is presented in Tables 6-10 and 6-11. As described in Section 6.3.5,this value was obtained following a test for normality and a comparison of the calculated 95th UCL and the maximum value, whichever was the lower of the two.

6.3.5.2.2 Quantification of Exposure to Incidental Ingestion of Soil

The quantitative assessment of this exposure pathway includes current and future land use exposures.

The equation for the intake is taken from the RAGS (USEPA, 1989b) and the pathway variables were taken from the SDEF (USEPA, 1991g).

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

TABLE 6-8

CALCULATION OF INTAKE (ONSITE)
FROM INHALATION OF FUGITIVE DUST (WHILE WORKING)
INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Intake (Nc) (mg/kg-day)	Intake (Car) (mg/kg-day)	95% UCL Air (ug/m3)	Inhalation Rate (m3/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
								Nc	Car
Semivolatiles									
Methylnaphthalene, 2-			5.14E-06	20	150	25	70	9,125	25,550
Nitroaniline, 3-			2.17E-05	20	150	25	70	9,125	25,550
Dinitrotoluene, 2,4-			1.20E-05	20	150	25	70	9,125	25,550
Phenanthrene			5.45E-06	20	150	25	70	9,125	25,550
Benzo(a)anthracene			5.97E-06	20	150	25	70	9,125	25,550
Chrysene			6.00E-06	20	150	25	70	9,125	25,550
Benzo(b)fluoranthene			6.03E-06	20	150	25	70	9,125	25,550
Benzo(k)fluoranthene			5.71E-06	20	150	25	70	9,125	25,550
Benzo(a)pyrene			5.99E-06	20	150	25	70	9,125	25,550
Indeno(1,2,3-cd)pyrene			5.60E-06	20	150	25	70	9,125	25,550
Dibenzo(a,h)anthracene			5.16E-06	20	150	25	70	9,125	25,550
Benzo(g,h,i)perylene			5.16E-06	20	150	25	70	9,125	25,550
Pesticides/PCBs									
Dieldrin		8.3E-12	1.98E-07	20	150	25	70	9,125	25,550
4,4'-DDE		1.3E-11	3.08E-07	20	150	25	70	9,125	25,550
4,4'-DDT		1.3E-11	3.19E-07	20	150	25	70	9,125	25,550
Explosives									
RDX			1.56E-06	20	150	25	70	9,125	25,550
1,3,5-Trinitrobenzene			1.89E-06	20	150	25	70	9,125	25,550
Tetryl			2.56E-06	20	150	25	70	9,125	25,550
2,4,6-Trinitrotoluene			2.24E-06	20	150	25	70	9,125	25,550
4-amino-2,6-Dinitrotoluene			2.22E-06	20	150	25	70	9,125	25,550
2-amino-4,6-Dinitrotoluene			2.46E-06	20	150	25	70	9,125	25,550
Metals									
Barium	2.9E-06		2.47E-02	20	150	25	70	9,125	25,550
Cadmium		2.0E-08	4.82E-04	20	150	25	70	9,125	25,550
Chromium		1.0E-06	2.45E-02	20	150	25	70	9,125	25,550
Copper			1.20E-02	20	150	25	70	9,125	25,550
Lead			4.85E-02	20	150	25	70	9,125	25,550
Thallium			5.53E-06	20	150	25	70	9,125	25,550
Zinc			1.51E-02	20	150	25	70	9,125	25,550

EQUATION: **Intake (mg/kg-day) =**

$$\frac{CA \times IR \times EF \times ED}{BW \times AT}$$

Variables:	**Assumptions:**
CA = Chemical Concentration in Air (mg/m3)	**95% UCL Air Model Data**
IR = Inhalation Rate (m3/day)	**20**
EF = Exposure Frequency (days/yr)	**150**
ED = Exposure Duration (years)	**25**
BW = Bodyweight (kg)	**70**
AT = Averaging Time (days)	**25 x 365 (Nc) 70 x 365 (Car)**

TABLE 6-9

CALCULATION OF INTAKE
FROM INHALATION OF FUGITIVE DUST (DAILY)
RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Intake (Nc) (mg/kg-day)	Intake (Car) (mg/kg-day)	95% UCL Air (ug/m3)	Inhalation Rate (m3/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
								Nc	Car
Semivolatiles									
Methylnaphthalene, 2-			5.14E-06	20	350	30	70	10,950	25,550
Nitroaniline, 3-			2.17E-05	20	350	30	70	10,950	25,550
Dinitrotoluene, 2,4-			1.20E-05	20	350	30	70	10,950	25,550
Phenanthrene			5.45E-06	20	350	30	70	10,950	25,550
Benzo(a)anthracene			5.97E-06	20	350	30	70	10,950	25,550
Chrysene			6.00E-06	20	350	30	70	10,950	25,550
Benzo(b)fluoranthene			6.03E-06	20	350	30	70	10,950	25,550
Benzo(k)fluoranthene			5.71E-06	20	350	30	70	10,950	25,550
Benzo(a)pyrene			5.99E-06	20	350	30	70	10,950	25,550
Indeno(1,2,3-cd)pyrene			5.60E-06	20	350	30	70	10,950	25,550
Dibenzo(a,h)anthracene			5.16E-06	20	350	30	70	10,950	25,550
Benzo(g,h,i)perylene			5.16E-06	20	350	30	70	10,950	25,550
Pesticides/PCBs									
Dieldrin		2.3E-11	1.98E-07	20	350	30	70	10,950	25,550
4,4'-DDE		3.6E-11	3.08E-07	20	350	30	70	10,950	25,550
4,4'-DDT		3.7E-11	3.19E-07	20	350	30	70	10,950	25,550
Explosives									
RDX			1.56E-06	20	350	30	70	10,950	25,550
1,3,5-Trinitrobenzene			1.89E-06	20	350	30	70	10,950	25,550
Tetryl			2.56E-06	20	350	30	70	10,950	25,550
2,4,6-Trinitrotoluene			2.24E-06	20	350	30	70	10,950	25,550
4-amino-2,6-Dinitrotoluene			2.22E-06	20	350	30	70	10,950	25,550
2-amino-4,6-Dinitrotoluene			2.46E-06	20	350	30	70	10,950	25,550
Metals									
Barium	6.8E-06		2.47E-02	20	350	30	70	10,950	25,550
Cadmium		5.7E-08	4.82E-04	20	350	30	70	10,950	25,550
Chromium		2.9E-06	2.45E-02	20	350	30	70	10,950	25,550
Copper			1.20E-02	20	350	30	70	10,950	25,550
Lead			4.85E-02	20	350	30	70	10,950	25,550
Thallium			5.53E-06	20	350	30	70	10,950	25,550
Zinc			1.51E-02	20	350	30	70	10,950	25,550

EQUATION: **Intake (mg/kg-day) =** $$\frac{CA \times IR \times EF \times ED}{BW \times AT}$$

Variables:	**Assumptions:**
CA = Chemical Concentration in Air (mg/m3)	**95% UCL Air Model Data**
IR = Inhalation Rate (m3/day)	**20**
EF = Exposure Frequency (days/yr)	**350**
ED = Exposure Duration (years)	**30**
BW = Bodyweight (kg)	**70**
AT = Averaging Time (days)	**30 x 365 (Nc) 70 x 365 (Car)**

TABLE 6-10

CALCULATION OF INTAKE (ONSITE)
FROM INGESTION OF SOIL WHILE WORKING
INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Intake (Nc) (mg/kg-day)	Intake (Car) (mg/kg-day)	95th UCL Soil (mg/kg)	Ingestion Rate (mg soil/day)	Conv. Factor (kg/mg)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
										Nc	Car
Semi-volatiles											
Methylnaphthalene, 2-			3.00E-01	480	1.0E-06	1	150	25	70	9,125	25,550
3-Nitroaniline			1.27E+00	480	1.0E-06	1	150	25	70	9,125	25,550
Dinitrotoluene, 2,4-	2.0E-06		6.98E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Phenanthrene			3.19E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Benzo(a)anthracene		3.5E-07	3.49E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Chrysene		3.5E-07	3.51E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Benzo(b)fluoranthene		3.5E-07	3.53E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Benzo(k)fluoranthene		3.4E-07	3.34E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Benzo(a)pyrene		3.5E-07	3.50E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Indeno(1,2,3-cd)pyrene		3.3E-07	3.27E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Dibenzo(a,h)anthracene		3.0E-07	3.01E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Benzo(g,h,i)perylene			3.02E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Pesticides/PCB's											
Dieldrin	3.3E-08	1.2E-08	1.16E-02	480	1.0E-06	1	150	25	70	9,125	25,550
4,4'-DDE		1.8E-08	1.80E-02	480	1.0E-06	1	150	25	70	9,125	25,550
4,4'-DDT	5.3E-08	1.9E-08	1.87E-02	480	1.0E-06	1	150	25	70	9,125	25,550
Explosives											
RDX	2.6E-07	9.2E-08	9.14E-02	480	1.0E-06	1	150	25	70	9,125	25,550
1,3,5-Trinitrobenzene	3.1E-07		1.10E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Tetryl			1.50E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Trinitrotoluene, 2,4,6-	3.7E-07	1.3E-07	1.31E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Dinitrotoluene, 2,6-, 4-amino			1.30E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Dinitrotoluene, 4,6-, 2-amino			1.43E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Metals											
Barium	4.1E-03		1.45E+03	480	1.0E-06	1	150	25	70	9,125	25,550
Cadmium	1.6E-05		5.74E+00	480	1.0E-06	1	150	25	70	9,125	25,550
Chromium	8.9E-05		3.16E+01	480	1.0E-06	1	150	25	70	9,125	25,550
Copper	1.9E-03		6.78E+02	480	1.0E-06	1	150	25	70	9,125	25,550
Lead			2.84E+03	480	1.0E-06	1	150	25	70	9,125	25,550
Thallium	9.1E-07		3.23E-01	480	1.0E-06	1	150	25	70	9,125	25,550
Zinc	2.5E-03		8.84E+02	480	1.0E-06	1	150	25	70	9,125	25,550

EQUATION:

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Variables:	Assumptions:	Variables:	Assumptions:
CS = Chemical Concentration in Soil (mg soil/kg)	95th UCL Soil Data	EF = Exposure Frequency (days/yr)	150 events/year
IR = Ingestion Rate (mg soil/day)	480	ED = Exposure Duration (years)	25 years
CF = Conversion Factor (10-6 kg/mg)	10-6	BW = Bodyweight (kg)	70 kg
FI = Fraction Ingested (unitless)	1	AT = Averaging Time (days)	25 x 365 (NC) 70 x 365(c)

TABLE 6-11

CALCULATION OF INTAKE (ONSITE)
FROM INGESTION OF SOIL (DAILY)
RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	30 Year Intake (Nc) (mg/kg-day)	30 Year Intake (Car) (mg/kg-day)	Child Intake (Nc) (mg/kg-day)	Child Intake (Car) (mg/kg-day)	Adult Intake (Nc) (mg/kg-day)	Adult Intake (Car) (mg/kg-day)	95th UCL Soil (mg/kg)	Child Ingestion Rate (mg soil/day)	Adult Ingestion Rate (mg soil/day	Conv. Factor (kg/mg)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Child Exposure Duration (years)	Adult Exposure Duration (years)	Child Body Weight (kg)	Adult Body Weight (kg)	Averaging Time (days)		
																	Child(Nc)	Adult(Nc)	Car
Semivolatiles																			
Methylnaphthalene, 2-							3.00E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
3-Nitroaniline							1.27E+00	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Dinitrotoluene, 2,4-	2.6E-06		8.9E-06		9.6E-07		6.98E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Phenanthrene							3.19E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Benzo(a)anthracene		5.5E-07		3.8E-07		1.6E-07	3.49E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Chrysene		5.5E-07		3.8E-07		1.6E-07	3.51E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Benzo(b)fluoranthene		5.5E-07		3.9E-07		1.7E-07	3.53E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Benzo(k)fluoranthene		5.2E-07		3.7E-07		1.6E-07	3.34E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Benzo(a)pyrene		5.5E-07		3.8E-07		1.6E-07	3.50E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Indeno(1,2,3-cd)pyrene		5.1E-07		3.6E-07		1.5E-07	3.27E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Dibenzo(a,h)anthracene		4.7E-07		3.3E-07		1.4E-07	3.01E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Benzo(g,h,i)perylene							3.02E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Pesticides/PCBs																			
Dieldrin	4.2E-08	1.8E-08	1.5E-07	1.3E-08	1.6E-08	5.4E-09	1.16E-02	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
4,4'-DDE		2.8E-08		2.0E-08		8.4E-09	1.80E-02	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
4,4'-DDT	6.8E-08	2.9E-08	2.4E-07	2.0E-08	2.6E-08	8.8E-09	1.87E-02	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
					ERR	ERR													
Explosives					ERR	ERR													
					ERR	ERR													
RDX	3.3E-07	1.4E-07	1.2E-06	1.0E-07	1.3E-07	4.3E-08	9.14E-02	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
1,3,5-Trinitrobenzene	4.0E-07		1.4E-06		1.5E-07		1.10E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Tetryl							1.50E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Trinitrotoluene, 2,4,6-	4.8E-07	2.0E-07	1.7E-06	1.4E-07	1.8E-07	6.1E-08	1.31E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Dinitrotoluene, 2,6-, 4-amino							1.30E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Dinitrotoluene, 4,6-, 2-amino							1.43E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Metals																			
Barium	5.3E-03		1.8E-02		2.0E-03		1.45E+03	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Cadmium	2.1E-05		7.3E-05		7.9E-06		5.74E+00	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Chromium	1.2E-04		4.0E-04		4.3E-05		3.16E+01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Copper	2.5E-03		8.7E-03		9.3E-04		6.78E+02	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Lead							2.84E+03	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Thallium	1.2E-06		4.1E-06		4.4E-07		3.23E-01	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550
Zinc	3.2E-03		1.1E-02		1.2E-03		8.84E+02	200	100	1.0E-06	1	350	6	24	15	70	2,190	8,760	25,550

EQUATION: Intake (mg/kg-day) =

$$\frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Variables:	**Assumptions:**
CS = Chemical Concentration in Soil (mg soil/kg)	95th UCL Soil Data
IR = Ingestion Rate (mg soil/day)	100 (Adult)/ 200 (Child)
CF = Conversion Factor (10-6 kg/mg)	10-6
FI = Fraction Ingested (unitless)	1
EF = Exposure Frequency (days/years)	350 events/year
ED = Exposure Duration (years)	30 years
BW = Bodyweight (kg)	70 (Adult male)/ 15 (Child 6-7)
AT = Averaging Time (days)	6 x 365 child ; 24 x 365 adult (NC) 70 x 365 (C)

Where:

CS = Chemical Concentration in Soil (mg/kg soil)
IR = Ingestion Rate (mg soil/day)
CF = Conversion Factor (10^{-6} kg/mg)
FI = Fraction Ingested from Contaminated Source (unitless)
EF = Exposure Frequency (days/years)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The results of these calculations are shown in Table 6-10 and 6-11.

For the current land use scenario, certain high end assumptions have been made. One is that the site worker ingests an average of 480 miligrams of soil/day. This figure, taken from the works of Hawley (1985) is for someone doing yardwork for the day which is the closest association that could be made with a site worker. Another assumption is that due to the nature of their duties, select weather patterns have to be in place in order for the OB ground activities to take place. Thus, work is assumed to be 3 days/week for 50 weeks/year resulting in 150 days/year for the Exposure Frequency (EF). Exposure Duration (ED) is 25 years and Fraction Ingested (FI) is 100 percent or 1.

For the future residential use, the exposure period was divided into 6 years of childhood and 24 years of adulthood for a total of 30 years. Table 6-11 is divided into two periods to reflect this assumption. The weighted average of the two intakes were used to arrive at the 30-year intake. An IR of 200 mg soil/day was assumed for children, and 100 mg soil/day for adults (USEPA, 1991). The EF for the residential scenario was assumed to be 350 days/year. The Exposure Frequency (EF) was assumed at 350 days/year. The Fraction Ingested (FI) was assumed to be 100% or 1, a worst case assumption.

6.3.5.3 Dermal Contact to Onsite Soils (current and future land use)

The site worker activities under current land use conditions are dermaly exposed to the surficial on-site soils. Future residential use could also lead to dermal exposure. Exposure concentrations for the future residential land scenario utilized use the same soil sampling database as the current land use scenario.

6.3.5.3.1 Exposure Concentrations for Dermal Contact to Onsite Soils

As with the previous scenarios, the 95th UCL of the mean was used as the exposure concentration for cadmium. Only cadmium was considered for this exposure pathway because only cadmium has an EPA recommended dermal absorption factor. These dermal absorption factors are presented in the EPA *Dermal Exposure Assessment* (USEPA, 1992) guidance manual on page 6-14.

6.3.5.3.2 Quantification of Exposure from Dermal Contact to Onsite Soils

The quantitative assessment of this exposure pathway considers current and future land use. The equation for the absorbed dose, is taken from RAGS (USEPA, 1989b).

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:

CS = Chemical Concentration in Soil (mg/kg soil)
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact (cm^2/day)
AF = Soil to Skin Adherence Factor (mg/cm^2)
ABS = Absorption Factor (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged -- days)

The exposure calculations are summarized in Tables 6-12 and 6-13.

In calculating the RME, the 50th percentile values for the skin surface area were used. The rationale is that bodyweight of a typical male (70 kg) is closely correlated to the 50th percentile for the skin surface area: (USEPA, 1989b). The skin surface area available for contact (SA) to soil was assumed as 0.31 m^2 and 0.15 m^2 (adult & child), respectively. This is representative of the surface area associated with the hands and arms. The soil adherence factor (AF) is a mass weight (mg) of soil per cm^2 of skin surface area being exposed under

TABLE 6-12

CALCULATION OF ABSORBED DOSE (ONSITE)
FROM DERMAL CONTACT TO SOIL (WHILE WORKING)
INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Absorbed Dose (Nc) (mg/kg-day)	Absorbed Dose (Car) (mg/kg-day)	95th UCL (mg/kg)	Conv. Factor (kg/mg)	Skin Surface Area Contact (cm2/event)	Adherence Factor (mg soil/cm2)	Adsorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days) Nc	Averaging Time (days) Car
Semivolatiles												
Pesticides/PCBs												
Explosives												
Metals												
Cadmium	2.9E-06		5.74E+00	1.0E-06	3,120	2.77	0.01	150	25	70	9,125	25,550

EQUATION: Absorbed Dose (mg/kg-day) = $\frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$

Variables:	Assumptions:
CS = Chemical Concentration in Soil (mg soil/kg)	95th UCL soil data
CF = Conversion Factor (10-6 kg/mg)	10-6
SA = Surface Area Contact (cm2)	3,120
AF =Soil to Skin Adherence Factor (mg/cm2)	2.77
ABS = Absorption Factor (unitless)	1.0%

Variables:	Assumptions:
EF = Exposure Frequency (dy/yr)	150 events/year
ED = Exposure Duration (years)	25 years
BW = Bodyweight (kg)	70 kg
AT = Averaging Time (days)	25 x 365 (NC) 70 x 365(c)

TABLE 6-13

CALCULATION OF ABSORBED DOSE (ONSITE)
FROM DERMAL CONTACT TO SOIL (DAILY)
RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	30 Year Dose (Nc) (mg/kg-day)	30 Year Dose (Car) (mg/kg-day)	Child Absorbed Dose (Nc) (mg/kg-day)	Child Absorbed Dose (Car) (mg/kg-day)	Adult Absorbed Dose (Nc) (mg/kg-day)	Adult Absorbed Dose (Car) (mg/kg-day)	95th UCL Soil (mg/kg)	Conv. Factor (kg/mg)	Child Skin Surface Area Contact (cm2/event)	Adult Skin Surface Area Contact (cm2/event)	Adherence Factor (mg soil/cm2)	Absorption Factor (unitless)	Exposure Frequency (days/year)	Child Exposure Duration (years)	Adult Exposure Duration (years)	Child Body Weight (kg)	Adult Body Weight (kg)	Averaging Time (days)		
																		Child(Nc)	Adult(Nc)	Car
Semivolatiles																				
Pesticides/PCBs																				
Explosives																				
Metals																				
Cadmium	8.5E-06	0.0E+00	1.5E-05		6.8E-06		5.74E+00	1.0E-06	1,510	3,120	2.77	0.01	350	6	24	15	70	2,190	8,760	25,550

EQUATION:

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Variables:	Assumptions:	Variables:	Assumptions:
CS = Chemical Concentration in Soil (mg soil/kg)	95th UCL Soil Data	EF = Exposure Frequency (days/year)	350 events/year
CF = Conversion Factor (10-6 kg/mg)	10-6	ED = Exposure Duration (years)	6 Child, 24 Adult
SA = Surface Area Contact (cm2)	1510(C)/3120(A)	BW = Bodyweight (kg)	15 kg (child) 70 kg (adult)
AF =Soil to Skin Adherence Factor (mg/cm2)	2.77	AT = Averaging Time (days)	6 x 365 (Nc)+ 24 x 365 (Nc)
ABS = Absorption Factor (unitless)	1.0 %		70 x 365 (Car)

the exposure pathway scenario. A factor of 2.77 mg soil/cm^2 (USEPA, 1989b) was used as the adherence factor for direct contact with soil and sediment throughout this assessment. A Dermal Absorption Factor (ABS) for cadmium of 0.01 was used (USEPA, 1992). This was the highest dermal absorption factor provided by EPA. The ABS values for cadmium ranged from 0.001 to 0.01.

Values for the exposure frequency (EF), exposure duration (ED), and averaging time (AT) are the same as for the previous scenario for each of the land use cases. The average body weight (BW) of 70 kg for an adult and 15 kg for a child was used.

6.3.5.4 Surface Water Ingestion while Swimming (current & future land use)

The security at SEDA restricts access to the OB grounds and would prevent nearby residents from entering the area of the OB grounds. Under current land use conditions, it is possible that area residents of Romulus/Varick could swim in areas of Reeder Creek which are offsite and downstream of the OB grounds. This is considered to be a seasonal activity confined to approximately the three summer months of the year. For the future residential exposure scenario, it was assumed that the on-site receptors could also swim in Reeder Creek.

6.3.5.4.1 Exposure Concentrations for Surface Water Ingestion

The exposure concentrations for this pathway are based upon the accumulated data from Phase I and Phase II. These exposure concentrations have been estimated as the 95th UCL of the mean of all Reeder Creek surface water data. This concentration was used for both the current off-site resident and the future on-site resident.

6.3.5.4.2 Quantification of Exposure for Surface Water Ingestion while swimming

The quantitative assessment of this exposure pathway includes current and future uses. The equation for the intake, taken from RAGS (USEPA, 1989b) is as follows:

$$\text{Intake (mg/kg-day)} = \frac{CW \times CR \times ET \times EF \times ED}{BW \times AT}$$

Where:

CW = Chemical Concentration in Water (mg/liter)
CR = Contact Rate (liters/hour)
ET = Exposure Time (hours/event)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Bodyweight (kg)
AT = Averaging time (days)

The exposure calculations are summarized in Table 6-14.

The Contact Rate (CR) for this pathway is representative of the amount (in liters/hour) of contaminated medium that is expected to be contacted per unit time. The *Exposure Factors Handbook* (EPA, 1989c) suggests that 50 ml/hour be used for this value. Additional assumptions regarding the surface water ingestion scenario include an Exposure Time of 2.6 hours/day, an Exposure Frequency of 7 days/year, an Exposure Duration of 30 years, and a 70 kg adult male bodyweight. All these scenario assumptions constitute the most conservative estimates available to achieve the best possible RME potential.

6.3.5.5 Dermal Contact to Surface Water while Swimming or Wading (current & future land use)

The absorbed dose calculated for current conditions was also used for the future absorbed dose. Two exposure scenarios for surface water were considered and include: (1) swimming, which is a seasonal-recreational, activity and, (2) wading in on-site wetlands by site workers.

6.3.5.5.1 Exposure Concentrations for Surface Water

The 95th UCL of the mean from the sampling programs collected during Phase I and Phase II of the RI was calculated for each chemical of concern in the surface water medium. Two data sets were developed. For the swimming risks, only data from Reeder Creek data was used, since this is the only surface water body large enough for swimming. For the wading risks, only the on-site wetlands were considered since these areas are used by site workers.

TABLE 6-14

CALCULATION OF INTAKE
FROM INGESTION OF SURFACE WATER (WHILE SWIMMING)
RESIDENTIAL EXPOSURE (CURRENT AND FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Intake (Nc) (mg/kg-day)	Intake (Car) (mg/kg-day)	95th UCL (mg/l)	Contact Rate (liters/hour)	Exposure Time (hours/event)	Exposure Frequency (events/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
									Nc	Car
Volatile Organics										
1,2-Dichloroethane		5.7E-08	3.73E-03	0.05	2.6	7	30	70	10,950	25,550
Trichloroethene		5.7E-08	3.76E-03	0.05	2.6	7	30	70	10,950	25,550
Semivolatiles										
bis(2-Ethylhexyl)phthalate	2.3E-07	9.8E-08	6.44E-03	0.05	2.6	7	30	70	10,950	25,550
Explosives										
RDX	5.9E-09	2.5E-09	1.67E-04	0.05	2.6	7	30	70	10,950	25,550
Tetryl			1.25E-04	0.05	2.6	7	30	70	10,950	25,550
Metals										
Aluminum			1.39E-01	0.05	2.6	7	30	70	10,950	25,550
Arsenic	5.1E-08	2.2E-08	1.44E-03	0.05	2.6	7	30	70	10,950	25,550
Barium	2.0E-06		5.75E-02	0.05	2.6	7	30	70	10,950	25,550
Beryllium	5.0E-08	2.1E-08	1.40E-03	0.05	2.6	7	30	70	10,950	25,550
Chromium	1.5E-07		4.27E-03	0.05	2.6	7	30	70	10,950	25,550
Copper	3.2E-07		8.90E-03	0.05	2.6	7	30	70	10,950	25,550
Lead			9.88E-04	0.05	2.6	7	30	70	10,950	25,550
Manganese	4.6E-06		1.30E-01	0.05	2.6	7	30	70	10,950	25,550
Nickel			1.51E-02	0.05	2.6	7	30	70	10,950	25,550
Vanadium	6.7E-07		1.89E-02	0.05	2.6	7	30	70	10,950	25,550

EQUATION: Intake (mg/kg-day) = $\frac{CW \times CR \times ET \times EF \times ED}{BW \times AT}$

Variables:	Assumptions:
CW = Chemical Concentration in Water (mg/liter)	95th UCL Surface Water Data
CR = Contact Rate (liters/hour)	0.05
ET = Exposure Time (hours/day)	2.6
EF = Exposure Frequency (days/year)	7
ED = Exposure Duration (years)	30
BW = Bodyweight (kg)	70
AT = Averaging Time (days)	30 x 365(NC) 70 x 365(C)

6.3.5.5.2 Quantification of Exposure from Surface Water while Swimming or Wading

The quantitative assessment of this exposure pathway includes current and future uses. The equation for the absorbed dose, obtained from RAGS, (USEPA, 1989b) is as follows:

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

Where:

CW = Chemical Concentration in Water (mg/liter)
SA = Skin Surface Area Available for Contact (cm^2)
PC = Dermal Permeability Constant (cm/hr)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor for Water (1 liter/1000 cm^3)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged (days)

The exposure calculations are summarized in Tables 6-15 through 6-17.

For swimming, the total body surface area (1.94 m^2) was used in considering surface water contact to Reeder Creek. This is the 50th percentile for total body surface area (m^2) according to the *Exposure Factors Handbook* (USEPA, 1989c). The 50th percentile is recommended by EPA guidance because of the relative proportionality to the 70 kilogram bodyweight used as the average adult male within a population such as Romulus and Varick. For wading, a value of 0.86m^2 was used, which is representative of the hands, arms and legs.

According to the *Superfund Exposure Assessment Manual* (USEPA, 1988), permeability constants (PC) for various chemicals are listed in accordance with chemical families. It is stated in this document that, "for many compounds, dermal permeability constants will not be available". "In such cases, the analyst must assume that contaminants are carried through the skin as a solute in water which is absorbed (rather than being preferentially absorbed independently of the water), and that the contamination concentration in the water being

TABLE 6-15

CALCULATION OF ABSORBED DOSE (SWIMMING)
FROM DERMAL CONTACT TO SURFACE WATER
RESIDENTIAL EXPOSURE (CURRENT AND FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Absorbed Dose (Nc) (mg/kg-day)	Absorbed Dose (Car) (mg/kg-day)	95th UCL (mg/kg)	Skin Surface Area Contact	Permeability Constant (cm/hr)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Volumetric Conv. Factor (1 liter/1000 c	Body Weight (kg)	Averaging Time (days)	
											Nc	Car
Volatile Organics												
1,2-Dichloroethane		1.8E-08	3.73E-03	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Trichloroethene		1.8E-08	3.76E-03	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Semi-volatiles												
bis(2-Ethylhexyl)phthalate	7.1E-08	3.1E-08	6.44E-03	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Explosives												
RDX	1.8E-09	7.9E-10	1.67E-04	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Tetryl			1.25E-04	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Metals												
Aluminum			1.39E-01	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Arsenic	1.6E-08	6.8E-09	1.44E-03	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Barium	6.4E-07		5.75E-02	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Beryllium	1.5E-08	6.6E-09	1.40E-03	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Chromium	4.7E-08		4.27E-03	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Copper	9.8E-08		8.90E-03	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Lead			9.88E-04	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Manganese	1.4E-06		1.30E-01	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Nickel			1.51E-02	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550
Vanadium	2.1E-07		1.89E-02	19,400	8.0E-04	2.6	7	30	1.0E-03	70	10,950	25,550

Absorbed Dose (mg/kg-day) = $\frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$

Variables:	Assumptions:	Variables:	Assumptions:
CW = Chemical Concentration in Water (mg/liter)	95th UCL Surface Water Data	EF = Exposure Frequency (days/year)	7
SA = Surface Area Contact (cm2)	19400	ED = Exposure Duration (years)	30
PC = Permeability Constant (cm/hour)	0.0008 (Pc for water)	CF = Vol. Conv. Factor (1 liter/1000 cm3)	0.001
ET = Exposure Time (hours/day)	2.6	BW = Bodyweight (kg)	70
		AT = Averaging Time (days)	30 x 365(Nc), 70 x 365 (C)

TABLE 6-16

CALCULATION OF ABSORBED DOSE (WADING) FROM DERMAL CONTACT TO SURFACE WATER INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Absorbed Dose (Nc) (mg/kg-day)	Absorbed Dose (Car) (mg/kg-day)	95th UCL Surface Water (mg/kg)	Skin Surface Area Contact (cm2)	Permeability Coefficient (cm/hr)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Volumetric Conv. Factor (1 liter/1000 cm3)	Body Weight (kg)	Averaging Time (days)	
											Nc	Car
<u>Volatile Organics</u>												
1,2-Dichloroethane		1.0E-07	4.30E-03	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Trichloroethene		1.4E-07	5.69E-03	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
<u>**Semivolatiles**</u>												
bis(2-Ethylhexyl)phthalate	6.3E-07	2.3E-07	9.37E-03	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
<u>**Explosives**</u>												
RDX	1.3E-07	4.7E-08	1.93E-03	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Tetryl			1.79E-04	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
<u>**Metals**</u>												
Aluminum			5.22E+00	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Arsenic	1.3E-07	4.8E-08	1.97E-03	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Barium	1.3E-05		1.91E-01	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Beryllium	3.7E-08	1.3E-08	5.55E-04	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Chromium	2.1E-07		3.10E-03	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Copper	4.0E-06		5.98E-02	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Lead			5.30E-02	8,620	4.0E-06	4	50	25	1.0E-03	70	9,125	25,550
Manganese	7.3E-05		1.08E+00	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Nickel			6.83E-03	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550
Vanadium	2.2E-06		3.24E-02	8,620	1.0E-03	4	50	25	1.0E-03	70	9,125	25,550

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times Kp \times ET \times EF \times ED \times CF}{BW \times AT}$$

<u>Variables:</u>	<u>Assumptions:</u>	<u>Variables:</u>	<u>Assumptions:</u>
CW = Chemical Concentration in Water (mg/liter)	95th UCL Surf. Water Data	EF = Exposure Frequency (days/year)	50
SA = Surface Area Contact (cm2)	8,620	ED = Exposure Duration (years)	25
Kp = Permeability Coefficient (cm/hour)	Compound Specific	CF = Vol. Conv. Factor (1 L/1000 cm3)	0.001
ET = Exposure Time (hours/day)	4	BW = Bodyweight (kg)	70

TABLE 6-17

CALCULATION OF ABSORBED DOSE (WADING)
FROM DERMAL CONTACT TO SURFACE WATER
RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Absorbed Dose (Nc) (mg/kg-day)	Absorbed Dose (Car) (mg/kg-day)	95th UCL Surface Water (mg/kg)	Skin Surface Area Contact (cm2)	Permeability Coefficient (cm/hr)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Volumetric Conv. Factor (1 liter/1000 cm3)	Body Weight (kg)	Averaging Time (days)	
											Nc	Car
Volatile Organics												
1,2-Dichloroethane		1.1E-08	4.30E-03	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Trichloroethene		1.5E-08	5.69E-03	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Semivolatiles												
bis(2-Ethylhexyl)phthalate	5.8E-08	2.5E-08	9.37E-03	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Explosives												
RDX	1.2E-08	5.1E-09	1.93E-03	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Tetryl			1.79E-04	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Metals												
Aluminum			5.22E+00	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Arsenic	1.2E-08	5.2E-09	1.97E-03	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Barium	1.2E-06		1.91E-01	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Beryllium	3.4E-09	1.5E-09	5.55E-04	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Chromium	1.9E-08		3.10E-03	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Copper	3.7E-07		5.98E-02	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Lead			5.30E-02	8,620	4.0E-06	2.6	7	30	1.0E-03	70	10,950	25,550
Manganese	6.6E-06		1.08E+00	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Nickel			6.83E-03	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
Vanadium	2.0E-07		3.24E-02	8,620	1.0E-03	2.6	7	30	1.0E-03	70	10,950	25,550
											0	25,550

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times Kp \times ET \times EF \times ED \times CF}{BW \times AT}$$

Variables:	Assumptions:	Variables:	Assumptions:
CW = Chemical Concentration in Water (mg/liter)	95th UCL Surf. Water Data	EF = Exposure Frequency (days/year)	7
SA = Surface Area Contact (cm2)	8,620	ED = Exposure Duration (years)	30
Kp = Permeability Coefficient (cm/hour)	Compound Specific	CF = Vol. Conv. Factor (1 L/1000 cm3)	0.001
ET = Exposure Time (hours/day)	2.6	BW = Bodyweight (kg)	70

absorbed is equal to the ambient concentration". Hence, a permeability constant of 0.0008 cm/hour is used for all chemicals in this pathway, which is the PC for water.

For swimming, an exposure time of 2.6 hours/day and an exposure frequency of 7 days/year were used, based on a 1973 United States Department of Interior evaluation of outdoor recreation. The overall Exposure Duration will be for 30 years which is the 90th percentile for residency at one location according to the *Exposure Factors Handbook* (USEPA, 1989c). For wading an exposure time of 4 hours/day and an exposure frequency of 50 days/year were used. These are conservative estimates based on the number of days the workers are at the site when there is standing water present.

All exposure pathways have an averaging time (AT) of 70 years (25,550 days) for carcinogenic compounds, and 30 years (10,950 days) for non-carcinogenic compounds. It is important to note that in considering carcinogenic compounds, a 70 year averaging time is used regardless of the exposure duration to correspond with the Carcinogenic Slope Factors.

6.3.5.6 Ingestion of Sediment While Swimming (current and future land use)

This exposure scenario is applicable to both the current and future land use scenarios. For current land use, it is assumed that nearby residents swim in Reeder Creek immediately downstream from the Depot. In the future use scenario, residents living at the OB ground would also swim in Reeder Creek.

6.3.5.6.1 Exposure Concentrations for Ingestion of Sediments

The exposure concentrations used were the 95th UCL of the sediment sample concentrations collect from Reeder Creek. For the current and future land use scenarios the exposure concentrations were assumed to be the same.

6.3.5.6.2 Quantification of Exposure from Ingestion of Sediments

The exposures to sediments from ingestion while swimming were calculated by the following equation (USEPA, 1989b):

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Where:

CS = Chemical concentration in sediment (mg/kg - soil)
IR = Ingestion rate (mg soil/day)
CF = Conversion factor (10^{-6} kg/mg)
FI = Fraction ingested (dimensionless)
EF = Exposure Frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

The exposure calculations are summarized in Table 6-18.

Most of the values used in the calculation were the same as for previous scenarios. The ingestion rate (IR) was assumed to be 100 mg sediment/day, the same as that used for ingestion of soil. The fraction ingested (FI) was assumed to be 100% or 1, a worst case estimate. The exposure frequency was assumed to be 7 days/year, the national average for swimming (USEPA, 1989b). Exposure duration (ED) was 30 years, and the body weight (BW) was 70 kg. As with all other scenarios, an averaging time (AT) of 30 years (10,950 days) was used for non-carcinogens, while an averaging time (AT) of 70 years (25,550 days) was used for carcinogens.

6.3.5.7 Dermal Exposure to Sediment While Swimming or Wading (current & future land use)

The land use depicted in this scenario considers both current and future land use together. As with dermal contact to surface water, two exposure scenarios were considered, residential exposure while swimming in Reeder Creek and worker exposure while wading in the on-site wetlands. The values selected for current conditions are assumed to be steady-state. When determining future risk, the absorbed dose was assumed to be the same as for current conditions.

6.3.5.7.1 Exposure Concentrations for Dermal Exposure to Sediment

In determining the exposure concentrations for each analyte found in sediment, two data sets were developed. For Reeder Creek, the 95th UCL of the mean of the Reeder Creek sediment data were determined. For the on-site wetlands, the 95th UCL of the mean for the

TABLE 6-18

CALCULATION OF INTAKE
FROM INGESTION OF SEDIMENT (WHILE SWIMMING)
RESIDENTIAL EXPOSURE (CURRENT AND FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Intake (Nc) (mg/kg-day)	Intake (Car) (mg/kg-day)	95th UCL Sediment (mg/kg)	Ingestion Rate (mg soil/day)	Conv. Factor (kg/mg)	Fraction Ingested (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
										Nc	Car
Semivolatiles											
Methylnaphthalene, 2-			4.12E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Phenanthrene			3.97E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Benzo(a)anthracene		4.8E-09	4.08E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Benzo(b)fluoranthene		4.8E-09	4.08E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Benzo(k)fluoranthene		4.8E-09	4.08E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Benzo(a)pyrene		4.8E-09	4.08E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Indeno(1,2,3-cd)pyrene		4.8E-09	4.08E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Explosives											
Dinitrotoluene, 2,6-, 4-amino-			6.00E-02	100	1.0E-06	1	7	30	70	10,950	25,550
Dinitrotoluene, 4,6,- 2-amino-			6.00E-02	100	1.0E-06	1	7	30	70	10,950	25,550
Metals											
Aluminum			1.22E+04	100	1.0E-06	1	7	30	70	10,950	25,550
Antimony	1.1E-07		4.05E+00	100	1.0E-06	1	7	30	70	10,950	25,550
Arsenic	1.8E-07	7.8E-08	6.66E+00	100	1.0E-06	1	7	30	70	10,950	25,550
Barium	1.8E-06		6.62E+01	100	1.0E-06	1	7	30	70	10,950	25,550
Beryllium	1.8E-08	7.7E-09	6.54E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Cadmium	6.2E-08		2.27E+00	100	1.0E-06	1	7	30	70	10,950	25,550
Chromium	6.3E-07		2.28E+01	100	1.0E-06	1	7	30	70	10,950	25,550
Cobalt			1.02E+01	100	1.0E-06	1	7	30	70	10,950	25,550
Copper	2.8E-05		1.03E+03	100	1.0E-06	1	7	30	70	10,950	25,550
Lead			3.32E+02	100	1.0E-06	1	7	30	70	10,950	25,550
Manganese	1.3E-05		4.75E+02	100	1.0E-06	1	7	30	70	10,950	25,550
Mercury	1.9E-08		6.90E-01	100	1.0E-06	1	7	30	70	10,950	25,550
Nickel			3.80E+01	100	1.0E-06	1	7	30	70	10,950	25,550
Selenium	2.8E-08		1.02E+00	100	1.0E-06	1	7	30	70	10,950	25,550
Vanadium	4.9E-07		1.80E+01	100	1.0E-06	1	7	30	70	10,950	25,550
Zinc	1.4E-05		4.97E+02	100	1.0E-06	1	7	30	70	10,950	25,550

EQUATION: **Intake (mg/kg-day) =**

$$\frac{CS \times IR \times CF \times FI \times EF \times ED}{BW \times AT}$$

Variables:	**Assumptions:**	**Variables:**	**Assumptions:**
CS = Chem. Conc. in Sediment (mg/kg-soil)	**95th UCL Sediment Data**	**EF = Exposure Frequency (days/year)**	**7 events/year**
IR = Ingestion Rate (mg soil/day)	**100**	**ED = Exposure Duration (years)**	**30 years**
CF = Conversion Factor (10-6 kg/mg)	**10-6**	**BW = Bodyweight (kg)**	**70 kg**
FI = Fraction Ingested (unitless)	**1**	**AT = Averaging Time (days)**	**30 x 365 (NC) 70 x 365 (C)**

on-site wetland sediment data were used. This was done to reduce the level of uncertainty associated with estimation of the RME concentration. The only dermal adsorption factor available for the analytes of concern at this site is for cadmium (USEPA, 1992), therefore, only cadmium was considered. The same dermal adsorption factor used for cadmium adsorption in soil was used to estimate the exposure of cadmium in sediments.

6.3.5.7.2 Quantification of Exposure From Dermal Contact to Sediment

The quantitative assessment of this exposure pathway includes both current and future uses. The equation for the absorbed dose, taken from RAGS, (USEPA, 1989b) is as follows:

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

Where:

CS = Chemical Concentration in Sediment (mg/kg-sediment)
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact (cm^2/day)
AF = Soil to Skin Adherence Factor (mg/cm^2)
ABS = Absorption Factor (unitless)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
BW = Body Weight (kg)
AT = Averaging Time (days)

The results of the calculations are shown in Table 6-19 through 6-21.

As described previously, a skin-surface area value (SA) of $1.94m^2$ was used which was the same factor use for swimming. For wading a value of $0.86m^2$ was used. The dermal absorption factor (ABS) used for this exposure dose was 0.01, which was the same as the one used to estimate the dose for dermal contact to soils in Section 6.3.5.3.2.

TABLE 6-19

CALCULATION OF ABSORBED DOSE
FROM DERMAL CONTACT TO SEDIMENT (WHILE SWIMMING)
RESIDENTIAL EXPOSURE (CURRENT AND FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Absorbed Dose (Nc) (mg/kg-day)	Absorbed Dose (Car) (mg/kg-day)	95th UCL Sediment (mg/kg)	Conversion Factor (kg/mg)	Skin Surface Area Contact (cm2/event)	Adherence Factor (mg soil/cm2)	Adsorption Factor (unitless)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
											Nc	Car
Semivolatiles												
Explosives												
Metals												
Cadmium	3.3E-07		2.27E+00	1.0E-06	19,400	2.77	0.01	7	30	70	10,950	25,550

EQUATION: Absorbed Dose (mg/kg-day) = $\frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$

Variables:	Assumptions:
CS = Chemical Concentration in Soil (mg/kg-sediment)	95th UCL Sed. Data
CF = Conversion Factor (10-6 kg/mg)	10-6
SA = Surface Area Contact (cm2)	19,400
AF =Soil to Skin Adherence Factor (mg/cm2)	2.77
ABS = Absorption Factor (unitless)	1.0 %

Variables:	Assumptions:
EF = Exposure Frequency (events/year)	7 events/year
ED = Exposure Duration (years)	30 years
BW = Bodyweight (kg)	70 kg
AT = Averaging Time (days)	30 x 365 (NC) 70 x 365 (C)

TABLE 6-20

CALCULATION OF ABSORBED DOSE
FROM DERMAL CONTACT TO SEDIMENT (WHILE WADING)
INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Absorbed Dose (Nc) (mg/kg-day)	Absorbed Dose (Car) (mg/kg-day)	95th UCL Sediment (mg/kg)	Conversion Factor (kg/mg)	Skin Surface Area Contact (cm2/event)	Adherence Factor (mg soil/cm2)	Adsorption Factor (unitless)	Exposure Frequency (events/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
											Nc	Car
Semivolatiles												
Explosives												
Metals												
Cadmium	1.6E-06		3.38E+00	1.0E-06	8,620	2.77	0.01	50	25	70	9,125	25,550

EQUATION: Absorbed Dose (mg/kg-day) = $\frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$

Variables:	Assumptions:	Variables:	Assumptions:
CS = Chemical Concentration in Soil (mg/kg-sediment)	95th UCL Sed. Data	EF = Exposure Frequency (events/year)	50 events/year
CF = Conversion Factor (10-6 kg/mg)	10-6	ED = Exposure Duration (years)	25 years
SA = Surface Area Contact (cm2)	8,620	BW = Bodyweight (kg)	70 kg
AF =Soil to Skin Adherence Factor (mg/cm2)	2.77	AT = Averaging Time (days)	25 x 365 (NC) 70 x 365 (C)
ABS = Absorption Factor (unitless)	1.0 %		

TABLE 6-21

CALCULATION OF ABSORBED DOSE
FROM DERMAL CONTACT TO SEDIMENT (WHILE WADING)
RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Absorbed Dose (Nc) (mg/kg-day)	Absorbed Dose (Car) (mg/kg-day)	95th UCL Sediment (mg/kg)	Conversion Factor (kg/mg)	Skin Surface Area Contact (cm2/event)	Adherence Factor (mg soil/cm2)	Adsorption Factor (unitless)	Exposure Frequency (events/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
											Nc	Car
Semivolatiles												
Explosives												
Metals												
Cadmium	2.2E-07		3.38E+00	1.0E-06	8,620	2.77	0.01	7	30	70	10,950	25,550

EQUATION: Absorbed Dose (mg/kg-day) = $\frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$

Variables:	Assumptions:	Variables:	Assumptions:
CS = Chemical Concentration in Soil (mg/kg-sediment)	95th UCL Sed. Data	EF = Exposure Frequency (events/year)	7 events/year
CF = Conversion Factor (10-6 kg/mg)	10-6	ED = Exposure Duration (years)	30 years
SA = Surface Area Contact (cm2)	8,620	BW = Bodyweight (kg)	70 kg
AF =Soil to Skin Adherence Factor (mg/cm2)	2.77	AT = Averaging Time (days)	30 x 365 (NC) 70 x 365 (C)
ABS = Absorption Factor (unitless)	1.0 %		

The sediment adherence factor (AF) is the mass (mg) of sediment per cm^2 of skin surface area being exposed. The same set of factors used for to the estimated of exposure dose due to dermal contact with onsite soils was used for estimating the does for this pathway. The AF of 2.77 mg soil/cm^2 was used to estimate the amount of soil that adheres to skin, (USEPA, 1989). This variable the degree to which soil and sediment adhere during water activities.

The exposure frequency, exposure duration, body weight and averaging time factors used to estimate the ingestion of sediment while swimming was also used to estimate the exposure of sediment due to the adsorption while swimming. This was appropriate because both events occur at the sametime, i.e. swimming and stepping in sediment while swimming.

6.3.5.8 Groundwater Ingestion (Residential Exposure)

The water supply within the Depot boundaries is not from the aquifer under the site. All water used at the SEDA is piped up from nearby Seneca Lake. The nearest off-site residential drinking water well is approximately 2500 feet away from the OB grounds. The majority of groundwater does not flow in the direction of this residential well and therefore offsite residential exposures remains unlikely under current land use. Under the future residential exposure scenario the reasonable maximum exposure has considered residential exposures using current site groundwater concentrations.

6.3.5.8.1 Exposure Concentrations for Groundwater Ingestion

Only Phase II groundwater sampling data collected during the RI were used as the basis for exposure concentrations for groundwater chemicals of concern. The Phase I groundwater database was not used because this database contained filtered samples and samples with high turbidity, (i.e. >200 NTUs). The concentration of metals in the unfiltered Phase I groundwater samples were likely the result of suspended sediment since the concentration of metals in the same unfiltered samples were low or not detected. The procedures for sample collection were modified following Phase I in order to eliminate both the turbidity and the need to filter, therefore, only the Phase 2 database was considered to be representative groundwater data. Using the Phase 2 metals database, a statistical test for significance was performed to determine if the on-site 95th UCL of the mean was statistically different than background. This test for significance was performed for metals only. The result indicated that only Ca, Na and Mg were different than background. These metals were eventually eliminated from consideration in the risk assessment since they are essential human nutrients. Consequently, no metals were considered in the exposure to drinking on-site groundwater.

TABLE 6-22

CALCULATION OF INTAKE
FROM INGESTION OF GROUNDWATER (DAILY)
RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Intake (Nc) (mg/kg-day)	Intake (Car) (mg/kg-day)	95th UCL Groundwater (mg/l)	Ingestion Rate (liters/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Body Weight (kg)	Averaging Time (days)	
								Nc	Car
Volatile Organics									
Acetone	1.0E-04		3.68E-03	2	350	30	70	10,950	25,550
Semi-volatiles									
Di-n-butylphthalate	1.4E-04		5.00E-03	2	350	30	70	10,950	25,550
Di-n-octylphthalate	1.4E-04		5.00E-03	2	350	30	70	10,950	25,550
Explosives									
RDX	1.6E-06	7.0E-07	6.00E-05	2	350	30	70	10,950	25,550
Trinitrotoluene, 2,4,6-	1.6E-06	7.0E-07	6.00E-05	2	350	30	70	10,950	25,550
Dinitrotoluene, 2,6-	1.6E-06		6.00E-05	2	350	30	70	10,950	25,550

EQUATION: **Intake (mg/kg-day) =**

$$\frac{CW \times IR \times EF \times ED}{BW \times AT}$$

Variables:	**Assumptions:**
CW = Chemical Concentration in Water (mg/liter)	**95th UCL Groundwater Data**
IR = Ingestion Rate (liters/day)	**2**
EF = Exposure Frequency (days/year)	**350**
ED = Exposure Duration (years)	**30**
BW = Bodyweight (kg)	**70**
AT = Averaging Time (days)	**30 x 365(Nc) 70 x 365(C)**

6.3.5.9.1 Exposure Concentrations for Dermal Contact to Groundwater

Groundwater monitoring data from Phase II were used in calculating the 95th UCL of the mean and are presented in Table 6-23. These exposure concentrations are used for both the dermal and the ingestion of groundwater exposure pathways.

6.3.5.9.2 Quantification of Exposure from Groundwater while Showering/Bathing

The quantitative assessment of this exposure pathway considered only a future residential exposure scenario.

The equation for the absorbed dose, taken from RAGS (USEPA, 1989b) is as follows:

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times PC \times ET \times EF \times ED \times CF}{BW \times AT}$$

Where:

CW = Chemical Concentration in Water (mg/liter)
SA = Skin Surface Area Available for Contact (cm^2)
PC = Dermal Permeability Constant (cm/hr)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Conversion Factor for Water (1 liter/1000 cm^3)
BW = Body Weight (kg)
AT = Averaging Time (period over which exposure is averaged (days)

The exposure calculations are summarized in Table 6-23.

This exposure calculation was estimated using the assumptions presented in Exhibit 6-13 in the RAGS document. This scenario was used previously to quantify exposure to surface water while swimming. Exposure concentrations were obtained from the field investigations. Some of the assumptions deviated slightly from the exposure scenario for dermal contact to surface water while swimming. These differences included changes to the Exposure Time

TABLE 6-23

CALCULATION OF ABSORBED DOSE
FROM DERMAL CONTACT TO GROUNDWATER (WHILE SHOWERING/BATHING)
RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	Absorbed Dose (Nc) (mg/kg-day)	Absorbed Dose (Car) (mg/kg-day)	95th UCL Groundwater (mg/l)	Skin Surface Area Contact (cm2)	Permeability Constant (cm/hr)	Exposure Time (hours/day)	Exposure Frequency (days/year)	Exposure Duration (years)	Volumetric Conv. Factor (1 liter/1000 c	Body Weight (kg)	Averaging Time (days)	
											Nc	Car
Volatile Organics												
Acetone	1.6E-07		3.68E-03	19,400	8E-04	0.2	350	30	1E-03	70	10,950	25,550
Semivolatiles												
Di-n-butylphthalate	2.1E-07		5.00E-03	19,400	8E-04	0.2	350	30	1E-03	70	10,950	25,550
Di-n-octylphthalate	2.1E-07		5.00E-03	19,400	8E-04	0.2	350	30	1E-03	70	10,950	25,550
Explosives												
RDX	2.6E-09	1.1E-09	6.00E-05	19,400	8E-04	0.2	350	30	1E-03	70	10,950	25,550
Trinitrotoluene, 2,4,6-	2.6E-09	1.1E-09	6.00E-05	19,400	8E-04	0.2	350	30	1E-03	70	10,950	25,550
Dinitrotoluene, 2,6-	2.6E-09		6.00E-05	19,400	8E-04	0.2	350	30	1E-03	70	10,950	25,550
										70		25,550

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times PC \times ET \times EF \times ED\ CF}{BW \times AT}$$

Variables:	**Assumptions:**	**Variables:**	**Assumptions:**
CW = Chemical Conc. in Water (mg/liter)	95th UCL Groundwater Data	ED = Exposure Duration (years)	30
SA = Surface Area Contact (cm2)	19400	ET = Exposure Time (hours/day)	0.2
PC = Permeability Constant (cm/hr)	0.0008 (Pc for water)	BW = Body Weight (kg)	70
EF = Exposure Frequency (days/year)	350	CF = Volumetric Conv. Factor	0.001
		AT = Averaging Time (days)	30 x 365 (Nc) 70 x 365 (Car)

(ET) and the Exposure Frequency (EF). The ET for showering was assumed to be 12 minutes/day which is equivalent to the 90th percentile presented in the *Exposure Factors Handbook* (USEPA, 1989c). The EP is assumed to be 350 days/year, allowing an average of two weeks vacation for the population as recommended by the *Standard Default Exposure Factors, Supplemental Guidance* (USEPA, 1991h). The inhalation of volatiles while showering was not considered as a viable pathway due to the lack of volatile organic compounds in the groundwater.

6.4 TOXICITY ASSESSMENT

The objective of the toxicity assessment is to weigh available evidence regarding the potential of the analytes to cause adverse effects in exposed individuals, and to provide, where possible, an estimate of the relationship between the extent of exposure to an analyte and the increased likelihood and/or severity of adverse effects. The types of toxicity information considered in this assessment include the reference dose (RfD) and reference concentration (RfC), which was used to evaluate noncarcinogenic effects, and the slope factor and unit risk, which was used to evaluate carcinogenic effects.

Most toxicity information used in this evaluation was obtained from the Integrated Risk Information System (IRIS) (June 23-25, 1993). If values were not available from IRIS, the *Health Effects Assessment Summary Tables* (HEAST) (USEPA, 1993) were consulted. Finally, the EPA Region II was consulted to provide any additional values not included in these two sources. The toxicity factors used in this evaluation are summarized in Table 6-24 for both noncarcinogenic and carcinogenic effects.

6.4.1 Toxicity Assessment Noncarcinogenic Effects

For chemicals that exhibit noncarcinogenic (i.e., systemic) effects, an organisms' repair and detoxification capabilities must be exceeded by some critical concentration (threshold) before the health effect is manifested. For example, an organ can have a large number of cells performing the same or similar functions that must be significantly depleted before the effect on the organ is seen. This threshold view holds that a range of exposures from just above zero to some finite value can be tolerated by the organism without an appreciable risk of adverse effects.

TABLE 6-24

TOXICITY VALUES

SENECA ARMY DEPOT
OB GROUNDS

Analyte	RfD (mg/kg-day)		RfC (mg/kg-day)		Carc. Slope Oral (mg/kg-day)-1		Rank Wt. of Evidence	Carc. Slope Inhalation (mg/kg-day)-1	
Volatile Organics									
Methylene Chloride	6.00E-02	a	8.57E-01	b	7.50E-03	a	B2	1.65E-03	a
Acetone	1.00E-01	a	NA		NA		D	NA	
Dichloroethane, 1,2-	NA		2.90E-03		9.10E-02	a	B2	9.10E-05	a
Dichloroethene, 1,2- (total)	9.00E-03	b	NA		NA		NA	NA	
Chloroform	1.00E-02	a	NA		6.10E-03	a	B2	8.05E-02	a
Butanone, 2-	6.00E-01	a	2.86E-01	a	NA		D	NA	
Carbon Tetrachloride	7.00E-04	a	NA		1.30E-01	a	B2	5.25E-02	a
Trichloroethane, 1,1,1-	NA		NA		NA		D	NA	
Carbon disulfide	1.00E-01	a	2.86E-03	b	NA		NA	NA	
Trichloroethene	NA		NA		1.10E-02		NA	6.00E-03	
Benzene	NA		NA		2.90E-02	a	A	2.91E-02	a
Tetrachloroethene	1.00E-02	a	NA		5.00E-02		NA	2.00E-03	
Toluene	2.00E-01	a	1.14E-01	a	NA		D	NA	
Chlorobenzene	2.00E-02	a	5.71E-03	b	NA		D	NA	
Xylene (total)	2.00E+00	a	NA		NA		D	NA	
Semivolatiles									
Phenol	6.00E-01	a	NA		NA		D	NA	
Methylphenol, 2-	5.00E-02	a	NA		NA		C	NA	
Methylphenol, 4-	5.00E-03	b	NA		NA		C	NA	
Dimethylphenol, 2,4-	2.00E-02	a	NA		NA		NA	NA	
Benzoic acid	4.00E+00	a	NA		NA		D	NA	
Naphthalene	4.00E-02		NA		NA		D	NA	
Methylnaphthalene, 2-	NA		NA		NA		NA	NA	
Chloronaphthalene, 2-	8.00E-02	a	NA		NA		NA	NA	
Nitoaniline, 2-	2.00E-04	b	NA		NA		NA	NA	
Acenaphthylene	NA		NA		NA		NA	NA	
Dinitrotoluene, 2,6-	1.00E-03	b	NA		NA		NA	NA	
Nitroaniline, 3-	NA		NA		NA		NA	NA	
Acenaphthene	6.00E-02	a	NA		NA		NA	NA	
Dibenzofuran	NA		NA		NA		D	NA	
Dinitrotoluene, 2,4-	2.00E-03	a	NA		NA		NA	NA	
Diethylphthalate	8.00E+00	b	NA		NA		NA	NA	
Fluorene	4.00E-02	a	NA		NA		D	NA	
N-Nitrosodiphenylamine	NA		NA		4.90E-03	a	B2	NA	
Hexachlorobenzene	3.00E-04	a	NA		NA		NA	NA	
Pentachlorophenol	3.00E-02	a	NA		1.20E-01	a	B2	NA	
Phenanthrene	NA		NA		NA		NA	NA	
Anthracene	3.00E-01	a	NA		NA		D	NA	
Carbazole	NA		NA		2.00E-02	b	B2	NA	
Di-n-butylphthalate	1.00E-01	a	NA		NA		D	NA	
Fluoranthene	4.00E-02	a	NA		NA		D	NA	
Pyrene	3.00E-02	a	NA		NA		NA	NA	
Butylbenzylphthalate	2.00E+00	b	NA		NA		NA	NA	
Benzo(a)anthracene	NA		NA		7.30E-01	c	B2	NA	
Chrysene	NA		NA		7.30E-02	c	B2	NA	
bis(2-Ethylhexyl)phthalate	2.00E-02	a	NA		1.40E-02	a	B2	NA	
Di-n-octylphthalate	2.00E-02	b	NA		NA		NA	NA	
Benzo(b)fluoranthene	NA		NA		7.30E-01	c	B2	NA	
Benzo(k)fluoranthene	NA		NA		7.30E-01	c	B2	NA	
Benzo(a)pyrene	NA		NA		7.30E+00	a	B2	NA	
Indeno(1,2,3-cd)pyrene	NA		NA		7.30E-01	c	B2	NA	
Dibenz(a,h)anthracene	NA		NA		7.30E+00	c	B2	NA	
Benzo(g,h,i)perylene	NA		NA		NA		NA	NA	

TABLE 6-24

TOXICITY VALUES

SENECA ARMY DEPOT
OB GROUNDS

Analyte	RfD (mg/kg-day)		RfC (mg/kg-day)		Carc. Slope Oral (mg/kg-day)-1		Rank Wt. of Evidence	Carc. Slope Inhalation (mg/kg-day)-1	
Pesticides/PCBs									
beta-BHC	NA		NA		1.80E+00	a	C	1.86E+00	a
delta-BHC	NA		NA		NA		D	NA	
gamma-BHC(Lindane)	3.00E-04	a	NA		NA		NA	NA	
Heptachlor	5.00E-04	a	NA		4.50E+00	a	B2	4.55E+00	a
Aldrin	3.00E-05	a	NA		1.70E+01	a	B2	1.72E+01	a
Heptachlor epoxide	1.30E-05	a	NA		9.10E+00	a	B2	9.10E+00	a
Endosulfan I	5.00E-05	b	NA		NA		NA	NA	
Dieldrin	5.00E-05	a	NA		1.60E+01	a	B2	1.61E+01	a
DDE, 4,4'-	NA		NA		3.40E-01	a	B2	3.40E-01	a
Endrin	3.00E-04	b	NA		NA		D	NA	
Endosulfan II	5.00E-05	b	NA		NA		NA	NA	
DDD, 4,4'-	NA		NA		2.40E-01	a	B2	NA	
Endosulfan sulfate	5.00E-05	b	NA		NA		NA	NA	
DDT, 4,4'-	5.00E-04	a	NA		3.40E-01	a	B2	3.40E-01	a
Endrin aldehyde	NA		NA		NA		NA	NA	
alpha-Chlordane	6.00E-05	b	NA		NA		NA	NA	
Aroclor-1254	NA		NA		NA		NA	NA	
Aroclor-1260	NA		NA		7.70E+00		NA	NA	
Explosives									
HMX	5.00E-02	a	NA		NA		D	NA	
RDX	3.00E-03	a	NA		1.10E-01	a	C	NA	
Trinitrobenzene, 1,3,5-	5.00E-05	a	NA		NA		NA	NA	
Dinitrobenzene, 1,3-	1.00E-03	b	NA		NA		NA	NA	
Tetryl	NA		NA		NA		NA	NA	
Trinitrotoluene, 2,4,6-	5.00E-04	a	NA		3.00E-02	a	C	NA	
Dinitrotoluene, 2,6-, 4-amino-	NA		NA		NA		NA	NA	
Dinitrotoluene, 4,6-, 2-amino-	NA		NA		NA		NA	NA	
Dinitrotoluene, 2,6-	1.00E-03	b	NA		NA		NA	NA	
2,4-Dinitrotoluene	2.00E-03	a	NA		NA		NA	NA	
Metals									
Aluminum	NA		NA		NA		NA	NA	
Antimony	4.00E-04	b	NA		NA		NA	NA	
Arsenic	3.00E-04	a	NA		1.75E+00	d	A	1.51E+01	a
Barium	7.00E-02	a	1.43E-04	b	NA		NA	NA	
Beryllium	5.00E-03	a	NA		4.30E+00	a	B2	8.40E+00	a
Cadmium	5.00E-04	a	NA		NA		B1	6.30E+00	a
Calcium	NA		NA		NA		NA	NA	
Chromium	5.00E-03	a	NA		NA		A	4.20E-02	a
Cobalt	NA		NA		NA		NA	NA	
Copper	4.00E-02	b	NA		NA		D	NA	
Iron	NA		NA		NA		NA	NA	
Lead	NA		NA		NA		B2	NA	
Magnesium	NA		NA		NA		NA	NA	
Manganese	5.00E-03	a	1.14E-04	a	NA		D	NA	
Mercury	3.00E-04	b	8.57E-05	b	NA		NA	NA	
Nickel	NA		NA		NA		NA	8.40E-01	
Potassium	NA		NA		NA		NA	NA	
Selenium	5.00E-03	b	NA		NA		NA	NA	
Silver	5.00E-03	a	NA		NA		NA	NA	
Sodium	NA		NA		NA		NA	NA	
Thallium	9.00E-05		NA		NA		NA	NA	
Vanadium	7.00E-03	b	NA		NA		D	NA	
Zinc	3.00E-01	a	NA		NA		D	NA	
Cyanide	2.00E-02	a	NA		NA		D	NA	

a = Taken from the Integrated Risk Information System (IRIS)
Online June 23-25, 1992
b = Taken from HEAST
c = Calculated using TEF
d = Calculated from proposed oral unit risk value
NA = Not Available

Health criteria for chemicals exhibiting noncarcinogenic effects for use in risk assessment are generally developed using USEPA RfDs and RfCs developed by the RfD/RfC Work Group and are included in the IRIS database. In general, the RfD/RfC is an estimate of an average daily exposure to an individual (including sensitive individuals) below which there will not be an appreciable risk of adverse health effects. The RfD/RfC is derived using uncertainty factors (e.g., to adjust from animals to humans and to protect sensitive subpopulations) to ensure that it is unlikely to underestimate the potential for adverse noncarcinogenic effects to occur. The purpose of the RfD/RfC is to provide a benchmark against which the sum of other doses (i.e, those projected from human exposure to various environmental conditions) might be compared. Doses that are significantly higher than the RfD/RfC may indicate that an inadequate margin of safety could exist for exposure to that substance and that an adverse health effect could occur. The chemicals of potential concern may affect different target organs in the body.

6.4.1.1 Toxicity Values for Oral and Inhalation Exposure

The types of toxicity values used to evaluate the noncarcinogenic effects of chemicals include RfDs for oral exposure, and RfCs for inhalation exposure. The chronic RfD or RfC for a chemical is ideally based on studies where either animal or human populations were exposed to a given chemical by a given route of exposure for the major portion of the life span (referred to as a chronic study). Various effect levels may be determined in a study; however, the preferred effect level for calculating noncarcinogenic toxicity values is the No-Observed-Adverse-Effect Level, or NOAEL. Second to the NOAEL is the Lowest-Observed-Adverse-Effect Level, or LOAEL. RfDs and RfCs represent thresholds for toxicity. They are derived such that human lifetime exposure to a given chemical, via a given route at levels at or below the RfD or RfC, as appropriate, should not result in adverse health effects, even for the most sensitive members of the population.

The RfD is an oral value that is derived by determining dose-specific effect levels from all the available quantitative studies, and applying uncertainty factors and/or a modifying factor to the most appropriate effect level in order to determine a chronic RfD for humans. Uncertainty factors are intended to account for 1) the variation in sensitivity among members of the human population, 2) the uncertainty in extrapolating animal data to the case of humans, 3) the uncertainty in extrapolating from data obtained in a study that is less than lifetime exposure, 4) the uncertainty in using LOAEL data rather than NOAEL data, and 5) the uncertainty resulting from inadequacies in the data base. The modifying factor may be used to account for uncertainties not covered by the uncertainty factors such as inadequacy of the number of animals in the critical study. Usually each of these uncertainty factors is set equal to 10, while the modifying factor varies between one and 10. RfDs are reported as doses in milligrams of chemical per kilogram body weight per day (mg/kg-day).

RfCs are inhalation values that are derived by determining concentration-specific effect levels from all of the available literature and transforming the most appropriate concentration to a human RfC. Transformation usually entails converting the concentration and exposure duration used in the study to an equivalent continuous 24-hour exposure. The exposure-adjusted value accounts for differences in animal and human inhalation. Uncertainty factors and/or a modifying factor are then applied to the adjusted human exposure concentration to arrive at an RfC. The uncertainty factors potentially used are the same ones used to arrive at an RfD (see above). RfCs are reported as concentrations in milligrams of chemical per cubic meter of air (mg/m^3). To make use of the RfC's in calculating risks, they are converted to inhalation reference doses in units of milligrams of chemical per kilogram of body weight per day (mg/kg/day). This conversion was made by assuming an inhalation rate of 20 m^3/day and an adult body weight of 70 kg. Thus:

$$Inhalation\ reference\ dose\ (mg/kg/day) = RfC\left(\frac{mg}{m^3}\right)x\frac{20m^3}{day}x\frac{1}{70kg}$$

6.4.1.2 Toxicity Values for Dermal Exposure

The USEPA has not derived toxicity values for all routes of exposure. Most of the available toxicity values are for oral exposure. Some inhalation values are also available. No values are currently available for dermal exposure. This is due to the lack of scientific studies available to quantify dermal toxicity and carcinogenic potential for the vast majority of priority pollutants.

In the absence of dermal reference toxicity values, USEPA has suggested (USEPA, 1989b) that in some cases it is appropriate to modify an oral RfD so it can be used to estimate the hazard incurred by dermal exposure. This requires that the toxic endpoints observed are the same for both oral and dermal exposure, and that one have quantitative estimates of both dermal and oral absorption of the chemical. This information is generally not available for most priority pollutants, and oral toxicity values are nevertheless often used to quantify risks associated with dermal exposure. As a consequence, any valuation of the contribution of dermal exposure to the overall hazard needs to be viewed as highly tentative at best.

RAGS (USEPA 1989b) provides guidance for use of oral toxicity values in determining dermal toxicity. RfDs and slope factors are expressed as the amount of substance administered per unit time and unit body weight (administered-dose), whereas exposure estimates for the dermal route of exposure are expressed as the amount of substance absorbed into the body per unit time and unit body weight (absorbed-dose). Thus, for dermal exposure to contaminants in water or in soil, it is necessary to adjust an oral toxicity value from an administered to an absorbed dose. In the absence of any information on absorption for the substance or chemically related substances, one must assume an oral absorption efficiency. Assuming 100 percent absorption in an oral administration study that serves as the basis for an RfD or slope factor could underestimate risk for dermal exposure to contaminants in water or soil. This is because the true absorbed dose might be lower than 100 percent and thus the adverse effects are actually occurring at a dose lower than that associated with 100 percent absorption. However, chemical specific information on oral absorption efficiency is not available. Hence, oral toxicity values are used without adjustment, assuming 100 percent absorption.

6.4.1.3 Exposure Periods

As mentioned earlier, chronic RfDs and RfCs are intended to be set at levels such that human lifetime exposure at or below these levels should not result in adverse health effects, even for the most sensitive members of the population. These values are ideally based on chronic exposure studies in humans or animals. "Chronic exposure" would mean exposure of humans for seven years or more, or exposure of rodents for one year or more.

6.4.2 Health Criteria for Carcinogenic Effects

For chemicals that exhibit carcinogenic effects, one or more molecular events can evoke changes in a single cell or a small number of cells that can lead to tumor formation. This is the non-threshold theory of carcinogenesis which purports that any level of exposure to a carcinogen can result in some finite possibility of generating the disease. Generally, regulatory agencies assume the non-threshold hypothesis for carcinogens in the absence of information concerning the mechanisms of action for the chemical of concern.

USEPA's Carcinogen Risk Assessment Verification Endeavor (CRAVE) has developed slope factors and unit risks (i.e., dose-response values) for estimating excess lifetime cancer risks associated with various levels of lifetime exposure to potential human carcinogens. The carcinogenic slope factors can be used to estimate the lifetime excess cancer risk associated with exposure to a potential carcinogen. Risks estimated using slope factors are considered unlikely to underestimate actual risks, but they may overestimate actual risks. Excess lifetime cancer risks are generally expressed in scientific notation and are probabilities. An excess lifetime cancer risk of 1×10^{-6} (one in a million), for example, represents the probability of an individual developing cancer over a lifetime as a result of exposure to the specific carcinogenic chemical. USEPA considers total excess lifetime cancer risks within the range of 10^{-4} (one in ten thousand) to 10^{-6} (USEPA, 1990) to be acceptable when developing remedial alternatives for cleanup of superfund sites.

In practice, slope factors are derived from the results of human epidemiology studies or chronic animal bioassays. The data from animals studies are fitted to the linearized, multistage model and a dose-response curve is obtained. The upper limit of the 95th percentile confidence-interval slope of the dose-response curve is subjected to various adjustments, and an interspecies scaling factor is applied to conservatively derive the slope factor for humans. Thus, the actual risks associated with exposure to a potential carcinogen quantitatively evaluated based on animal data are not likely to exceed the risks estimated using these slope factors, but they may be much lower. Dose-response data derived from human epidemiological studies are fitted to dose-time-response curves on an ad-hoc basis. These models provide rough but plausible estimates of the upper limits on lifetime risk. Slope factors based on human epidemiological data are also derived using very conservative assumptions and, as such, they too are considered unlikely to underestimate risks. In summary, while the actual risks associated with exposures to potential carcinogens are unlikely to be higher than the risks calculated using a slope factor, they could be considerably lower. It should be emphasized that the linearized multistage procedure leads to a plausible upper limit of the risk that is consistent with some proposed mechanisms of carcinogenesis.

In addition, there are varying degrees of confidence in the weight of evidence for carcinogenicity of a given chemical. The USEPA system involves characterizing the overall weight of evidence for a chemical's carcinogenicity based on availability of animal, human, and other supportive data (USEPA, 1986). The weight-of-evidence classification is an attempt to determine the likelihood that the agent is a human carcinogen, and thus qualitatively affects the estimation of potential health risks. Three major factors are considered in characterizing the overall weight of evidence for carcinogenicity: (1) the quality of evidence from human studies and (2) the quality of evidence from animal studies, which are combined into a characterization of the overall weight of evidence for human carcinogenicity; and (3) other supportive information which is assessed to determine whether the overall weight of evidence should be modified. No uncertainty values are associated with carcinogenic toxicity values because the uncertainty is reflected by the category to which the chemical is assigned. USEPA's final classification of the overall weight of evidence includes the following five categories:

Group A - Human Carcinogen - This category indicates that there is sufficient evidence from epidemiological studies to support a causal association between an agent and cancer.

Group B - Probable Human Carcinogen - This category generally indicates that there is at least limited evidence from epidemiological studies of carcinogenicity to humans (Group B1) or that, in the absence of adequate data on humans, there is sufficient evidence of carcinogenicity in animals (Group B2).

Group C - Possible Human Carcinogen - This category indicates that there is limited evidence of carcinogenicity in animals in the absence of data on humans.

Group D - Not Classified - This category indicates that the evidence for carcinogenicity in animals is inadequate.

Group E - No Evidence of Carcinogenicity to Humans - This category indicates that there is no evidence for carcinogenicity in at least two adequate animal tests in different species, or in both epidemiological and animal studies.

Slope factors and unit risks are developed by the USEPA based on epidemiological or animal bioassay data for a specific route of exposure, either oral or inhalation. For some chemicals, sufficient data are available to develop route-specific slope factors for inhalation and ingestion. For chemicals with only one route-specific slope factor but for which carcinogenic effects may also occur via another route, the available value may be used by the USEPA to evaluate risks associated with potential routes of exposure (USEPA, 1989b).

Several of the chemicals of potential concern have been classified as carcinogens or potential carcinogens by USEPA, and each of these has also been assigned a carcinogenicity weight-of-evidence category (Table 6-24). These chemicals are:

Group A - Human Carcinogens

Arsenic
Benzene
Chromium VI

Group B - Probable Human Carcinogens

Methylene Chloride
Chloroform
Carbon Tetrachloride
1,2-Dichloroethane
N-Nitrosodiphenylamine
Phenanthrene
Pentachlorophenol
Carbazole
Benzo(a)anthracene
Chyrsene
bis(2-Ethylhexyl)phthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(1,2,3-cd)pyrene
Dibenz(a,h)anthracene
Heptachlor
Aldrin
Heptachlor epoxide
Dieldrin
DDE, 4,4'-
DDD, 4,4'-
DDT, 4,4'-
Lead
Beryllium
Cadmium

Group C - Possible Human Carcinogens

2-Methylphenol
4-Methylphenol
beta-BHC
RDX
2,4,6-Trinitrotoluene

All remaining chemicals of concern are either not found to have weight of evidence rankings or are Group D or E, meaning there is little carcinogenic likelihood from exposure to these chemicals. All potential carcinogenic effects and slope factors for chemicals of potential concern are identified at the OB grounds are shown in Table 6-24.

6.4.2.1 Toxicity Values for Oral and Inhalation Exposure

The types of toxicity values used to evaluate the carcinogenic effects of chemicals include slope factors (SFs) for oral exposure, and unit risk factors (URFs) for inhalation exposure. Slope factors and unit risk factors are route-specific values derived only for chemicals that have been shown to cause an increased incidence of tumors in human and/or animal studies. Slope factors and unit risk factors are used to calculate the 95th UCLs on lifetime risk and are determined by low-dose extrapolation from human or animal studies. When an animal study is used, the final slope factor or unit risk factor has been adjusted to account for extrapolation of animal data to humans. If the studies used to derive the slope factor or unit risk factor were conducted for less than the life span of the test organism, the final slope factor has been adjusted to reflect risk associated with lifetime exposure. Oral slope factors are reported as risk per dose $(mg/kg\text{-}day)^{-1}$. Inhalation unit risk factors are reported in units of risk per concentration $(mg/m^3)^{-1}$. To make use of the unit risk factors in calculating risks they first had to be converted to inhalation slope factors in units of (mg/kg-day). This conversion was made by assuming an inhalation rate of 20 m^3/day and an adult bodyweight of 70kg. Thus:

$$Inhalation\ slope\ factor\ (mg/kg\text{-}day)^{-1} =$$

$$UnitRisk\left(\frac{ug}{m^3}\right)^{-1} x \frac{day}{20m^3} x\ 70kg\ x \frac{1000ug}{mg}$$

When slope factors and unit risks were not available for all potentially carcinogenic members of a chemical class, toxicity values were calculated using toxicity equivalency factors (TEFs). TEFs are values that compare the carcinogenic potential of a given chemical in a class to the carcinogenic potential of a chemical in the class that has a verified slope factor and/or unit risk. USEPA has provided TEFs for PAHs (USEPA, 1988b). TEF values are as follows:

PAH	TEF
Benzo(a)pyrene	1.0
Benzo(a)anthracene	0.1
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Dibenzo(a,h)anthracene	1.0
Chrysene	0.01
Indeno(1,2,3-cd)pyrene	0.1

To calculate a slope factor for a given PAH the appropriate TEF value is multiplied by the slope factor for benzo(a)pyrene.

6.4.2.2 Toxicity Values for Dermal Exposure

As discussed above, USEPA has derived dermal toxicity values for three chemicals, (PCBs, dioxins and cadmium). In the absence of dermal reference toxicity values, USEPA has suggested (USEPA, 1989b) that, in some cases, it is appropriate to modify an oral slope factor so it can be used to estimate the risk incurred by dermal exposure. However, chemical specific modification factors are not available so oral values are used without adjustment. As discussed previously any valuation of the contribution of dermal exposure to the overall risk needs to be viewed as highly tentative at best. This is particularly true for PAHs which are carcinogens at the point of contact, i.e., to skin.

6.5 RISK CHARACTERIZATION

6.5.1 Introduction

To characterize risk, toxicity and exposure assessments were summarized and integrated into quantitative and qualitative expressions of risk. To characterize potential noncarcinogenic effects, comparisons were made between projected intakes of substances and toxicity values. To characterize potential carcinogenic effects, probabilities that an individual will develop cancer over a lifetime of exposure are estimated from projected intakes and chemical-specific dose-response information. Major assumptions, scientific judgments, and, to the extent possible, estimates of the uncertainties embodied in the assessment are also presented.

6.5.1.1 Noncarcinogenic Effects

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period with an RfD derived for a similar exposure period. This ratio of exposure to toxicity is called a hazard quotient according to the following equation:

$$\textit{Noncancer Hazard Quotient} = E/RfD$$

Where:

E = Exposure level or intake, and
RfD = Reference Dose.

The noncancer hazard quotient assumes that there is a level of exposure (i.e., an RfD) below which it is unlikely for even sensitive populations to experience adverse health effects. If the exposure level (E) exceeds the threshold (i.e., If E/RfD exceeds unity) there may be concern for potential noncancer effects.

To assess the overall potential for noncarcinogenic effects posed by more than one chemical, a hazard index (HI) approach has been developed by the USEPA. This approach assumes that simultaneous sub-threshold exposures to several chemicals could result in an adverse health effect. It also assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of the subthreshold exposures to respective acceptable exposures. This is expressed as:

$$HI = E_1/RfD_1 + E_2/RfD_2 + \ldots + E_i/RfD_i$$

Where:

E_i = the exposure level or intake of the ith toxicant, and
RfD_i = reference dose for the ith toxicant.

While any single chemical with an exposure level greater that the toxicity value will cause the HI to exceed unity, for multiple chemical exposures, the HI can also exceed unity even if no single chemical exposure exceeds its RfD. The assumption of dose additivity reflected in the HI is best applied to compounds that induce the same effects by the same mechanisms.

Applying the HI to cases where the known compounds do not induce the same effect may overestimate the potential for effects. To assess the overall potential for noncarcinogenic effects posed by several exposure pathways, the total HI for chronic exposure is the sum of the HI's for each pathway, for each receptor.

6.5.1.2 Carcinogenic Effects

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (i.e., excess individual lifetime cancer risk). The slope factor converts estimated daily intakes averaged over a lifetime of exposure directly to incremental risk of an individual developing cancer. It can generally be assumed that the dose-response relationship will be linear in the low-dose portion of the multistage model dose-response curve. Under this assumption, the slope factor is a constant, and risk will be directly related to intake. Thus, the following linear low-dose equation was used in this assessment:

$$Risk = CDI \times SF$$

Where:

Risk = A unitless probability of an individual developing cancer,
CDI = Chronic Daily Intake over 70 years (mg/kg-day), and
SF = Slope Factor $(\text{mg/kg-day})^{-1}$

Because the slope factor is often an upper 95th-percentile confidence limit of the probability of a response and is base on animal data used in the multistage model, the carcinogenic risk will generally be an upper-bound estimate. This means that the "true risk" is not likely to exceed the risk estimate derived through this model and is likely to be less than predicted.

For simultaneous exposure to several carcinogens, the USEPA assumes that the risks are additive. That is to say:

$$\text{Risk}_T = \Sigma\, \text{Risk}_i$$

Where:

Risk_T = Total cancer risk, expressed as a unitless probability, and
Risk_i = Risk estimate for the *i*th substance.

Addition of the carcinogenic risks is valid when the following assumptions are met:

- doses are low,
- no synergistic or antagonistic interactions occur, and
- similar endpoints are evaluated.

According to guidance in the National Contingency Plan, the target overall lifetime carcinogenic risks from exposures for determining clean-up levels should range from 10^{-4} to 10^{-6}.

6.5.2 Current Land Use - Onsite Workers

6.5.2.1 Exposure Pathway Hazard Quotients

Chemical-specific hazard quotients and the total hazard index for each current exposure pathway are presented in Tables 6-25 to 6-29.

Inhalation of Fugitive Dust in Ambient Air

The current land-use scenario for inhalation of fugitive dust in ambient air is defined as inhalation of fugitive dust by current on-site workers at the OB grounds. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-25. The pathway hazard index of 0.02 is below the USEPA defined target of unity. The only contributing chemical is barium (HQ = 0.02).

Ingestion of Soil

The current land-use scenario for ingestion of soil is defined as incidental ingestion of soil by on-site workers. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-26. The pathway hazard index of 0.18, which is below the USEPA-defined target of unity, is primarily the result of potential exposure to barium (HQ = 0.058), copper (HQ = 0.048), thallium (HQ=0.010) and zinc (HQ = 0.0083). However, the 95th UCL concentration for lead of 2352 mg/kg is above the USEPA remediation guideline level of 500 to 1000 mg/kg.

Dermal Exposure to Soil

The current land-use scenario for dermal exposure to soil is defined as dermal exposure to soil by on-site workers. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-27. The pathway hazard index of 0.058, which is below the

TABLE 6-25

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM INHALATION OF FUGITIVE DUST (WHILE WORKING) INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT OB GROUNDS

Analyte	**CDI (Nc)** (mg/kg-day)	**CDI (Car)** (mg/kg-day)	**RfC** (mg/kg-day)	**Carc. Slope Inhalation** (mg/kg-day)-1	**Hazard Quotient**	**Cancer Risk**
Semivolatiles						
Methylnaphthalene, 2-			NA	NA		
Nitroaniline, 3-			NA	NA		
Dinitrotoluene, 2,4-			NA	NA		
Phenanthrene			NA	NA		
Benzo(a)anthracene			NA	NA		
Chrysene			NA	NA		
Benzo(b)fluoranthene			NA	NA		
Benzo(k)fluoranthene			NA	NA		
Benzo(a)pyrene			NA	NA		
Indeno(1,2,3-cd)pyrene			NA	NA		
Dibenzo(a,h)anthracene			NA	NA		
Benzo(g,h,i)perylene			NA	NA		
Pesticides/PCBs						
Dieldrin		8.3E-12	NA	1.6E+01		1.3E-10
4,4'-DDE		1.3E-11	NA	3.4E-01		4.4E-12
4,4'-DDT		1.3E-11	NA	3.4E-01		4.5E-12
Explosives						
RDX			NA	NA		
1,3,5-Trinitrobenzene			NA	NA		
Tetryl			NA	NA		
2,4,6-Trinitrotoluene			NA	NA		
4-amino-2,6-Dinitrotoluene			NA	NA		
2-amino-4,6-Dinitrotoluene			NA	NA		
Metals						
Barium	2.9E-06		1.4E-04	NA	2.0E-02	
Cadmium		2.0E-08	NA	6.3E+00		1.3E-07
Chromium		1.0E-06	NA	4.2E-02		4.3E-08
Copper			NA	NA		
Lead			NA	NA		
Thallium			NA	NA		
Zinc			NA	NA		
Totals - HQ & CR					**2.0E-02**	**1.7E-07**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) / Reference Concentration
Cancer Risk = Chronic Daily Intake (Cancinogenic) x Inhalation Slope Factor

TABLE 6-26

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM INGESTION OF SOIL (ONSITE) INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	**CDI (Nc)** (mg/kg-day)	**CDI (Car)** (mg/kg-day)	**RfD** (mg/kg-day)	**Oral Slope Factor** (mg/kg-day)-1	**Hazard Quotient**	**Cancer Risk**
Semivolatiles						
Methylnaphthalene, 2-			NA	NA		
3-Nitroaniline			NA	NA		
Dinitrotoluene, 2,4-	2.0E-06		2.0E-03	NA	9.8E-04	
Phenanthrene			NA	NA		
Benzo(a)anthracene		3.5E-07	NA	7.3E-01		2.6E-07
Chrysene		3.5E-07	NA	7.3E-02		2.6E-08
Benzo(b)fluoranthene		3.5E-07	NA	7.3E-01		2.6E-07
Benzo(k)fluoranthene		3.4E-07	NA	7.3E-01		2.5E-07
Benzo(a)pyrene		3.5E-07	NA	7.3E+00		2.6E-06
Indeno(1,2,3-cd)pyrene		3.3E-07	NA	7.3E-01		2.4E-07
Dibenzo(a,h)anthracene		3.0E-07	NA	7.3E+00		2.2E-06
Benzo(g,h,i)perylene			NA	NA		
Pesticides/PCBs						
Dieldrin	3.3E-08	1.2E-08	5.0E-05	1.6E+01	6.5E-04	1.9E-07
4,4'-DDE		1.8E-08	NA	3.4E-01		6.2E-09
4,4'-DDT	5.3E-08	1.9E-08	5.0E-04	3.4E-01	1.1E-04	6.4E-09
Explosives						
RDX	2.6E-07	9.2E-08	3.0E-03	1.1E-01	8.6E-05	1.0E-08
1,3,5-Trinitrobenzene	3.1E-07		5.0E-05	NA	6.2E-03	
Tetryl			NA	NA		
Trinitrotoluene, 2,4,6-	3.7E-07	1.3E-07	5.0E-04	3.0E-02	7.4E-04	3.9E-09
Dinitrotoluene, 2,6-, 4-amino			NA	NA		
Dinitrotoluene, 4,6-, 2-amino			NA	NA		
Metals						
Barium	4.1E-03		7.0E-02	NA	5.8E-02	
Cadmium	1.6E-05		5.0E-04	NA	3.2E-02	
Chromium	8.9E-05		5.0E-03	NA	1.8E-02	
Copper	1.9E-03		4.0E-02	NA	4.8E-02	
Lead			NA	NA		
Thallium	9.1E-07		9.0E-05	NA	1.0E-02	
Zinc	2.5E-03		3.0E-01	NA	8.3E-03	
Totals - HQ & CR					**1.8E-01**	**6.0E-06**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic)/ Reference Dose (Oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (Oral)

TABLE 6-27

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM DERMAL CONTACT TO SOIL (ONSITE) INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	RfD (mg/kg-day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Semivolatiles						
Pesticides/PCBs						
Explosives						
Metals						
Cadmium	2.9E-06		5.0E-04	NA	5.8E-03	
Totals - HQ & CR					**5.8E-03**	**0.0E+00**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic)/ Reference Dose (Oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (Oral)

USEPA-defined target of unity, is the result of potential exposure to cadmium, the only compound considered.

Dermal Exposure to Surface Water While Wading

The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-28. The total pathway hazard index is 0.016, which is well below the USEPA defined target of unity. The risk is primarily due to manganese (HQ = 0.015).

Dermal Exposure to Sediment While Wading

The chemical-specific hazard quotients and the total hazard index for this pathway are presented in Table 6-29. The total pathway hazard index is 0.0032, which is below the USEPA defined target of unity. The hazard index is due to cadmium, the only compound considered.

Hazard Index Summary

The current land-use hazard index summary and total hazard index are presented in Table 6-41. The total hazard index for onsite workers of 0.23 is below the USEPA-defined target of unity.

Media-specific Hazard Indices

For the current soil pathways, a total hazard index of 0.18 was determined. This total was primarily driven by ingestion of soil. The hazard index for this pathway was driven by several explosives and metals. The medium specific hazard index of 0.18 is below the USEPA-defined target of unity.

For the current air pathway, a total hazard index of 0.020 was determined. This total was primarily driven by the inhalation of barium. The medium specific hazard index of 0.020 is below the USEPA defined target of unity.

For the current surface water pathways, a total hazard index of 0.016 was determined. This was primarily due to manganese (HQ = 0.015).

For the current sediment pathway, a total hazard index of 0.095 was determined. This was primarily due to manganese (HQ = 0.056) and antimony (HQ = 0.012).

TABLE 6-28

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM DERMAL CONTACT TO SURFACE WATER (WHILE WADING) INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg)	CDI (Car) (mg/kg)	RfD (mg/kg/day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Volatile Organics						
1,2-Dichloroethane		1.0E-07	NA	9.1E-02		9.4E-09
Trichloroethene		1.4E-07	NA	1.1E-02		1.5E-09
Semivolatiles						
bis(2-Ethylhexyl)phthalate	6.3E-07	2.3E-07	2.0E-02	1.4E-02	3.2E-05	3.2E-09
Explosives						
RDX	1.3E-07	4.7E-08	3.0E-03	1.1E-01	4.3E-05	5.1E-09
Tetryl			NA	NA		
Metals						
Aluminum			NA	NA		
Arsenic	1.3E-07	4.8E-08	3.0E-04	1.8E+00	4.4E-04	8.3E-08
Barium	1.3E-05		7.0E-02	NA	1.8E-04	
Beryllium	3.7E-08	1.3E-08	5.0E-03	4.3E+00	7.5E-06	5.8E-08
Chromium	2.1E-07		5.0E-03	NA	4.2E-05	
Copper	4.0E-06		4.0E-02	NA	1.0E-04	
Lead			NA	NA		
Manganese	7.3E-05		5.0E-03	NA	1.5E-02	
Nickel			NA	NA		
Vanadium	2.2E-06		7.0E-03	NA	3.1E-04	
Totals - HQ & CR					**1.6E-02**	**1.6E-07**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic)/Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

TABLE 6-29

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM DERMAL CONTACT TO SEDIMENT (WHILE WADING) INDUSTRIAL EXPOSURE (CURRENT LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	RfD (mg/kg-day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Semivolatiles						
Explosives						
Metals						
Cadmium	1.6E-06		5.0E-04	NA	3.2E-03	
Totals - HQ & CR					**3.2E-03**	**0.0E+00**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) / Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

Chemical-specific Hazard Indices

The total hazard index of 0.23 is primarily the result of exposure to barium (HI = 0.078), cadmium (HI = 0.041), copper (HI=0.048), and chromium (0.018). All these chemical specific hazard indices are below the EPA defined target of unity.

6.5.2.2 Exposure Pathway Cancer Risks

Chemical-specific cancer risks and the total cancer risk for each current exposure pathway are presented in Tables 6-25 to 6-29. As stated in RAGS (USEPA 1989b), cancer risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen (i.e., incremental or excess individual lifetime cancer risk). Throughout this baseline risk assessment, the term cancer risk refers to excess or incremental cancer risk. A summary of the total cancer risk for the current use scenario is presented in Table 6-41. The land-use scenarios for each exposure pathway are the same as described for the noncarcinogenic pathways.

Inhalation of Fugitive Dust in Ambient Air

Chemical-specific cancer risks and total pathway risk for inhalation of fugitive dust in ambient air are presented in Table 6-25. The total pathway risk of 1.7×10^{-7} is the result of potential exposure to cadmium (risk = 1.3×10^{-7}) and chromium (risk = 4.3×10^{-8}). The total and individual risks fall below the USEPA-defined target range of 10^{-6} to 10^{-4}.

Ingestion of Soil

Chemical-specific cancer risks and the total pathway risk for ingestion of soil are presented in Table 6-26. The total pathway risk of 6.0×10^{-6}, which is within the USEPA-defined target range of 10^{-6} to 10^{-4}, is primarily the result of potential exposure to dibenzo(a,h)anthracene (risk = 2.2×10^{-6}), and benzo(a)pyrene (risk = 2.6×10^{-6}).

Dermal Exposure to Soil

As shown in Table 6-27, no chemical-specific cancer risks and total pathway risk for dermal exposure to soil were calculated for this pathway. Cadmium, the only compound considered, has no published oral slope factor.

Dermal Exposure to Surface Water

Chemical-specific cancer risks and total pathway risk for dermal exposure to surface water while wading are presented in Table 6-28. The total pathway risk of 1.6×10^{-7}, which is below the USEPA defined target range of 10^{-6} to 10^{-4} is primarily the result of potential exposure to arsenic (risk = 8.3×10^{-8}) and beryllium (risk = 5.8×10^{-8}).

Dermal Exposure to Sediment

As shown in Table 6-29, no cancer risks were calculated for this pathway. Cadmium has no published oral slope factor.

Cancer Risk Summary

The total excess cancer risk for onsite workers under the current land-use scenario is presented in Table 6-41. The total excess cancer risk of 6.4×10^{-6} is primarily due to ingestion of on-site soils (risk = 6.0×10^{-6}). The chemicals primarily responsible for the elevated cancer risk are dibenzo(a,h)anthracene and benzo(a)pyrene in the soil. The total and individual risks fall within the USEPA-defined target range of 10^{-6} to 10^{-4}.

Media-specific Cancer Risks

For the current soil exposure pathways which include exposure due to ingestion of on-site soil and dermal contact with soils, the total cancer risk was determined to be 6.0×10^{-6}. This total was due to the ingestion of soil. The cancer risks for this pathways were primarily due to dibenzo(a,h)anthracene and benzo(a)pyrene. The cancer risk of 6.0×10^{-6} is within the USEPA-defined target range of 10^{-6} to 10^{-4}.

For the current on-site worker, exposure due to inhalation of fugitive dust contributed a total cancer risk of 1.7×10^{-7}. This total was due mainly due to the inhalation of cadmium and chromium in fugitive dust in ambient air. The cancer risk of 1.7×10^{-7} is below the USEPA-defined target range of 10^{-4} to 10^{-6}.

Chemical-specific Cancer Risks

The total cancer risk to onsite workers resulting from exposure via all relevant current land-use pathways of 6.4×10^{-6} is primarily the result of exposure to dibenzo(a,h)anthracene (risk = 2.2×10^{-6}), and benzo(a)pyrene (risk = 2.6×10^{-6}).

6.5.3 Current Land Use - Off-site Residents

6.5.3.1 Exposure Pathway Hazard Quotients

Chemical-specific hazard quotients and the total hazard index for each current exposure pathway are presented in Tables 6-30 to 6-33.

Ingestion of Surface Water while Swimming

The current off-site land-use scenario includes the ingestion of surface water by current off-site residents while swimming in Reeder Creek. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-30. The pathway hazard index of 0.0013 which is below the USEPA-defined target of unity is primarily the result of potential exposure to manganese (HQ = 0.0009) and arsenic (HQ = 0.0002).

Dermal Exposure to Surface Water while Swimming

The current off-site land-use scenario includes as dermal exposure to surface water by off-site residents while swimming in Reeder Creek. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-31. The pathway hazard index of 0.0004, which is below the USEPA-defined target of unity, is primarily the result of potential exposure to manganese (HQ = 0.0003).

Ingestion of Sediment while Swimming

The incidental ingestion of sediment by off-site residents while swimming is also included as a potential contributor to exposure. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-32. The pathway hazard index of 0.0047 is below the USEPA-defined target of unity. The risk contributed by this exposure is primarily the result of potential exposure to manganese (HQ = 0.0026).

Dermal Exposure to Sediment while Swimming

The dermal exposure to sediment by off-site residents while swimming is included as a contributor to risk and has been included in this exposure pathway. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-33. The pathway hazard index of 0.00067 is below the USEPA-defined target of unity. The risk is due to the potential exposure to cadmium.

TABLE 6-30

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM INGESTION OF SURFACE WATER (WHILE SWIMMING) RESIDENTIAL EXPOSURE (CURRENT AND FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg)	CDI (Car) (mg/kg)	RfD (mg/kg-day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Volatile Organics						
1,2-Dichloroethane		5.7E-08	NA	9.1E-02		5.2E-09
Trichloroethene		5.7E-08	NA	1.1E-02		6.3E-10
Semi-volatiles						
bis(2-Ethylhexyl)phthalate	2.3E-07	9.8E-08	2.0E-02	1.4E-02	1.1E-05	1.4E-09
Explosives						
RDX	5.9E-09	2.5E-09	3.0E-03	1.1E-01	2.0E-06	2.8E-10
Tetryl			NA	NA		
Metals						
Aluminum			NA	NA		
Arsenic	5.1E-08	2.2E-08	3.0E-04	1.8E+00	1.7E-04	3.8E-08
Barium	2.0E-06		7.0E-02	NA	2.9E-05	
Beryllium	5.0E-08	2.1E-08	5.0E-03	4.3E+00	1.0E-05	9.2E-08
Chromium	1.5E-07		5.0E-03	NA	3.0E-05	
Copper	3.2E-07		4.0E-02	NA	7.9E-06	
Lead			NA	NA		
Manganese	4.6E-06		5.0E-03	NA	9.3E-04	
Nickel			NA	NA		
Vanadium	6.7E-07		7.0E-03	NA	9.6E-05	
Totals - HQ & CR					**1.3E-03**	**1.3E-07**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic)/Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

TABLE 6-31

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM DERMAL CONTACT TO SURFACE WATER (WHILE SWIMMING) RESIDENTIAL EXPOSURE (CURRENT AND FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg)	CDI (Car) (mg/kg)	RfD (mg/kg/day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Volatile Organics						
1,2-Dichloroethane		1.8E-08	NA	9.1E-02		1.6E-09
Trichloroethene		1.8E-08	NA	1.1E-02		2.0E-10
Semi-volatiles						
bis(2-Ethylhexyl)phthalate	7.1E-08	3.1E-08	2.0E-02	1.4E-02	3.6E-06	4.3E-10
Explosives						
RDX	1.8E-09	7.9E-10	3.0E-03	1.1E-01	6.1E-07	8.7E-11
Tetryl			NA	NA		
Metals						
Aluminum			NA	NA		
Arsenic	1.6E-08	6.8E-09	3.0E-04	1.8E+00	5.3E-05	1.2E-08
Barium	6.4E-07		7.0E-02	NA	9.1E-06	
Beryllium	1.5E-08	6.6E-09	5.0E-03	4.3E+00	3.1E-06	2.9E-08
Chromium	4.7E-08		5.0E-03	NA	9.5E-06	
Copper	9.8E-08		4.0E-02	NA	2.5E-06	
Lead			NA	NA		
Manganese	1.4E-06		5.0E-03	NA	2.9E-04	
Nickel			NA	NA		
Vanadium	2.1E-07		7.0E-03	NA	3.0E-05	
Totals - HQ & CR					**4.0E-04**	**4.1E-08**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic)/Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

TABLE 6-32

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISK
FROM INGESTION OF SEDIMENT (WHILE SWIMMING)
RESIDENTIAL EXPOSURE (CURRENT AND FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg/day)	CDI (Car) (mg/kg/day)	RfD (mg/kg/day)	Oral Slope Factor (mg/kg/day)-1	Hazard Quotient	Cancer Risk
Semivolatiles						
Methylnaphthalene, 2-			NA	NA		
Phenanthrene			NA	NA		
Benzo(a)anthracene		4.8E-09	NA	7.3E-01		3.5E-09
Benzo(b)fluoranthene		4.8E-09	NA	7.3E-01		3.5E-09
Benzo(k)fluoranthene		4.8E-09	NA	7.3E-01		3.5E-09
Benzo(a)pyrene		4.8E-09	NA	7.3E+00		3.5E-08
Indeno(1,2,3-cd)pyrene		4.8E-09	NA	7.3E-01		3.5E-09
Explosives						
Dinitrotoluene, 2,6-, 4-amino-			NA	NA		
Dinitrotoluene, 4,6-, 2-amino-			NA	NA		
Metals						
Aluminum			NA	NA		
Antimony	1.1E-07		4.0E-04	NA	2.8E-04	
Arsenic	1.8E-07	7.8E-08	3.0E-04	1.8E+00	6.1E-04	1.4E-07
Barium	1.8E-06		7.0E-02	NA	2.6E-05	
Beryllium	1.8E-08	7.7E-09	5.0E-03	4.3E+00	3.6E-06	3.3E-08
Cadmium	6.2E-08		5.0E-04	NA	1.2E-04	
Chromium	6.3E-07		5.0E-03	NA	1.3E-04	
Cobalt			NA	NA		
Copper	2.8E-05		4.0E-02	NA	7.1E-04	
Lead			NA	NA		
Manganese	1.3E-05		5.0E-03	NA	2.6E-03	
Mercury	1.9E-08		3.0E-04	NA	6.3E-05	
Nickel			NA	NA		
Selenium	2.8E-08		5.0E-03	NA	5.6E-06	
Vanadium	4.9E-07		7.0E-03	NA	7.1E-05	
Zinc	1.4E-05		3.0E-01	NA	4.5E-05	
Totals - HQ & CR					**4.7E-03**	**2.2E-07**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) / Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

TABLE 6-33

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISK FROM DERMAL CONTACT TO SEDIMENT (WHILE SWIMMING) RESIDENTIAL EXPOSURE (CURRENT AND FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	RfD (mg/kg-day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Semivolatiles						
Explosives						
Metals						
Cadmium	3.3E-07		5.0E-04	NA	6.7E-04	
Totals - HQ & CR					**6.7E-04**	**0.0E+00**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) / Reference Dose (Oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (Oral)

Hazard Index Summary

The current land-use hazard index summary and total hazard index are presented in Table 6-41. The total hazard index of 0.007 for current off-site residents, which is below the USEPA defined target of unity, is primarily due to the ingestion of sediment (HI = 0.0047). The chemical primarily responsible for the hazard indices is manganese.

Media-specific Hazard Indices

For the current off-site residential exposure scenarios, two surface-water pathways were considered. The sum of these two pathways yielded a total hazard index of 0.0017. The greatest contribution of risk was due to the ingestion of surface water. The hazard indices for this pathway was driven primarily by manganese. The hazard index of 0.0017 is below the USEPA-defined target of unity.

For the current off-site residential exposure scenarios, two sediment pathways were considered. The sum of these two pathways yielded a total hazard index of 0.0054. This total was primarily due to the ingestion of sediment. The hazard index for this pathway was driven by metals, especially manganese. The hazard index of 0.0054 is below the USEPA-defined target of unity.

Chemical-specific Hazard Indices

The total hazard index for current off-site residents resulting from exposure for this pathway was 0.007. This is primarily the result of exposure to manganese (HI = 0.0038). This hazard index is well below the USEPA-defined target of unity.

6.5.3.2 Exposure Pathway Cancer Risks

Chemical-specific cancer risks and the total cancer risk for each current exposure pathway are presented in Tables 6-30 to 6-33. The land-use scenarios for each exposure pathway are the same as described for the noncarcinogenic pathways.

Ingestion of Surface Water while Swimming

Chemical-specific cancer risks and total pathway risk for ingestion of surface water are presented in Table 6-30. The total pathway risk of 1.3×10^{-7} which is below the USEPA-defined target range is the result of potential exposure to arsenic (risk = 3.8×10^{-8}) and beryllium (risk = 9.2×10^{-8}).

Dermal Exposure to Surface Water while Swimming

Chemical-specific cancer risks and the total pathway risk for dermal exposure to surface water are presented in Table 6-31. The total pathway risk of 4.1×10^{-8}, which is below the USEPA-defined target range of 10^{-6} to 10^{-4}, is primarily the result of potential exposure to arsenic (risk = 1.2×10^{-8}), and benzo(a)pyrene (risk = 2.9×10^{-8}).

Ingestion of Sediment while Swimming

Chemical-specific cancer risks and total pathway risk for ingestion of sediment are presented in Table 6-32. The total pathway risk of 2.2×10^{-7}, which is below the USEPA-defined target range of 10^{-6} to 10^{-4}, is primarily the result of potential exposure to arsenic (risk = 1.4×10^{-7}).

Dermal Exposure to Sediment While Swimming

As shown in Table 6-33, chemical-specific cancer risks and total pathway risk for dermal exposure to surface water were not calculated. There is no published oral slope factor for cadmium.

Cancer Risk Summary

The total excess cancer risk for the current off-site residential land-use scenario is presented in Table 6-41. The total excess cancer risk of 3.9×10^{-7} for current off-site residents is below the USEPA-defined target range of 10^{-6} to 10^{-4}. This risk is primarily due to the ingestion of sediment (risk = 2.2×10^{-7}) and the ingestion of surface water (risk = 1.3×10^{-7}). The chemicals primarily responsible for the elevated cancer risk are arsenic and PAH's.

Media-specific Cancer Risks

For the two current off-site residential surface-water exposure pathways, the total cancer risk was determined to be 1.7×10^{-7}. This total was primarily due to the ingestion of surface water while swimming in Reeder Creek. The cancer risks were primarily due to arsenic. The cancer risk of 1.7×10^{-7} is below the USEPA-defined target range of 10^{-6} to 10^{-4}.

For the two current off-site residential sediment exposure pathways, the total cancer risk was determined to be 2.2×10^{-7}. This total was due to the ingestion of sediment while swimming. The cancer risks for these pathways were driven primarily by arsenic and PAHs. The cancer risk of 2.2×10^{-7} is below the USEPA-defined target range of 10^{-6} to 10^{-4}.

Chemical-specific Cancer Risks

For the current off-site receptor, the total cancer risk is 3.9×10^{-7}. The majority of this risk is the result of exposure to arsenic (risk = 1.9×10^{-7}).

6.5.4 Future Land Use On-Site Resident

6.5.4.1 Exposure Pathway Hazard Quotients

Chemical-specific hazard quotients and the total hazard index for the future exposure pathway are presented in Tables 6-30 to 6-40. A summary of the total hazard index for the future land-use scenario is presented in Table 6-41.

Ingestion of Drinking Water

The future land-use scenario considers ingestion of drinking water from on-site wells by future on-site residents. Chemical-specific hazard quotients and the total hazard index for this pathway are presented in Table 6-34. The pathway hazard index of 0.015 is primarily the result of potential exposure to Di-n-octylphthalate (HQ = 0.0068). The balance of the hazard index results mainly from potential exposure to 2,4,6-trinitrotoluene (HQ = 0.0033), 2,6 dinitrotoluene (HQ = 0.0016), and di-n-butylphthalate (HQ = 0.0014). The hazard quotient is below the USEPA-defined target of unity.

Ingestion of Surface Water While Swimming

The future on-site land use exposure scenario and the current off-site land-use exposure scenario considered the ingestion of surface water while swimming in Reeder Creek. The pathway hazard index of 0.0013 has been presented previously in Table 6-30. The value is below the USEPA-defined target of unity.

Ingestion of Soil

The future on-site land-use exposure scenario considers ingestion of soil by future on-site residents. The chemical-specific hazard quotients and the total hazard index for this pathway are presented in Table 6-35. The pathway hazard index of 0.24 which is below the USEPA-defined target of unity is the result of potential exposure to barium (HQ = 0.075), cadmium (HQ = 0.042), chromium (HQ = 0.023), copper (HQ = 0.062), thallium (HQ=0.013), and zinc (HQ = 0.011). The 95th UCL concentration for lead of 2352 mg/kg is above the USEPA remediation guideline level of 500 to 1,000 mg/kg.

TABLE 6-34

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM INGESTION OF GROUNDWATER (DAILY) RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT OB GROUNDS

Analyte	CDI (Nc) (mg/kg/day)	CDI (Car) (mg/kg/day)	RfD (mg/kg/day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Volatile Organics						
Acetone	1.0E-04		1.0E-01	NA	1.0E-03	
Semi-volatiles						
Di-n-butylphthalate	1.4E-04		1.0E-01	NA	1.4E-03	
Di-n-octylphthalate	1.4E-04		2.0E-02	NA	6.8E-03	
Explosives						
RDX	1.6E-06	7.0E-07	3.0E-03	1.1E-01	5.5E-04	7.7E-08
Trinitrotoluene, 2,4,6-	1.6E-06	7.0E-07	5.0E-04	3.0E-02	3.3E-03	2.1E-08
Dinitrotoluene, 2,6-	1.6E-06		1.0E-03	NA	1.6E-03	
Totals - HQ & CR					**1.5E-02**	**9.9E-08**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) /Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

TABLE 6-35

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM INGESTION OF SOIL (DAILY) RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT OB GROUNDS

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	RfD (mg/kg-day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Semivolatiles						
Methylnaphthalene, 2-			NA	NA		
3-Nitroaniline			NA	NA		
Dinitrotoluene, 2,4-	2.6E-06		2.0E-03	NA	1.3E-03	
Phenanthrene			NA	NA		
Benzo(a)anthracene		5.5E-07	NA	7.3E-01		4.0E-07
Chrysene		5.5E-07	NA	7.3E-02		4.0E-08
Benzo(b)fluoranthene		5.5E-07	NA	7.3E-01		4.0E-07
Benzo(k)fluoranthene		5.2E-07	NA	7.3E-01		3.8E-07
Benzo(a)pyrene		5.5E-07	NA	7.3E+00		4.0E-06
Indeno(1,2,3-cd)pyrene		5.1E-07	NA	7.3E-01		3.7E-07
Dibenzo(a,h)anthracene		4.7E-07	NA	7.3E+00		3.4E-06
Benzo(g,h,i)perylene			NA	NA		
Pesticides/PCBs						
Dieldrin	4.2E-08	1.8E-08	5.0E-05	1.6E+01	8.4E-04	2.9E-07
4,4'-DDE		2.8E-08	NA	3.4E-01		9.6E-09
4,4'-DDT	6.8E-08	2.9E-08	5.0E-04	3.4E-01	1.4E-04	9.9E-09
Explosives						
RDX	3.3E-07	1.4E-07	3.0E-03	1.1E-01	1.1E-04	1.6E-08
1,3,5-Trinitrobenzene	4.0E-07		5.0E-05	NA	8.1E-03	
Tetryl			NA	NA		
Trinitrotoluene, 2,4,6-	4.8E-07	2.0E-07	5.0E-04	3.0E-02	9.5E-04	6.1E-09
Dinitrotoluene, 2,6-, 4-amino			NA	NA		
Dinitrotoluene, 4,6-, 2-amino			NA	NA		
Metals						
Barium	5.3E-03		7.0E-02	NA	7.5E-02	
Cadmium	2.1E-05		5.0E-04	NA	4.2E-02	
Chromium	1.2E-04		5.0E-03	NA	2.3E-02	
Copper	2.5E-03		4.0E-02	NA	6.2E-02	
Lead			NA	NA		
Thallium	1.2E-06		9.0E-05	NA	1.3E-02	
Zinc	3.2E-03		3.0E-01	NA	1.1E-02	
Totals - HQ & CR					**2.4E-01**	**9.4E-06**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic)/ Reference Dose (Oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (Oral)

Ingestion of Sediment while Swimming

The future on-site land-use exposure scenario for the ingestion of sediment is the same as the current land use exposure scenario. The pathway hazard index is 0.0047 and has been presented previously in Table 6-32. This value below the USEPA defined target of unity.

Inhalation of Fugitive Dust in Ambient Air

The future land-use scenario for inhalation of ambient air is defined as inhalation of fugitive dust in ambient air by future on-site residents. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-36. The pathway hazard index of 0.047 is below the USEPA-defined target of unity is the result of potential exposure to barium (HQ = 0.047).

Dermal Exposure to Soil

The future land-use scenario for dermal exposure to soil is defined as dermal exposure to soil by future on-site residents. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-37. The pathway hazard index is 0.017, which is below the USEPA-defined target of unity. This risk is the result of potential exposure to cadmium.

Dermal Exposure to Sediment While Swimming

The future land-use scenario for dermal exposure to sediment is the same as the current off-site land use scenario. The pathway hazard index of 0.00067 has been presented previously in Table 6-33 and is below the USEPA defined target of unity. This is due to the potential exposure to cadmium.

Dermal Exposure to Sediment While Wading

The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-38. The pathway hazard index of 0.00044, which is below the USEPA-defined target of unity, is the result of potential exposure to cadmium.

TABLE 6-36

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM INHALATION OF FUGITIVE DUST (DAILY) RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	RfC (mg/kg-day)	Carc. Slope Inhalation (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Semivolatiles						
Methylnaphthalene, 2-			NA	NA		
Nitroaniline, 3-			NA	NA		
Dinitrotoluene, 2,4-			NA	NA		
Phenanthrene			NA	NA		
Benzo(a)anthracene			NA	NA		
Chrysene			NA	NA		
Benzo(b)fluoranthene			NA	NA		
Benzo(k)fluoranthene			NA	NA		
Benzo(a)pyrene			NA	NA		
Indeno(1,2,3-cd)pyrene			NA	NA		
Dibenzo(a,h)anthracene			NA	NA		
Benzo(g,h,i)perylene			NA	NA		
Pesticides/PCBs						
Dieldrin		2.3E-11	NA	1.6E+01		3.7E-10
4,4'-DDE		3.6E-11	NA	3.4E-01		1.2E-11
4,4'-DDT		3.7E-11	NA	3.4E-01		1.3E-11
Explosives						
RDX			NA	NA		
1,3,5-Trinitrobenzene			NA	NA		
Tetryl			NA	NA		
2,4,6-Trinitrotoluene			NA	NA		
4-amino-2,6-Dinitrotoluene			NA	NA		
2-amino-4,6-Dinitrotoluene			NA	NA		
Metals						
Barium	6.8E-06		1.4E-04	NA	4.7E-02	
Cadmium		5.7E-08	NA	6.3E+00		3.6E-07
Chromium		2.9E-06	NA	4.2E-02		1.2E-07
Copper			NA	NA		
Lead			NA	NA		
Thallium			NA	NA		
Zinc			NA	NA		
Totals - HQ & CR					**4.7E-02**	**4.8E-07**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) / Reference Concentration
Cancer Risk = Chronic Daily Intake (Cancinogenic) x Inhalation Slope Factor

TABLE 6-37

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM DERMAL CONTACT TO SOIL (DAILY) RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT OB GROUNDS

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	RfD (mg/kg-day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Semivolatiles						
Pesticides/PCBs						
Explosives						
Metals						
Cadmium	8.5E-06	0.0E+00	5.0E-04	NA	1.7E-02	
Totals - HQ & CR					**1.7E-02**	**0.0E+00**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic)/ Reference Dose (Oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (Oral)

TABLE 6-38

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISK FROM DERMAL CONTACT TO SEDIMENT (WHILE WADING) RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg-day)	CDI (Car) (mg/kg-day)	RfD (mg/kg-day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Semivolatiles						
Explosives						
Metals						
Cadmium	2.2E-07		5.0E-04	NA	4.4E-04	
Totals - HQ & CR					**4.4E-04**	**0.0E+00**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) / Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

Dermal Exposure to Water while Showering

The future land-use scenario considered dermal exposure to future on-site residents from on-site groundwater during showering. The chemical-specific hazard quotients and total hazard index for this pathway are presented in Table 6-39. The pathway hazard index of 0.000023, which is far below the USEPA-defined target of unity, is primarily the result of potential exposure to di-n-octylphthalate (HQ = 0.000011).

Dermal Exposure to Surface Water While Swimming

The future land-use scenario for dermal exposure to surface water is the same as the current off-site land use scenario. The pathway hazard index of 0.0004 has been presented previously in Table 6-30 and is below the USEPA-defined target to unity.

Dermal Exposure to Surface Water While Wading

The chemical specific hazard quotients and the total hazard index for this pathway are presented in Table 6-40. The pathway hazard index of 0.0014, which is well below the USEPA defined target of unity, is primarily due to potential exposure from manganese (HQ = 0.0013).

Hazard Index Summary

The future land-use hazard index summary and total hazard index are presented in Table 6-41. The total hazard index of 0.33 is primarily due to ingestion of on-site soil (HI = 0.24). The chemicals primarily responsible for the elevated hazard index are metals and explosives in the soil. The hazard index of 0.33 is below the USEPA-defined target of unity.

Media-specific Hazard Indices

For the future groundwater exposure pathways, the total hazard index was determined to be 0.015. This total was mostly the result of the ingestion-of-drinking-water pathway. The greatest chemical contributor of risk was due to the ingestion of phthalates and explosives. The hazard index of 0.015 is below the USEPA-defined target of unity.

TABLE 6-39

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM DERMAL CONTACT TO GROUNDWATER (DAILY) RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT OB GROUNDS

Analyte	CDI (Nc) (mg/kg/day)	CDI (Car) (mg/kg/day)	RfD (mg/kg/day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Volatile Organics						
Acetone	1.6E-07		1.0E-01	NA	1.6E-06	
Semivolatiles						
Di-n-butylphthalate	2.1E-07		1.0E-01	NA	2.1E-06	
Di-n-octylphthalate	2.1E-07		2.0E-02	NA	1.1E-05	
Explosives						
RDX	2.6E-09	1.1E-09	3.0E-03	1.1E-01	8.5E-07	1.2E-10
Trinitrotoluene, 2,4,6-	2.6E-09	1.1E-09	5.0E-04	3.0E-02	5.1E-06	3.3E-11
Dinitrotoluene, 2,6-	2.6E-09		1.0E-03	NA	2.6E-06	
Totals - HQ & CR					**2.3E-05**	**1.5E-10**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic) /Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

TABLE 6-40

CALCULATION OF NONCARCINOGENIC AND CARCINOGENIC RISKS FROM DERMAL CONTACT TO SURFACE WATER (WHILE WADING) RESIDENTIAL EXPOSURE (FUTURE LAND USE)

SENECA ARMY DEPOT
OB GROUNDS

Analyte	CDI (Nc) (mg/kg)	CDI (Car) (mg/kg)	RfD (mg/kg/day)	Oral Slope Factor (mg/kg-day)-1	Hazard Quotient	Cancer Risk
Volatile Organics						
1,2-Dichloroethane		1.1E-08	NA	9.1E-02		1.0E-09
Trichloroethene		1.5E-08	NA	1.1E-02		1.6E-10
Semivolatiles						
bis(2-Ethylhexyl)phthalate	5.8E-08	2.5E-08	2.0E-02	1.4E-02	2.9E-06	3.5E-10
Explosives						
RDX	1.2E-08	5.1E-09	3.0E-03	1.1E-01	4.0E-06	5.6E-10
Tetryl			NA	NA		
Metals						
Aluminum			NA	NA		
Arsenic	1.2E-08	5.2E-09	3.0E-04	1.8E+00	4.0E-05	9.1E-09
Barium	1.2E-06		7.0E-02	NA	1.7E-05	
Beryllium	3.4E-09	1.5E-09	5.0E-03	4.3E+00	6.8E-07	6.3E-09
Chromium	1.9E-08		5.0E-03	NA	3.8E-06	
Copper	3.7E-07		4.0E-02	NA	9.2E-06	
Lead			NA	NA		
Manganese	6.6E-06		5.0E-03	NA	1.3E-03	
Nickel			NA	NA		
Vanadium	2.0E-07		7.0E-03	NA	2.8E-05	
Totals - HQ & CR					**1.4E-03**	**1.7E-08**

Hazard Quotient = Chronic Daily Intake (Noncarcinogenic)/Reference Dose (oral)
Cancer Risk = Chronic Daily Intake (Carcinogenic) x Slope Factor (oral)

TABLE 6-41

CALCULATION OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS
CURRENT INDUSTRIAL, CURRENT RESIDENTIAL, AND FUTURE RESIDENTIAL LAND USE

SENECA ARMY DEPOT
OB GROUNDS

RECEPTOR	EXPOSURE ROUTE	EXPOSURE ASSESSMENT Table Number	RISK CHARACTERIZATION Table Number	HAZARD INDEX	CANCER RISK
CURRENT INDUSTRIAL					
ONSITE WORKER	Inhalation of Fugitive Dust	Table 6-8	Table 6-25	2.0E-02	1.7E-07
	Ingestion of Onsite Soils	Table 6-10	Table 6-26	1.8E-01	6.0E-06
	Dermal Contact to Onsite Soils	Table 6-12	Table 6-27	5.8E-03	0.0E+00
	Dermal Contact to Surface Water while Wading	Table 6-16	Table 6-28	1.6E-02	1.6E-07
	Dermal Contact to Sediment while Wading	Table 6-20	Table 6-29	3.2E-03	0.0E+00
TOTAL RECEPTOR RISK (Nc & CAR)				2.3E-01	6.4E-06
CURRENT RESIDENTIAL					
CURRENT OFF-SITE RESIDENTS	Ingestion of Surface Water while Swimming	Table 6-14	Table 6-30	1.3E-03	1.3E-07
	Dermal Contact to Surface Water while Swimming	Table 6-15	Table 6-31	4.0E-04	4.1E-08
	Ingestion of Sediment while Swimming	Table 6-18	Table 6-32	4.7E-03	2.2E-07
	Dermal Contact to Sediment while Swimming	Table 6-19	Table 6-33	6.7E-04	0.0E+00
TOTAL RECEPTOR RISK (Nc & CAR)				7.0E-03	3.9E-07
FUTURE RESIDENTIAL					
ONSITE FUTURE RESIDENT	Ingestion of Surface Water while Swimming	Table 6-14	Table 6-30	1.3E-03	1.3E-07
	Dermal Contact to Surface Water while Swimming	Table 6-15	Table 6-31	4.0E-04	4.1E-08
	Ingestion of Sediment while Swimming	Table 6-18	Table 6-32	4.7E-03	2.2E-07
	Dermal Contact to Sediment while Swimming	Table 6-19	Table 6-33	6.7E-04	0.0E+00
	Dermal Contact to Surface Water while Wading	Table 6-17	Table 6-40	1.4E-03	1.7E-08
	Dermal Contact to Sediment while Wading	Table 6-21	Table 6-38	4.4E-04	0.0E+00
	Inhalation of Fugitive Dust	Table 6-9	Table 6-36	4.7E-02	4.8E-07
	Ingestion of Onsite Soils	Table 6-11	Table 6-35	2.4E-01	9.4E-06
	Dermal Contact to Onsite Soils	Table 6-13	Table 6-37	1.7E-02	0.0E+00
	Ingestion of Groundwater	Table 6-22	Table 6-34	1.5E-02	9.9E-08
	Dermal Contact to Groundwater	Table 6-23	Table 6-39	2.3E-05	1.5E-10
TOTAL RECEPTOR RISK (Nc & CAR)				3.3E-01	1.0E-05

For the future surface water exposure pathways, the total hazard index was determined to be 0.0048. This total was due to the ingestion of Reeder Creek surface water while swimming and dermal contact with surface water in the on-site wetlands during wading. Most of the risk was due to the potential exposure from metals. The hazard index of 0.0048 is below the USEPA-defined target of unity.

For the future sediment exposure pathways, a total hazard index of 0.0058 was determined. This total was driven by ingestion and dermal exposure of sediment while swimming and wading. The hazard indices for these pathways were driven by several metals and explosives. The hazard index of 0.0058 is below unity.

For the future soil pathways, a total hazard index of 0.26 was determined. This total was driven by ingestion and dermal exposure to soil. The hazard indices for these pathways were driven by several metals. The hazard index of 0.26 is below the USEPA-defined target of unity.

For the future air pathways, a total hazard index of 0.047 was determined. This total was primarily driven by the inhalation of metals. The hazard index is below the USEPA-defined tartet of unity.

Chemical-specific Hazard Indices

The total hazard index of 0.33 is primarily the result of exposure to barium (HQ = 0.12), copper (HQ = 0.06), and cadmiun (HQ = 0.06).

6.5.4.2 Exposure Pathway Cancer Risks

Chemical-specific excess cancer risks and the total excess cancer risk for each future exposure pathway are presented in Tables 6-30 to 6-40. A summary of the total cancer risk for the future use scenario is presented in Table 6-41. The land-use scenarios for each exposure pathway are the same as described for the future noncarcinogenic pathways.

Ingestion of Drinking Water

Chemical-specific cancer risks and the total pathway risk for the ingestion of drinking water are presented in Table 6-34. The total pathway risk of 9.9×10^{-8}, which is below the USEPA-defined target range of 10^{-6} to 10^{-4}, is primarily the result of potential exposure to RDX (risk = 7.1×10^{-8}).

Ingestion of Surface Water While Swimming

The future land use exposure scenario and the current land-use exposure scenario for ingestion of surface water are the same. The total pathway risk of 1.3×10^{-7} presented in Table 6-30 is below the USEPA-defined target range of 10^{-6} to 10^{-4}.

Ingestion of Soil

Chemical-specific cancer risks and the total pathway risk for the ingestion of soil are presented in Table 6-35. The total pathway risk of 9.4×10^{-6}, which falls within the USEPA-defined target range of 10^{-6} to 10^{-4}, is primarily the result of potential exposure to dibenzo(a,h)anthracene (risk = 3.4×10^{-6}), and Benzo(a)pyrene (risk = 4.0×10^{-6}).

Ingestion of Sediment

The future land use scenario and the current land use scenario for ingestion of sediment are the same. The total pathway risk of 2.2×10^{-7} is presented in Table 6-32 is below the USEPA-defined target range of 10^{-6} to 10^{-4}.

Inhalation of Fugitive Dust in Ambient Air

Chemical-specific cancer risks and the total pathway risk for the inhalation of fugitive dust in ambient air are presented in Table 6-36. The total pathway risk of 4.8×10^{-7} is below the USEPA's target range of 10^{-6} to 10^{-4}.

Dermal Exposure to Soil

As shown in Table 6-37, no chemical-specific cancer risks and total pathway risk for dermal contact with soil were calculated. There is no published oral slope factor for cadmium.

Dermal Exposure to Sediment While Swimming

The future land use scenario for dermal exposure to sediment is the same as the current land use scenario. No cancer risks were calculated because there is no published oral slope factor for cadmium.

Dermal Exposure to Sediment While Wading

As shown in Table 6-38, no chemical-specific cancer risks and total pathway risk for dermal exposure to sediment while wading were calculated. There is no published oral slope factor for cadmium.

Dermal Exposure to Water During Showering

Chemical-specific cancer risks and total pathway risk for dermal contact with water during showering are presented in Table 6-39. The total pathway risk of 1.5×10^{-10} is well below the USEPA-defined target range of 10^{-6} to 10^{-4}.

Dermal Exposure to Surface Water While Swimming

The future land use scenario for dermal exposure to surface water while swimming is the same as the current land use scenario. The total pathway risk of 4.1×10^{-8} is presented in Table 6-31 and is below the USEPA-defined target range of 10^{-6} to 10^{-4}.

Dermal Exposure to Surface Water While Wading

Chemical-specific cancer risks and the total pathway risk for dermal exposure to surface water while wading are presented in Table 6-40. The total pathway risk of 1.7×10^{-9}, which is below the USEPA-defined target range of 10^{-6} to 10^{-4}, is primarily due to potential exposure to arsenic (risk = 9.1×10^{-9}) and beryllium (risk = 6.3×10^{-9}).

Cancer Risk Summary

The future land use cancer risk summary is presented in Table 6-41. The total cancer risk of 1.0×10^{-5} which is within the USEPA target range of 10^{-6} to 10^{-4} is primarily due to ingestion of on-site soil (risk = 9.4×10^{-6}). The chemicals primarily responsible and benzo(a)pyrene are dibenzo(a,h)anthraene.

Media-specific Cancer Risks

For the future ground-water pathways, a total cancer risk of 9.9×10^{-8} was determined. This total was due to the ingestion-of-drinking-water pathway. For this pathway the risk was primarily the result of the ingestion of RDX and 2,4,6-trinitrotoluene. The cancer risk of 9.9×10^{-8} is below the target range of 10^{-6} to 10^{-4}.

For the future surface-water pathways, the total cancer risk was determined to be 3.6×10^{-7}. This total was due to ingestion of surface water, which was driven by potential exposure to arsenic and beryllium. The cancer risk of 1.9×10^{-7} is below the target range of 10^{-6} to 10^{-4}.

For the future air pathway, the total cancer risk was determined to be 4.8×10^{-7} which is well below the target range of 10^{-6} to 10^{-4}.

For the future sediment pathway, the total cancer risk was determined to be 2.2×10^{-7}. This total is due entirely to ingestion of sediment. The cancer risk for this pathway was the result of arsenic and several PAH's. The cancer risk of 2.2×10^{-7} is below the target range of 10^{-6} to 10^{-4}.

For the future soil pathways, the total cancer risk was determined to be 9.4×10^{-6}. This total was due to the ingestion of onsite soils. The cancer risk of 9.4×10^{-6} is within the target range of 10^{-6} to 10^{-4}.

Chemical-specific Cancer Risks

The total cancer risk of 4.8×10^{-5} is primarily the result of exposure to benzo(a)pyrene (risk $= 2.1 \times 10^{-5}$), and dibenzo(o,h)anthracene (risk $= 1.7 \times 10^{-5}$). These values are both within the USEPA-defined target range of 10^{-6} to 10^{-4}.

6.5.5 Risk Characterization for Lead

Although the previous analysis predicts minimum non-carcinogenic and carcinogenic health effects for both the current and future land use exposure scenarios, these analyses do not include any quantification of risk for lead since no approved RfD, RfC, slope factor or inhalation unit risk currently are available.

Therefore, the evaluation of risks associated with exposure to lead requires the use of a biokinetic uptake model (Version 0.9, USEPA, 1992) to predict the blood lead concentrations in children exposed to lead through a variety of media. The model is designed to estimate blood lead levels using a combination of default assumptions and exposure concentrations

Dermal Exposure to Sediment While Wading

As shown in Table 6-38, no chemical-specific cancer risks and total pathway risk for dermal exposure to sediment while wading were calculated. There is no published oral slope factor for cadmium.

Dermal Exposure to Water During Showering

Chemical-specific cancer risks and total pathway risk for dermal contact with water during showering are presented in Table 6-39. The total pathway risk of 1.5×10^{-10} is well below the USEPA-defined target range of 10^{-6} to 10^{-4}.

Dermal Exposure to Surface Water While Swimming

The future land use scenario for dermal exposure to surface water while swimming is the same as the current land use scenario. The total pathway risk of 4.1×10^{-8} is presented in Table 6-31 and is below the USEPA-defined target range of 10^{-6} to 10^{-4}.

Dermal Exposure to Surface Water While Wading

Chemical-specific cancer risks and the total pathway risk for dermal exposure to surface water while wading are presented in Table 6-40. The total pathway risk of 1.7×10^{-9}, which is below the USEPA-defined target range of 10^{-6} to 10^{-4}, is primarily due to potential exposure to arsenic (risk = 9.1×10^{-9}) and beryllium (risk = 6.3×10^{-9}).

Cancer Risk Summary

The future land use cancer risk summary is presented in Table 6-41. The total cancer risk of 1.0×10^{-5} which is within the USEPA target range of 10^{-6} to 10^{-4} is primarily due to ingestion of on-site soil (risk = 9.4×10^{-6}). The chemicals primarily responsible and benzo(a)pyrene are dibenzo(a,h)anthraene.

Media-specific Cancer Risks

For the future ground-water pathways, a total cancer risk of 9.9×10^{-8} was determined. This total was due to the ingestion-of-drinking-water pathway. For this pathway the risk was combined with site-specific exposure information where available. The model contains two separate components: an uptake section, which allows for the estimation of lead uptake from five media (air, drinking water, soil/dust, food, and paint), and the biokinetic section, which uses the uptake data to estimate the blood lead levels. The default values used by the uptake program are based on nationwide surveys of lead distribution in the environment and studies of inhalation and ingestion for each biologic age modeled. A linear method of gastrointestinal absorption of lead was utilized in the uptake section, allowing for a more accurate estimate over a wider range of environmental lead levels. The biokinetic section of the model also assumes a maternal contribution to the fetus or newborn. The default and site-specific model parameters used in this characterization are as follows:

Media	National Default Value	Site Specific Value
Air	0.20 ug/m^3	0.032 ug/m^3
Drinking Water	4.0 ug/L	6.11 ug/L
Soil	200 ug/g	1888 ug/g
Diet	Default Values Varies with Age	Default Values Varies with Age
Paint	0.00 ug/day	0.00 ug/day
Dust	28% of Soil Value	531.9

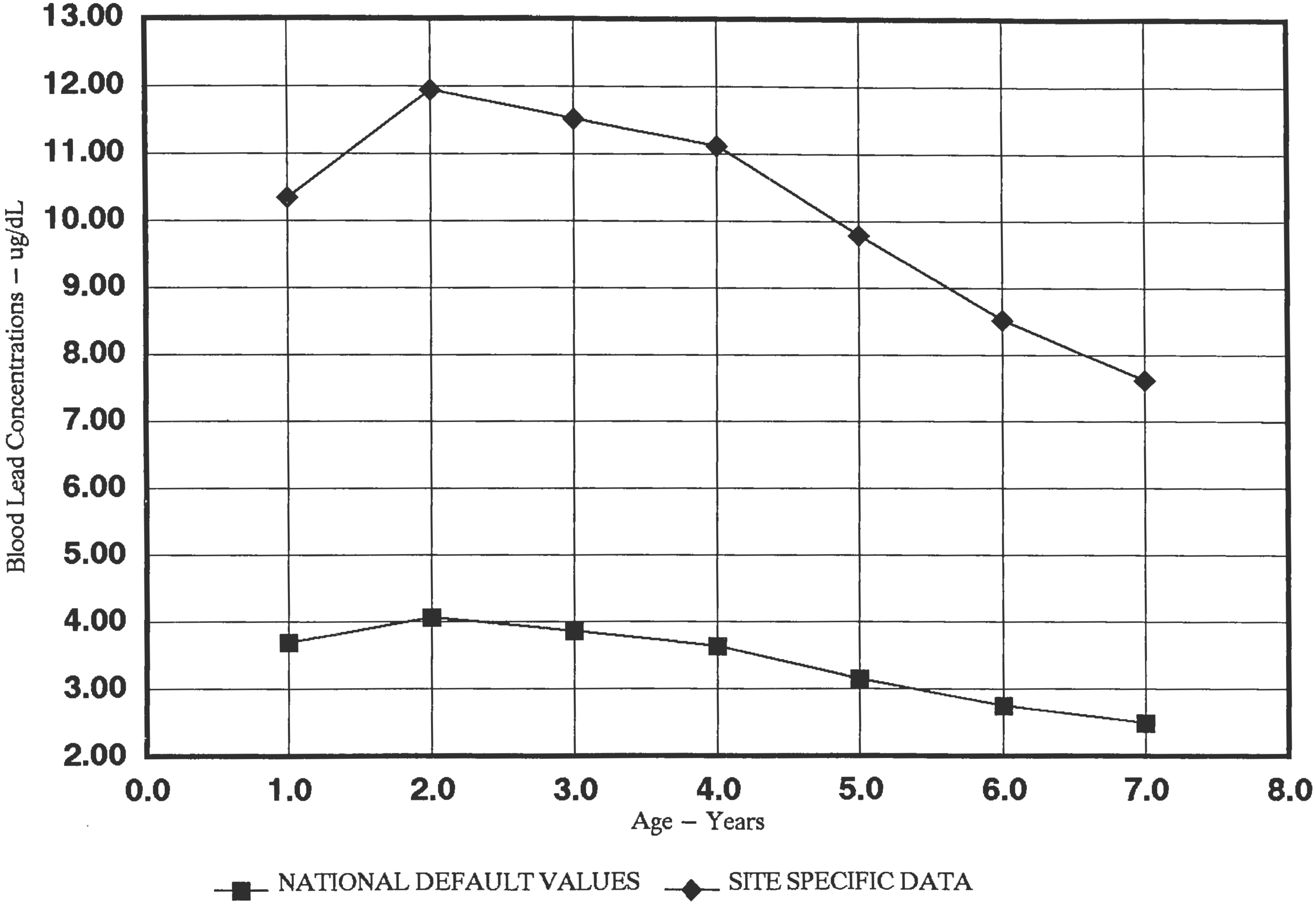
For this assessment, blood lead levels for children from 0 to 7 years of age were modeled for the future exposure scenario of on-site residential land use. According to USEPA and the Centers for Disease Control and Prevention, low-level exposure to lead during infancy and childhood increases the risk of irreversible neurobehavioral deficits at blood levels as low as 10 to 15 ug/dL (Federal Register, 1988). A blood level of 10 ug/dL or less in 95 percent of children was conservatively applied as a health guideline.

The model results are presented on Figure 6-4. This graph shows a comparison of child blood lead concentrations for ages 1 to 7 between the national default values and the site specific values. For the future exposure scenario the site specific values cause an exceedance of the 10 ug/dL health guideline for on-site child for ages from 1 to 4, indicating possible health risks. Furthermore, the uptake section model indicates that approximately 90% of the total lead uptake in this age range is the result of exposure to soil.

FIGURE 6-4

BIOKINETIC UPTAKE MODEL FOR LEAD

Comparison of Site Specific to National Default Values



The model results are reinforced by Interim Guidance set by USEPA (USEPA, 1989d) on Establishing Lead Cleanup Levels at Superfund Sites. This guidance states that lead-contaminated soil should be cleaned up to levels between 500 and 1,000 mg/kg.

6.6 ECOLOGICAL RISK ASSESSMENT

6.6.1 Objectives and Overview

The objective of this RI has been to obtain sufficient information to quantify identify pollutant concentrations, determine the nature and the extent of any impacts, if any exist, and to evaluate the potential risk to human health and the environment. The risk assessment will be used to support follow-on activities such as feasibility studies for remedial actions. This Ecological Risk Assessment (ERA) is an integral portion of the risk assessment process. The ERA of the OB grounds at the SEDA was undertaken to determine if residual materials remaining from the previous operation of open burning may have resulted in increased ecological risks. The ERA contributes to the overall characterization of the site and will serve as part of the baseline used to develop, evaluate, and select appropriate remedial alternatives. The primary objective of the ERA is to identify and characterize the potential risks posed to environmental receptors as a result of the presence of residual materials. Secondarily, the ERA objectives are to assess the ecological communities and dominant flora and fauna in the vicinity of the sites; to determine if residual materials have migrated from the site; to identify potential pathways of ecological exposure; and to determine the extent to which any response action is necessary at the site.

The statutory authority for this ERA is found in CERCLA as amended by the Superfund Amendments and Reauthorization Act (SARA). Through this authority, the EPA (USEPA) seeks to protect wildlife, fisheries, endangered and threatened species, and critical habitats. These statutes also require that remedial actions selected for NPL (i.e., Superfund) sites be sufficient to protect both human health and the environment. This ERA has been conducted in parallel with the human health risk assessment.

6.6.1.1 Scope of Investigation

This ERA is based upon site field and laboratory data collected during the Phase I and Phase II field observation and data collection program. This has also been supplemented with available literature on the toxicology of chemicals of potential concern to plant and animal species in the OB grounds vicinity. This study was conducted in accordance with *Risk*

Assessment Guidance For Superfund, Volume II, Environmental Evaluation Manual (USEPA, 1989e); *Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference* (USEPA, 1989a); and theDraft NYSDEC TAGM, *Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites* (NYSDEC, 1991). The sampling locations, procedures and strategies used to investigate the ecological status of this site was fully described in the EPA and NYSDEC approved workplan, prepared by ES prior to the implementation of the field program. The subsequent field program was conducted in strict compliance with the workplan.

The following steps were completed for the ERA:

- Qualitative and quantitative characterization of ecological communities and dominant nondomesticated plant and animal species in the area of the OB grounds,
- Selection of receptor species,
- Identification of chemicals of potential concern for ecological receptors,
- Identification of contaminant exposure pathways from the OB grounds to target species,
- Assessment of exposure of receptors to chemicals of potential concern,
- Assessments of the toxicity of chemicals of potential concern for each receptor group or species,
- Characterization of risk,
- Estimation of risk uncertainty.

During the Phase I RI program, quantitative characterization of the ecological communities was performed in order to determine the species frequency, dominance, diversity, and productivity of the biological population or community at the site. The Phase I program was performed to determine the need for performing chemical analysis of biological or plant material at the site and toxicity testing. The Phase 1 ecological investigation did not observe sufficient ecological impacts to warrant the need to perform either tissue testing nor toxicity testing during Phase 2. Consequently, concentrations of chemicals were not measured in biological or plant material during the Phase II program. However, fish data, both species type and number, were obtained during an extensive fish collection program. Bentic macroinvertebrates were identified in each sediment sample collected from Reeder Creek and the on-site wetlands. Terrestrial mammal trapping was performed to determine the type and numbers of mammals present at the site. Additionally, the terrestrial vegetation within a half mile radius of the site was characterized. Wetland areas were also mapped by ES ecologists. Chemical analyses were performed on each environmental media, including soil, sediment, surface water, and groundwater. The conclusions derived from this study focus on identifying potential adverse risks to the ecological species, habitats, and populations in the environment, based upon a comparison of the site quantitative data with ecological criteria, guidelines and standards.

The ERA addresses potentially significant risks to the following biological groups and special-interest resources associated with the site: vascular vegetation, wildlife, aquatic life (including both fish and aquatic macroinvertebrates), endangered and threatened species, and wetlands. The ERA focus is in the area of the OB grounds and the immediately surrounding vicinity, including Reeder Creek. The OB grounds have been evaluated as a single site, with references being made to specific locations as appropriate. The aquatic study area included Reeder Creek and intermittent drainage swales/wetlands at the OB grounds site. The terrestrial study area included the OB grounds and and area within an approximate 2 mile-radius from the site perimeter. Within the 2 mile radius significant resources such as NYSDEC significant habitats, habitats supporting endangered, threatened and rare species, species of concern and state regulated wetlands were identified. Within a smaller 0.5 mile radius, the major vegetative communites, wildlife species associated with each over type and the value of the habitats to the associated wildlife were identified. Trapping of small mammals was performed within a 0.5 mile radius to evaluate the diversity and abundance of species within an area closer to the actual site.

As preceding sections of this RI have indicated, a substantial site-specific data base of chemical and physical information was developed to characterize the types, locations, and concentrations of contaminants in soils, sediments, surface water, and ground water. Physical media samples were collected upgradient and downgradient from the OB ground, and from on-site and off-site (for soils) background reference stations. Multiple rounds of media sampling were conducted over the course of the two phases of investigation fieldwork. Physical media samples were chemically analyzed for a broad range of more than 150 analytes, including inorganics, explosives, PCBs/pesticides, VOCs and SVOCs. Field measurements included dissolved oxygen, pH, specific conductivity and temperature were measured for surface waters. Validated chemical analytical results were used in all ecological risk analyses. Contaminants' acute and chronic concentrations toxic to individual species and general biological groups (e.g., fish) were derived from the technical literature rather than from site specific toxicological studies. The literature researched is reflected in the chemical profiles presented in Appendix H.

Site ecological characterization activities were conducted in the fall of 1992 and the spring of 1993. Characterization activities included a site reconnaissance, terrestrial trapping, fish captures, qualitative evaluation of plant communities, macroinvertebrate sampling, quantitative sorting of the macroinvertebrate data, and identification and descriptions of visible evidence of environmental stresses.

6.6.2 Site Characterization

Ecological site characterization of the OB grounds is based on compilation of existing ecological information and on-site reconnaissance activities conducted in the fall of 1992 and the spring of 1993. The methods used to characterize the ecological resources included site walkovers for the evaluation of existing wildlife and vegetative communities; interviews with local, state, and SEDA resource personnel; and review of environmental data obtained from previous Army reports. SEDA has a strong wildlife management program which is reviewed and approved by the New York Fish and Game Agency. The depot manages an annual white-tailed deer (Odocoileus virginiana) harvest and has constructed a large wetland called the "duck pond" in the northeastern portion of the facility to provide a habitat for migrating waterfowl. Winter deer counts estimate the hard size at approximately 600 animals, between 250-300 animals are harvested each fall. Sources of environmental data include past wetland evaluation project reports prepared by AEHA, an Environmental Impact Statement (EIS) prepared by DeLeuw, Cather Co. for permitting of the U.S. Coast Guard Loran Transmitting Station, located in the southwestern portion of the Depot, a land use report issued by Cornell University and information provided by state wildlife resource agencies.

6.6.2.1 Site Characterization Methods

The methods used to characterize the natural resources at the site focused on aquatic and terrestrial resources at the OB grounds and the surrounding area within a 2-mile radius. The

2-mile-radius study area was selected in order to address ecological resources that may be potentially at risk from contaminants should they migrate beyond the site boundaries. This area was surveyed for ecological characterization of major plant communities and land uses, as well as any protected, significant, or special-interest ecological resources.

In order to secure as much existing ecological information as possible for the site, phone contacts with SEDA personnel were made prior to site reconnaissance activities. Additionally, local and state resource personnel were contacted for specific information on resources at the depot, within the 2-mile radius study area. Site-specific information obtained included the presence of state and federal threatened and endangered species, species of special concern, and wildlife and fisheries resources data. Information on unique and special-concern habitats, preserves, and natural areas within the general vicinity, and information on wild, scenic, and recreational rivers also were obtained. Aerial photographs of the site and the surrounding area also were reviewed for historical site features and land uses. Soil classification maps and soil characterization data were obtained from the Soil Conservation Service.

Ecological reconnaissance surveys of the OB grounds and the surrounding area were conducted by ES field biologists in October and November 1992 and in April and May 1993. Field trapping of small mammals and fish netting yielded information regarding the number and type of biological ecological resources at the site. Sampling of sediments and macroinvertebrate identification and counting was used to identify the macroinvertebrate biological community. The study area was primarily observed on foot, although some areas were observed with slow drive-throughs. The primary survey objective was to collect qualitative information on the types, quantities, and locations of biological resources at the OB ground and the surrounding area. This was done as follows:

- Dominant plant species were identified, and reference specimens were collected.

- Plant communities were defined based on dominant species observed.

- Observations of fauna were made. Mammals were identified by tracks, scat, burrows, and actual sightings in addition to trapping. Bird, reptile, and aquatic invertebrate identifications were made by actual individual sightings and examination of sediment. Fish in Reeder Creek were trapped and field identified.

- Areas were examined for vegatative sites, including plants displaying stunted growth.

The purpose of these activities was to identify potential representative receptors, observe any impacts and determine likely exposure scenarios for the risk assessment.

6.6.3 Environmental Setting

SEDA is situated between Seneca Lake and Cayuga Lake and encompasses portions of Romulus Township and Varick Township. Land use in this region of New York is largely agricultural, with some forestry and public land (school, recreational and state parks). The most recent land use report is that issued by Cornell University. This report classifies in further detail land uses and environments of this region (Cornell 1967). Agricultural land use is categorized as inactive and active use. Inactive agricultural land consists of land committed to eventual forest regeneration, land waiting to be developed, or land presently under construction. Active agricultural land surrounding SEDA consists of largely cropland and cropland pasture. The USGS quadrangle maps for the Towns of Ovid and Dresden, New York (1970), New York State DOT quadrangles for Romulus, New York (1978) and Geneva South, New York (1978) do not indicate land designated for dairy production in the vicinity of SEDA.

6.6.3.1 Aquatic Assessment Program

6.6.3.1.1 Benthic Invertebrate Community

The benthic community of Reeder Creek is dominated by insects based on the results of the macroinvertebrate Surber sampling program at six stations, shown in Table 3-10. Insects comprised approximately 87 percent of the almost 3,000 specimens collected and identified, whereas the remaining 13 percent was a combination of worms (Turbellaria and Oligochaeta), leeches (Hirudinea), snails (Gastropoda), clams (Bivalvia), seed shrimp (Ostracoda) and scuds (Amphipoda). Insects collected included stoneflies (Plecoptera), caddisflies (Trichoptera), hellgramites (Megaloptera), beetles (Coleoptera), mayflies (Ephemeroptera), true flies (Diptera) and damselflies (Odonata). This fauna is characteristic of stony, riffle/run habitat such as Reeder Creek (Hynes 1979). The true flies dominated the combined collections (38.4 percent), closely followed by beetles (30.1 percent). Subdominant taxa in order of abundance include caddisfly larvae, stoneflies and snails as described in Table 3-10. All seven remaining groups collected comprised a total of 7.8 percent of the overall collection. Thus, as frequently occurs in streams of this nature, the benthic macroinvertebrate taxa in Reeder Creek are unevenly distributed.

The relative abundance of taxa identified at the downstream stations was similar to that of the entire collection, where insects comprised from 76.9 percent to 92.5 percent of the collection at a specific station. Specifically, true flies and beetles were the dominant insect groups at all downstream stations except at station SW-110. At the upstream reference Station SW196 beetles were the dominant macroinvertebrate group.

Species richness at each station was fairly similar. The number of taxa identified was the lowest at reference Station SW196 (22) and the highest at Station SW-130 (29). Overall, 45 different taxa were identified at the six stations in Reeder Creek. If adverse effects of contaminants in Reeder Creek were affecting the water quality and thus the benthic community, lower species richness would be expected at the downstream stations rather than at the reference Station SW196. Since there is no apparent difference between species richness there is no evidence of adverse effects on the benthic community of Reeder Creek, based on the variety of organisms collected.

The distribution of taxa among the downstream stations was fairly similar. At the reference Station SW-196 the distribution of taxa was somewhat different when compared to the downstream stations. At SW-196 no mayflies were collected, compared with two to three different families of mayfly reported at each downstream station. Combining all three replicates at each station, the total number of organisms collected at the downstream stations ranged between 959 at Station SW120 and 223 at Station SW140. The mean number of organisms collected at the five downstream stations was 520. The number of individuals collected at the reference Station (SW196) was within the range of all downstream stations (297).

Although organisms were not identified to the species level, it is possible to discuss guild structure in Reeder Creek in a generalized manner. Trophic relationships of all insect families identified are presented in Table 3-11. The functional feeding groups of insect families in Reeder Creek appear varied and incorporate virtually all types of feeding mechanisms. This overall hierarchy-including scrapers, herbivores, detritivores, predators and piercers suggest that no apparent vacancies in trophic relationships exist in Reeder Creek.

The presence or absence of "indicator species" is commonly used to assess adverse effects to ecological communities. Pollution tolerance values for each of the aquatic arthropods identified in Reeder Creek are given in Table 3-11. The pollution tolerance of the arthropods identified in Reeder Creek is wide and ranges from pollution tolerant organisms such as the Coenagrionidae, with a tolerance value of 9, to pollution intolerant organisms such as Nemouridae, with a tolerance value of 2. However, most of the individuals identified, are within the facultative classification (4-6). These are organisms that have a wide range of tolerance and are often associated with moderate levels of organic chemical contamination (USEPA 1990). The presence of an intolerant group, specifically Nemouridae, in relatively high abundance at stations SW-110, SW-120, and SW-130 provides evidence of favorable water quality at these downstream locations. The absence of this taxa at stations SW-140 and SW-196 does not necessarily imply degraded water quality at these locations. If the water quality at specific location were consistently degraded, tolerant taxa such as Coenagrionidae would be expected to be especially common. Such was not the case at any Reeder Creek Station. Most healthy benthic communities have a mixture of tolerant, facultative and intolerant organisms.

An additional measure of pollution sensitivity is the presence and/or absence of mayflies, (Ephemeroptera), stoneflies, (Plecoptera), and caddisflies (Tricoptera), otherwise known as EPTs. These organisms are generally sensitive or facultative and are often first to suffer in a polluted environment (USEPA 1990, USEPA 1989a). The abundance of all three of these groups ranges from 17 at SW-140 to 280 at SW-120 and is suggestive of good water quality. The total number of taxa within these groups generally increases with improving water quality (USEPA 1990). The relative abundance of EPTs compared to the generally tolerant Chironomidae is also used as a measure of biotic conditions. Chironomids tend to increase in relative abundance along a gradient of increasing enrichment of heavy metals concentration (USEPA 1990). There is no clearly defined trend of EPT's compared to chironomids at the six Reeder Creek stations based on the data collected in 1991. (See Section 3.9.1.1).

Although the EPT to chironomid ratio for stations on Reeder Creek shows no clearly defined trend, the ratio did decline at Station SW-130, which is located downgradient of a surface water input from the OB grounds. This decrease may be attributable to natural causes within Reeder Creek. Any change in the substratum, such as a buildup of sediment (from either the tributary or from other causes), or a decrease in flow velocity reduces the oxygen level in the water. Since the EPT are not tolerant of low oxygen levels, there would be a decrease in EPT abundance at that location. Data from field notes support this idea because the lowest stream velocity (.03 fps) was measured at station SW-130. Therefore, the oxygen level at this site may be lower than other locations on the creek and sediment deposition may be occurring.

Generally, the more complex the substratum and the larger the stones, the more diverse the invertebrate fauna. The presence of silt reduces the number of EPT. Field notes give a description of the stream bed at SW-130 as being a combination of cobbles, gravel, and some embedded sand and silt, which may be a less than suitable environment for these invertebrate.

Review of the data from the sediments taken from Reeder Creek (SW-130, SW-140, SW-150) and from the tributary on the OB grounds near station SW-130 (SW-160 and SW-190) shows that concentrations of some metals are greater than the LOT values for the stations in the tributary and, in general, the aluminum concentrations are high. The concentration of nickel at station SW-160 (1520 ug/kg) is higher than the LOT value (110 ug/kg). The concentrations of mercury (2 ug/kg) and copper (416 ug/kg) at station SW-190 are higher than the LOT values (2 ug/kg and 114 ug/kg, respectively).

However, stations SW-140 and SW-150, which are located on Reeder Creek, have no concentrations of metals higher than the LOT values, but do have high concentrations of aluminum. At station SW-130, which exhibits a drop in the EPT ratio and is located downstram of these two stations, the only metal detected was manganese, which was detected in a concentration below the LOT value. This evidence may support the theory that the drop in the EPT to chironomid ratio is the result of natural causes rather than to contaminant exposure from the site.

6.6.3.1.2 Fish Community

Based on the aquatic sampling program, the fish community of Reeder Creek is dominated by minnows and shiners (Table 3-13). Seven of the ten species collected were minnows. The related white sucker, which is often found in association with minnows, was also collected. Banded killifish and pumpkinseeds were the only non-Cypriniforme (suckers and minnows) fish collected. As is frequently the case in small streams, most of the fish were relatively small. The largest fish collected was a 161 mm (6 inch) creek chub, although the great majority of fish collected were from 27 to 76 mm (1-3 inches) in length.

Overall, common shiners were the dominant species in Reeder Creek comprising 31.1 percent of the total catch (Table 3-13). Subdominant species were represented by a group of six species with overall relative abundance differing by only 2.2 percent. These species and their relative abundances were: central stoneroller (12.1 percent), fathead minnow (11.1 percent), creek chub (10.8 percent), white sucker (10.4 percent), blacknose dace (10.2 percent) and bluntnose minnow (9.9 percent). The remaining three species (banded killifish, pumpkinseed and finescale dace) comprise relatively minor components of the overall Reeder Creek fish community. Taken as a whole, the Reeder Creek community appears to have an unusually high degree of species evenness. It is much more frequent for a fish community to have only one or two species comprising the majority of the overall community.

The catch data from each station frequently did not reflect the relatively even distribution of individuals among species, with different species being dominant at different stations (Table 3-14). The differences in species composition at each station may be due to slight habitat differences which could favor one species over another.

Total number of individuals collected at each station can only validly be compared for the electroshocking data. The most fish (79) were collected at Station SW-110. This station has a fairly deep (approximately 4 feet) plunge pool below two large culverts, which offers cover to resident fish. The least number of fish (16) were collected at the reference station, SW-196. This may not be truly indicative of the abundance of fish in this general reach of Reeder Creek, as several sizeable groups of fish were observed in pools approximately 1000 feet upstream of this location.

Species richness at each station was quite variable and showed little in the way of a defined trend. All ten species were collected at Station SW-150, although only seven were collected by electroshocking. Seven species were also collected at Stations SW-140, SW-130 and SW-110. The least number of species (4) was collected at the reference station, SW-196.

As with many species of animals, fish often consume on several different trophic levels, as is evident in Table 3-15, with diet shifting as the fish grow, as the seasons change and as the availability of prey increases and decreases. The fish community of Reeder Creek consists predominantly of primary and secondary consumers. There are no fish that would be considered strictly piscivorous (fish eating) and the three species known to consume fish (creek chubs, common shiners and pumpkinseeds) are considered to be omnivorous (opportunistic).

There does not appear to be an unexpected vacancy in the fish guilds found in Reeder Creek that would be indicative of adverse effects of contaminants. There is a paucity of piscivorous fish but the small size of the stream would not support more than a few tertiary consumers. Some of the species of fish collected (e.g. common shiner and blacknose dace) are typically found in cool streams (Lee et al. 1989) which suggests that at least parts of Reeder Creek remain cool for most of the year. This raises the possibility that a missing component of the Reeder Creek fish community could be brook trout, especially since this species is often found in association with blacknose dace. However, there were few, if any, areas of the stream that would support trout spawning, since the interstitial spaces of any gravel beds were heavily imbedded with silt. This silt would tend to smother any brook trout eggs deposited in these gravel beds. Even without the silt, Reeder Creek in proximity to the OB grounds is too small to support a substantial population of brook trout.

Any abnormalities observed in the fish collected were also documented. There was a degree of subjectivity in these observations, since the time spent examining each fish was by necessity brief in an effort to quickly return collected fish alive to the stream. The most commonly observed abnormality were tumors (Table 3-16). At least some fish at every station had tumors. There was not a consistent trend in the percentage of fish with tumors, as the highest incidence was at reference station SW-196 and the lowest incidence was immediately downstream at Station SW-150. Differential species sensitivity was evident, as blacknose dace usually had more tumors than other species. The cause of observed tumors cannot be definitely stated but may be associated with parasitic cysts. Dissection of tumors on 16 fish revealed the presence of unidentified parasites within all tumors. Many fish at all stations also had varying degrees of infestations of "black spot", thought to be the "black grub" phase of parasitic trematodes. Parasitic infestations are not directly caused by chemical agents, although in some instances there may be an indirect relationship due to reduction of the immunosuppressive abilities of effected organisms. However, the distribution of fish with tumors in Reeder Creek was such that the causative agent does not appear to be associated with the OB grounds. The only other abnormality observed was one creek chub with an asymmetrical caudal fin. Such occasional occurrences are typically found in most populations of fish and are not considered to be unusual.

The results of the Phase I aquatic assessment indicate that the fish species in Reeder Creek which are potential aquatic receptors of contamination from the OB grounds are predominantly white suckers and minnows. The only species collected that would be considered by some to be a sport fish would be the pumpkinseed, although it is extremely doubtful that there is any fishing activity in the portion of Reeder Creek that is in proximity to the OB grounds or immediately downstream. Most, if not all, fish collected normally have fairly localized home ranges. The only species collected which is documented to show organized migrations is the white sucker (Smith 1985). However, these migrations are associated with lake dwelling populations that move into rivers and streams to spawn. It is unlikely that white sucker populations that live in Reeder Creek undergo extensive spawning migrations, other than to find suitable spawning substrate.

Localized movements of all species collected are expected in response to environmental factors such as low flow conditions. Another normal response of fish populations that exceed the carrying capacity of a stream reach is for some individuals to move into a less crowded portion of the stream. It is therefore possible that some fish move from the portion of Reeder Creek adjacent to the OB grounds to off-site, downstream locations. This could result in a limited number of fish (most likely minnows) moving into a class C(T) portion of Reeder Creek, where they would be susceptible to predation by piscivorous fish that may inhabit these off-site stream segments. It is considered unlikely that downstream movement would extend to the impassable barrier on Reeder Creek, which is approximately two miles downstream of Station SW-110. Therefore, predation on minnows originating from Reeder Creek on the Depot by steelhead or rainbow smelt is considered highly improbable, since these sportfish are not expected to occur above this barrier.

Movement of fish from lower stream reaches upstream onto the Depot is not possible under normal stream flows due to the presence of a culvert at the Depot fence line. Under high flow conditions, strong swimming fish may be able to move through the culvert, but this is not considered to represent a significant source of additional fish joining the existing fish community near the OB grounds.

The significance of the fisheries resources of Reeder Creek should be considered in terms of its value to associated fauna. It is clear from the species of fish collected that the on-site community is essentially non-piscivorous, relying mostly on other food sources. Although small fish may occasionally migrate to downstream stream reaches where more carnivorous fish are present, they certainly do not contribute substantially to the diet of such fish. During a reconnaissance of lower Reeder Creek, from State Route 125 to the Conrail Railroad bridge, numerous schools of minnows were observed throughout the entire stream segment indicating that sufficient prey already exist for resident predators.

The primary value of the fish community in Reeder Creek near the OB grounds is to fish-eating wildlife. Examples of wildlife that could consume the fish in Reeder Creek, as well as other aquatic organisms, include the northern water snake, various turtles, wading birds such as herons and egrets, and occasional ducks that may use the small beaver ponds, or other pools on this portion of the creek. Use of this area of the creek by such wildlife is considered to be minimal due to the small size of the stream and the availability of more suitable habitat elsewhere.

6.6.3.2 Terrestrial Assessment Program

6.6.3.2.1 Significant Resources and Resources Used by Humans

Based on state regulated wetland maps there are seven New York State regulated wetlands within the 2-mile study area, but none are in close proximity to the site perimeter (Figure 3-20). The closest wetland is GS-2 which is over 4,400 feet west of the site perimeter. The other six regulated wetlands are over one mile from the site perimeter. GS-3 and GS-4 are to the south, RO-19 and RO-20 are to the east, while RO-7 and RO-8 are to the north-northeast. None of the seven regulated wetlands are hydrologically connected to Reeder Creek.

The only other significant terrestrial resource known to occur in the 2-mile study area is the population of white-pelaged white-tailed deer (Odocoileus virginiana), which inhabits the fenced Depot (Buffington 1991). Annual deer counting at the depot indicate the herd size is approximately 600 animals, approximately one-third (200) are white-pelaged. Since the depot is totally enclosed, the white-pelaged deer is thought to occur as a result of inbreeding within the herd. To prevent overgrazing and starvation of the deer, the depot maintains the herd through an annual hunting season on the depot. The management plan of the herd is conducted by the New York State DFW. The normal brown-pelaged deer are also common. White-tailed deer are not listed as a rare or endangered species.

In the 2-mile study area agricultural crops and deciduous forests comprise the vegetative resources used by humans. Although no crops are grown on the Depot, farmland is the predominant land use in the surrounding private lands. Crops including corn, wheat, oats, beans and hay mixtures, are grown primarily for livestock feed. Deciduous forestland on the depot and surrounding private lands is under active forest management (Morrison 1992, SEDA 1992). Timber and firewood are harvested from private woodlots (Morrison 1992).

No timber harvesting occurs on the Depot (SEDA 1992). Although there are woods and tree rows in proximity to the OB grounds these resources were observed to be in normal, healthy condition with no apparent impacts noted.

Within the 2-mile study area, there are several wildlife species which are hunted and trapped on private lands. Game species hunted include the eastern cottontail, white-tailed deer, ruffed grouse, ring-necked pheasant and various waterfowl. Gray squirrel and wild turkey are hunted to a lesser extent. Furbearing species trapped in this study area include red and gray fox and raccoon. Muskrat and beaver are trapped to a lesser extent (Woodruff 1992). On the Depot, deer, waterfowl and small game hunting is allowed, although the designated waterfowl hunting area is outside the study area. Trapping is also permitted (SEDA 1992).

Due to the expected low populations of waterfowl in the OB grounds, no impact to these gamebirds is expected. The same holds true for the populations of squirrel, gray fox, and ruffed grouse due to the limited forest habitat. The eastern cottontail, red fox and ring-necked pheasant would utilize the habitats (old fields) present on the OB grounds, although pheasant populations on the depot are low (SEDA 1992). Raccoon would be found in all habitats on and adjacent to the OB grounds. Muskrat may occur in the wetlands and creek habitats, and beaver are known to inhabit nearby Reeder Creek. Those game and furbearing species with the most potential as receptors of OB Ground contaminants would be the eastern cottontail, red fox, deer, raccoon and muskrat. Although deer have an average home range of a square mile, the other four species have more localized or smaller home ranges (Dalrymple 1978).

6.6.3.2.2 Vegetative Resources

The major vegetative communities in the 0.5-mile study area are primarily upland cover types. Some freshwater wetlands occur, principally on the OB grounds and along Reeder Creek. Reeder Creek, and another small unnamed tributary of Seneca Lake in the southwestern corner of the study area form the only aquatic environments. Figure 3-19 shows the location of the major cover types in the study area.

The upland cover types in the study area include old field vegetative types, shrubland, deciduous forests and agricultural field vegetative typess. Old field vegetative types and shrublands are the dominate cover types. Old field vegetative types are prevalent on the OB grounds and adjacent environs, as well as the ammunition storage area to the east and an area in the southern section of the study area. These old field vegetative types are comprised of a mixture of herbaceous and shrub plant species with some small trees. Table 3-18 lists the various plant species associated with the four major cover types present in the area. Queen Anne's lace, panic grass, teasel, goldenrods, asters and field thistle are the most abundant species in these fields. Shrublands and old field vegetative typess dominate much of the remaining Depot land surrounding the OB grounds in the study area. Shrublands are comprised primarily of shrubs and small trees with some herbaceous species. Gray-stemmed dogweed, raspberry and blackberry vines, multiflora rose, buckhorn, black locust, sumacs and wild grape are the most common shrubs and vines in this cover type. Prior to becoming part of the Depot in 1941, most of the old fields and shrublands were active farmland. When they become part of the Depot and left fallow, these croplands succeeded to old field vegetative types and shrubland.

Agricultural fields are the next most prevalent cover type in the study area, but all occur on the privately owned farms in the western section. Crops typically grown in these cropfields surrounding the Depot include corn, wheat, soybeans, and various hay mixtures.

Deciduous forests comprise a relatively minor cover type in the study area and occur as woodlots and tree rows which line the fields, roads and the two streams. Various oaks, sugar maple, hickory, black locust, black cherry and aspens are the major overstory trees in these woodlots and tree rows.

Several non-vegetated areas occur on and near the OB grounds. The active demolition (bomb disposal) area is mostly bare ground due to periodic earth moving and filling activities. This activity is performed for fire control. Open buring of PEPs on the pad surface is no longer performed, however, open buring is performed in a steel tray. The steel tray is raised above the ground and is located on a large concrete pad. The construction of the new burning tray in the fall of 1991 resulted in some vegetative clearing and created bare soil conditions on and near the pad.

Several small freshwater wetlands are located on the OB grounds (Figure 2-4). Most of these emergent wetlands were created by soil excavation operations for the construction of the nine burn pad mounds. Several drainage ditches were also constructed to catch surface water run-off from the OB grounds. These ditches are also vegetated with emergent wetland plants. Narrow-leaved cattail is the most abundant and widely distributed emergent plant species in these areas. Rush and sphagnum moss also have wide distribution, but are not as abundant.

Common reed has very limited distribution on the OB grounds with only one dense stand of this tall emergent species located west of the active demolition area.

There are three other freshwater emergent wetlands within the study area, although all are small (0.3 to 1.2 acres) in size. Two of these wetlands are connected to the east side of Reeder Creek, directly east of the OB grounds, whereas the third wetland is to the northwest of the active demolition area. Two of the wetlands are dominated by narrow-leaved cattail, while the third is comprised of narrow-leaved cattail and common reed. This latter wetland was artificially created since it is a former soil excavation pit.

6.6.3.2.3 Wildlife Resources

The wildlife species expected to inhabit the 0.5 mile study area would be those typically occurring in the central New York region including some 18 species of amphibians, 15 species of reptiles, 166 species of birds, and 48 species of mammals. The most prevalent wildlife would be upland species, particularly those preferring old field vegetative types and shrublands, since these are abundant habitats in the study area. Such wildlife species would include the American toad, eastern garter snake, northern cardinal, and woodchuck. The mixture of these habitats with small woodlots and tree rows provides ideal habitat for the white-tailed deer which is common throughout the Depot. This combination of habitats is present within the study area, so it is expected that deer populations in the area would be high. The mixture of these upland habitats is also excellent for other wildlife such as the wood turtle, red-tailed hawk and raccoon. Reeder Creek and the unnamed stream in the study area provide sources of drinking water for deer and other wildlife, as well as permanent habitat to the northern water snake, pickerel frog and muskrat. The agricultural fields outside the Depot would serve as a source of food (grain, vegetation, insects) to many wildlife species, including deer, raccoon, mourning dove, common grackle and ring-billed gull. Since woodland habitat is relatively limited in the study area, populations of strictly forest-dwelling species such as the gray squirrel, blue jay and four-toed salamander would not be overly abundant. However, species richness is usually high in forested habitats. The series of small emergent wetlands in the study area do not comprise significant wildlife habitat due to their size. Frogs, salamanders and a few ducks would use the study area's wetlands. Much larger, higher quality wetland habitats occur on and off the Depot to attract waterfowl and other waterbirds.

Overall, the mixture of old field vegetative typess, shrublands, woodlots, tree rows, agricultural fields and two small streams provides valuable wildlife habitat in the study area, although similar habitats are abundant on and surrounding the Depot. Expected wildlife species diversity would be relatively high in the study area due to the variety of habitats present. The numbers and species of wildlife observed during the late fall surveys were actually low, but this was undoubtedly due to the time of year since many mammals, reptiles and amphibians would have gone into hibernation and only winter resident birds were present. During the surveys no reptiles were observed, and the only amphibians noted were a few salamanders and green frog tadpoles in Reeder Creek and the beaver ponds. White-tailed deer, woodchuck, gray squirrel, mice and voles (Cricetidae), and beaver comprised the only mammals that were observed at the site (Table 3-23).

6.6.3.2.4 Stressed or Altered Terrestrial Biota

No signs of stressed or altered terrestrial biota (vegetation and wildlife species) were observed during the surveys in the 0.5-mile study area. Due to late fall period of the surveys, many of the plant species had naturally lost their leaves or had been killed by frost and cold. However, there was no indications of unnatural die-off or stunted vegetation.

6.6.3.2.5 Potential Terrestrial Receptors

The results of the Phase I terrestrial assessment indicate that five vegetative communities are potential receptors of possible contamination from the OB grounds. The old fields and small wetlands, as well as some drainage ditches, presently occupy the OB grounds and would have the highest potential as terrestrial receptors. The other vegetative communities, including shrubland, deciduous wood lots and tree rows, and agricultural fields (off the Depot), as well as other old fields and small wetlands, would be less likely to be receptors due to their distance from the site.

The wildlife communities inhabiting the vegetative communities also appear to be normal. Although no intensive sampling program was conducted, the observations made in the late fall indicated that the seasonal (fall) wildlife species composition and density for the habitats present were normal.

The vegetative and wildlife species inhabiting the old fields, wetlands and ditches on the OB grounds would have the highest potential as receptors of contamination. Those having the lowest potential would be the plants and wildlife species inhabiting the shrublands, deciduous forest and tree rows, and agricultural fields, as well as other old fields and small wetlands, beyond the OB grounds. The white-tailed deer is the only big game species hunted in the study area, as well as being the only significant wildlife resource in its white-pelaged form. Deer utilize all habitat types in the study area, including those on the OB grounds. Observations of the deer herd in the study area showed this game population to be in healthy condition. Waterfowl and other small game species are hunted on the Depot, although waterfowl are not hunted in or near the OB grounds. In addition, waterfowl usage of the OB grounds and vicinity would be limited due to the small size of waterfowl habitat. The eastern cottontail, red fox, raccoon and muskrat are the game and furbearing species with the most potential as receptors since they would inhabit the OB grounds. Other game and furbearing species with less potential for exposure include the ruffed grouse, wild turkey, ring-necked pheasant, gray squirrel and beaver since these wildlife species would occur in habitats outside the OB grounds. Many non-game wildlife species are potential receptors, in particular those which are permanent residents and have localized home ranges such as amphibians, reptiles, small mammals, and some small non-migratory birds. Based on the fall 1991 surveys, none of the floral and faunal species observed in the OB grounds and adjacent habitats showed any visible signs of stress or alteration.

6.6.4 Ecological Risk Assessment

Potential biological effects of contaminant releases into the environment are analyzed and described in this section. The assessment focuses on evaluating the effects on vegetation, wildlife, aquatic life, and wetlands. Threatened and endangered species, including any currently proposed for listing, do not require evaluation because site characterization activities indicated the absence of such species at or near the OB grounds and the surrounding study area.

The risk assessment determines which chemicals found in physical media pose potential adverse risks to biological resources, identifies exposure routes, evaluates toxicological effects resulting from exposure, and identifies reasons some chemicals are not of concern. The assessment begins with identification of chemicals of potential environmental concern, proceeds through systematic evaluations of potential risks posed by these chemicals to each major biological group occurring on or near the OB grounds and concludes with determinations of those contaminants that represent significant environmental risks to site and nearby biota.

6.6.4.1 Selection of Chemicals of Potential Concern

The objective of this phase of the ERA was to initially identify those chemicals that pose a potential hazard to plants or animals at the OB grounds site and thus require detailed risk analyses by subsequent evaluation phases. The process begins with identification of the sources, types, locations, distribution, and approximate quantities of contaminants present in physical media. After proceeding through a screening process, this phase concludes with identifying a list of contaminants of potential concern for the site's biological receptors and resources.

For the purposes of this risk analysis, a chemical of concern is defined as a substance that can cause adverse toxicological effects to plants or animals at concentrations recorded at a site. Chemicals of concern were identified through a modest screening process. The screening process was applied to the initial list of 150 chemicals identified in the scope of work for analysis in one or more of the three media (soil, sediment, and surface water) examined during this investigation. The screening was designed to eliminate constituents that did not have at least one measured concentration during the investigation and were not measured on the OB grounds at concentrations statistically higher than in the background. The details of the screening process are described in Section 6.2 and the list of constituents of concern in the ERA is listed in Table 6-3.

The chemicals of potential concern for each biological group are discussed below. The discussions are divided into two media groups, one related to soils\sediments and other related to surface waters. Each potential ecological receptor group is then evaluated for each media being considered.

6.6.4.2 Receptor and Endpoint Selection

The objective of this analysis phase was to select a group of receptors and risk evaluation endpoints to represent the focus of the site-specific assessment. The assessment of potential effects on receptors addresses potential contaminant effects on the selected receptor species, and on the habitats of these species, as appropriate.

Evaluation of ecological risks is complex for several reasons. These include the large number of species typically present at a hazardous waste site; significant differences in biological reactions to the same contaminant concentration among different species; multiple factors regulating chemical bioavailability; and multiple levels of ecological organization (e.g., population or ecosystem) susceptible to contaminant effects. To practically address these complexities and constraints, USEPA (1989d) guidance allows use of specific indicator receptors to represent larger assemblages of species that share many common characteristics. Similarly, ecological risks should be expressed in terms of a definite endpoint, because the most objective evaluation of magnitude, probability, type of effect, and duration of a risk results from analyzing effects on a preselected or particular biological level or receptor. Thus, analytical endpoints are required. Receptors and endpoints selected for this ERA and the bases for their selections are discussed below.

Receptor Species Selection

The receptor species concept was used for evaluating potential biological risks for two reasons. First, evaluating a limited number of receptor species minimizes data interpretation difficulties created by the inherent differences in the ways various species react to the same contaminants. Second, evaluating receptor species provides a practical alternative to evaluating all of the several hundred species present on site. Receptor species were selected based on the likelihood that they would be present at the site.

Site biota were organized into five major groups, with one or two receptors selected for each group. Major groups of aquatic/wetland biota were vertebrates (fish), invertebrates, and vegetation. Major groups of terrestrial biota were vertebrates (small mammals and birds) and vegetation. The selection factors used to evaluate candidate species are listed in Table 6-42. The selected receptors and their associated biological groups are summarized in Table 6-43. Characteristics of each receptor are listed in Table 6-44.

Selection factors were used to identify species that offered the most favorable combination of characteristics for determining the implications of on-site contaminants. The factors were: 1) limited site mobility; 2) role in local nonhuman food chains; 3) potential high abundance and wide distribution on-site; 4) sufficient toxicological information available in the literature for comparative and interpretive purposes; 5) readily sampled; 6) availability in reference area; 7) separate populations present at or near waste disposal sites; 8) likely recurrence after site remediation; and 9) suitability for long-term monitoring, if necessary.

TABLE 6-42

SELECTION FACTORS FOR EVALUATING CANDIDATE RECEPTOR SPECIES

FACTOR	CONSIDERATION
Limited site mobility	• Reflect effects of site contamination concentrations • Establish completed pathways
Food chain role	• Address biomagnification risks • Address hazards to consumers • Determine exposure pathways
Adequate abundance and distribution	• Can reflect food chain linkages • Reflect site differences in contaminant mobility and accumulation
Available toxicologic data	• Support interpretaiton of sample information • Establish possible reasons for abundance of species on site • Determine exposure pathways
Readily sampled for confirmation studies	• Acquire sufficient data to achieve study objective • Time and cost efficiencies
Reference area presence	• Establish comparative baseline for data analysis and interpretation • Identify background concentrations
Present at different sites	• Address potential site influences without interference from species differences • Address remedial action effectiveness without interference from species differences
Present after remediation	• Monitor and measure responses to remediation • Available for monitoring after cleanup • Sampling requirements are cost-effective and reasonable
Long-term monitoring	• Estimate effectiveness of remedial actions • Reflects changes in site conditions

TABLE 6-43

ERA RECEPTOR SPECIES

SPECIES	DESCRIPTION
Aquatic/Wetland Species	
Cattail (Typha latifolia)	Vascular herbaceous plant, predominant biomass.
Fathead minnow (Pimpephales promelas)	Vertebrate, water column species, plankton food base.
Pumpkinseed (Lepomis diaphanus)	Vertebrate, carnivore food base, water column species.
Caddisfly (Trichoptera Hydrosychidae)	Invertebrate, phytoplankton food base.
Terrestrial Species	
Brome (Bromus spp.)	Vascular plant, abundant biomass, a forage-food grass.
Mallard (Anas platyrhynchos)	Vertebrate, omnivore food base; wetland associate; transitional aquatic and terrestrial species.
White-footed deer mouse (Peromyscus leucopus)	Vertebrate, omnivore food base, upland habitats.

TABLE 6-44

CHARACTERISTICS OF RECEPTORS

RECEPTOR	CHARACTERISTIC
Vegetation	
Cattail (Typha latifolia)	• Widespread, present at or near all aquatic sites. • Important aquatic plant and nutrient source. • Comparative toxicological data available. • Reference plants and data available. • Perennial species.
Brome/Bluegrass (Bromus/Poa spp.)	• Widespread, present at or on most terrestrial sites. • Food plants for rodents. • Can be restored after remedial action. • Perennial species.
Invertebrates	
Caddisfly (Trichoptera Hydrosychidae)	• Aquatic phytoplankton consumer. • Water-column dwelling species. • Important in aquatid foodchains. • Comparative toxicological data available. • Sensitive to toxins.
Fish	
Pumpkinseed (Lepomis diaphanus)	• Second-order aquatic carnivore. • Water-column dwelling species. • Comparative toxicological data available. • Availabe on site.
Fathead minnow (Pimephales promelas)	• Base of several aquatic and terrestrial foodchains. • Limited mobility. • Abundant interpretive data available. • First-order aquatic consumer (plankton). • Probably present on site. • Can be established for monitoring after cleanup.

TABLE 6-44
(Con't)

CHARACTERISTICS OF RECEPTORS

RECEPTOR	CHARACTERISTIC
Bird	
Mallard (Anas platyrhynchos)	• Occurs on-site with limited reproduction. • Potential human consumption linkage. • Comparative interpretive information available. • Wetland associate.
Mammal	
White-footed deer mouse (Peromyscus leucopus)	• Can be established for monitoring after cleanup. • First-order terrestrial omnivore. • Basis of several food chains. • Comparative interpretive information available. • Present on-site. • Limited mobility. • Uses several upland habitats. • Toxicological data available.

Vegetation

Receptor species representing upland grasses and old field vegetation are brome. This grass is a common member of grasslands and fields that occur in the OB grounds area. This species is relatively short lived and closely linked to upland conditions, which make them good indicators of short-term soil conditions. Cattail is the receptor species representing vegetation of wetlands and communities occurring on low, moist soils. The cattail was selected because it is an aquatic, vascular plant that typically occurs in the area on a permanent basis.

Wildlife

The receptor species representing terrestrial wildlife are the whitefooted mouse and the mallard. The whitefooted mouse has a relatively limited radius of mobility. It is abundant and a common associate of upland grasslands, riparian forests, wetlands, and many other cover types present at the OB grounds. It feeds primarily on plant materials, and also constitutes the primary prey for many predators. These characteristics make it a good indicator of potential effects on primary consumers due to contaminants in soils and plants, as well as an ideal indicator of potential food chain biomagnification effects. The abundant toxicological dosage data compiled for the laboratory mouse and rat may be transferred to the whitefooted mouse with reasonable confidence. The mallard is present on the depot at the "duck ponds" and represents wildlife affiliated with wetlands, creeks, and small ponds of the study area. It is a consumer both of terrestrial and aquatic plants and aquatic macroinvertebrates, which makes it a good indicator of potential cumulative contaminant effects through both ecosystems. Abundant toxicological dose data are available for the mallard, especially for inorganic contaminants.

Wetlands

Wetland systems will be represented by the combined characteristics of the wetland-affiliated species mentioned above. All major biological groups typically associated with wetlands are represented by the receptors chosen for this ERA. The ability to make inferences about contaminant effects on wetland systems was a factor influencing the selection of receptors. The primary receptors are the mallard and cattail. Both species occur on site either on a permanent (cattail) or seasonal (mallard) basis. Toxicological data are available for both species. The cattail represents a typical, short-lived, aquatic vascular plant; the mallard represents a semi-aquatic species that forages seasonally for either aquatic macroinvertebrates or aquatic plants.

Aquatic Life

Receptor species representing the fish component of the aquatic community are the pumpkinseed and the fathead minnow. Both species can occupy stream and pond environments and both are present in Reeder Creek. The pumpkinseed is the receptor representing predatory fish species, while the fathead minnow represents first-order consumers dependent on phytoplankton and zooplankton. The minnow also represents potential forage fish for wildlife predators. Receptor species representing the aquatic macroinvertebrate component is the caddisfly. The caddisfly is associated predominantly with the water column and is an important component of the aquatic food chain. This receptor represents a fundamental prey population for many aquatic and wetland food chains.

Endpoint Selection

In each major biological group, the risk assessment endpoints selected for this ERA focus on lethal and sublethal effects at the species and population levels, with habitats being addressed through effects to major species or physical media that characterize that habitat. Assessment endpoints for the species receptors include death, reduced survival, and reduced growth or productivity. Assessment endpoints for wetlands are the likely presence of contaminated sediments and surface waters with contaminant concentrations high enough to induce adverse effects in the receptors specifically chosen to represent wetland plants and animals. As was noted above, wetland-associated receptors include the mallard, caddisfly, cattail, and fathead minnow.

These endpoints were selected because experience in conducting ERAs indicates that sufficient technical and toxicological information are available to evaluate risks for these endpoints. Experience and research demonstrate that the ability to confidently separate contaminant-induced effects from other normal environmental regulating factors is most refined at the species and population levels of organization.

6.6.4.3 Risk Evaluation Criteria

ARARs are available for limited sectors of the diverse biological environment. Federal and state ARARs, based on the Clean Water Act and reflecting acute and chronic aquatic life standards, are generally used to establish freshwater aquatic life protection requirements. Risks to the remaining biological groups are evaluated by comparing site chemical concentrations to toxicological response data derived from laboratory and field testing and as reported in technical literature. In some situations, USEPA and a few states issue advisories or guidelines addressing acceptable concentrations of chemicals of concern in specific physical media. These recommendations are considered TBCs and are generally intended as interim planning or evaluation guidelines for avoiding or minimizing potential adverse effects from food chain biomagnification, bioaccumulation, or chronic exposures. The recommendations are usually chemical specific. Environmental risks are derived from several ARARs and TBCs. They are discussed separately for the applicable receptor groups.

Vegetation

Primary media of concern for terrestrial vegetation are soils and shallow (less than 8 feet deep) ground water. There are no established federal or NYSDEC ARARs relating specific chemical concentrations in these media directly to toxic effects on vegetation. However, there are toxicological data that relate soil concentrations of numerous inorganic chemicals to adverse effects on many agriculturally-important plants and to some common native plant species. USEPA (1983) has published guidelines addressing recommended maximum soil concentrations of some inorganic chemicals to avoid direct phytotoxic effects to plants and indirect food chain effects on wildlife and livestock foraging on plants grown in these soils. These guidelines are used as TBCs to evaluate potential risks to vegetation from inorganic chemicals of concern and are presented in Table 6-45.

Available data relating organic chemicals to toxic effects on terrestrial plant species are very limited. The PHYTOTOX database was searched to find references for allowable levels of soil concentrations for the analytes of concern. The database search did not provide a basis for these values. The PHYTOTOX database does provide recommended application rates, usually presented in Kg per hectare, that a licensed herbicide application specialist would use if a particular plant species were to be controlled. As would be expected, the chemicals for which such information was available for were herbicides and not the broader list of chemicals specific to this evaluation. Consequently, there are no formal organic chemical guidelines

TABLE 6-45

ECOLOGICAL RISK ASSESSMENT
CHEMICALS OF POTENTIAL CONCERN TO TERRESTRIAL VEGETATION IN SURFACE SOILS

SENECA ARMY DEPOT
OB GROUNDS

	CONCENTRATION (a)					
COMPOUND	MAX	95th UCL	MEAN	REGULATORY GUIDELINES (b)	NORMAL CONCENTRATIONS (c)	PHYTOTOXIC CONCENTRATIONS (d)
Volatile Organics (ug/kg)						
Methylene Chloride	21.0	4.9	4.7	NA	NA	NA
Acetone	230.0	6.8	7.4	NA	NA	NA
1,2-Dichloroethene (total)	8.0	4.7	4.5	NA	NA	NA
Chloroform	10.0	4.9	4.7	NA	NA	NA
2-Butanone	11.0	6.1	6.0	NA	NA	NA
1,1,1-Trichloroethane	8.0	4.7	4.6	NA	NA	NA
Carbon Tetrachloride	8.0	4.7	4.6	NA	NA	NA
Trichloroethene	100.0	5.0	5.0	NA	NA	NA
Benzene	8.0	4.7	4.6	NA	NA	525000
Tetrachloroethene	110.0	5.7	5.5	NA	NA	NA
Toluene	8.0	4.7	4.5	NA	NA	NA
Chlorobenzene	8.0	4.8	4.6	NA	NA	NA
Xylene (total)	8.0	4.8	4.6	NA	NA	NA
Semivolatiles (ug/kg)						
Phenol	425.0	296.1	285.1	NA	NA	NA
2-Methylphenol	425.0	296.1	285.1	NA	NA	NA
4-Methylphenol	440.0	298.7	287.5	NA	NA	NA
2,4-Dimethylphenol	425.0	296.1	285.1	NA	NA	NA
Benzoic acid	2200.0	1839.4	1781.9	NA	NA	NA
Naphthalene	440.0	290.3	277.2	NA	NA	NA
2-Methylnaphthalene	1300.0	298.8	280.9	NA	NA	NA
2-Chloronaphthalene	435.0	295.5	284.2	NA	NA	NA
2-Nitroaniline	2200.0	1247.3	1164.9	NA	NA	NA
Acenaphthylene	540.0	298.3	286.7	NA	NA	NA
2,6-Dinitrotoluene	2000.0	313.4	293.3	NA	NA	NA
3-Nitroaniline	2200.0	1248.2	1166.0	NA	NA	NA
Acenaphthene	435.0	295.2	283.9	NA	NA	NA
Dibenzofuran	435.0	295.0	283.5	NA	NA	NA
2,4-Dinitrotoluene	33000.0	736.1	893.1	NA	NA	NA
Diethylphthalate	450.0	291.5	278.5	NA	NA	NA
Fluorene	440.0	296.3	285.1	NA	NA	NA
N-Nitrosodiphenylamine	7000.0	347.9	346.5	NA	NA	NA
Hexachlorobenzene	440.0	294.7	282.6	NA	NA	NA
Pentachlorophenol	2200.0	1243.0	1160.7	NA	NA	NA
Phenanthrene	2600.0	316.9	288.4	NA	NA	NA
Anthracene	700.0	298.8	286.4	NA	100	NA
Carbazole	1200.0	243.9	221.4	NA	NA	NA
Di-n-butylphthalate	5800.0	459.1	362.9	NA	NA	NA
Fluoranthene	4400.0	369.4	312.2	NA	NA	NA
Pyrene	5600.0	378.6	315.9	NA	NA	NA
Butylbenzylphthalate	435.0	295.6	284.3	NA	NA	NA
Benzo(a)anthracene	3900.0	325.1	313.6	NA	NA	NA
Chrysene	8900.0	352.9	342.5	NA	NA	NA
bis(2-Ethylhexyl)phthalate	1450.0	348.3	324.6	NA	NA	NA
Di-n-octylphthalate	425.0	293.7	282.7	NA	NA	NA
Benzo(b)fluoranthene	11000.0	353.7	356.5	NA	NA	NA
Benzo(k)fluoranthene	4500.0	333.8	318.1	NA	NA	NA
Benzo(a)pyrene	3700.0	334.9	314.8	NA	NA	NA
Indeno(1,2,3-cd)pyrene	2300.0	328.5	304.4	NA	NA	NA
Dibenz(a,h)anthracene	670.0	298.6	286.8	NA	NA	NA
Benzo(g,h,i)perylene	960.0	304.7	290.9	NA	NA	NA

TABLE 6-45

ECOLOGICAL RISK ASSESSMENT
CHEMICALS OF POTENTIAL CONCERN TO TERRESTRIAL VEGETATION IN SURFACE SOILS

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	CONCENTRATION (a) MAX	95th UCL	MEAN	REGULATORY GUIDELINES (b)	NORMAL CONCENTRATIONS (c)	PHYTOTOXIC CONCENTRATIONS (d)
Pesticides/PCBs (ug/kg)						
beta-BHC	11.5	5.7	5.2	NA	NA	NA
delta-BHC	15.0	5.8	5.3	NA	NA	NA
gamma-BHC (Lindane)	11.5	5.7	5.2	NA	NA	NA
Heptachlor	32.0	5.9	5.3	NA	NA	NA
Aldrin	11.5	5.8	5.3	NA	NA	NA
Heptachlor epoxide	11.5	5.7	5.2	NA	NA	NA
Endosulfan I	11.5	5.7	5.2	NA	NA	NA
Dieldrin	50.0	11.7	10.6	NA	NA	NA
4,4'-DDE	830.0	18.3	17.0	NA	NA	NA
Endrin	50.0	11.8	10.8	NA	NA	NA
Endosulfan II	480.0	16.0	13.7	NA	NA	NA
4,4'-DDD	23.5	11.4	10.4	NA	NA	NA
Endosulfan sulfate	23.5	11.4	10.4	NA	NA	NA
4,4'-DDT	2800.0	18.6	27.8	NA	NA	NA
Endrin aldehyde	20.5	2.8	2.8	NA	NA	NA
alpha-Chlordane	270.0	194.9	46.8	NA	NA	NA
Aroclor-1254	430.0	116.0	105.6	NA	NA	NA
Aroclor-1260	240.0	113.7	103.7	NA	NA	NA
Explosives (ug/kg)						
HMX	1300.0	308.3	280.4	NA	NA	NA
RDX	4800.0	93.5	125.9	NA	NA	NA
1,3,5-Trinitrobenzene	7800.0	117.0	185.4	NA	NA	NA
1,3-Dinitrobenzene	440.0	70.7	66.6	NA	NA	NA
Tetryl	1000.0	153.7	140.8	NA	NA	NA
2,4,6-Trinitrotoluene	80000.0	141.7	668.8	NA	NA	NA
4-amino-2,6-Dinitrotoluene	8900.0	140.0	194.7	NA	NA	NA
2-amino-4,6-Dinitrotoluene	11000.0	155.7	228.5	NA	NA	NA
2,6-Dinitrotoluene	125.0	60.9	60.4	NA	NA	NA
2,4-Dinitrotoluene	5100.0	413.3	433.0	NA	NA	NA
Metals (mg/kg)						
Barium	34400.0	1693.4	1610.5	NA	200-554	400-2,000
Cadmium	28.2	6.1	3.6	3	0.6-15	2.5-5.0
Chromium	1430.0	32.4	37.2	1000	53-120	100-500
Copper	38100.0	762.1	856.2	250	20-50	70-640
Lead	56700.0	3185.2	2049.4	1,000	<1-120	150-1,000
Mercury	1.1	0.2	0.1	NA	0.03-0.5	1->10
Potassium	3570.0	1820.3	1749.7	NA	23,000	NA
Selenium	3.3	0.5	0.4	NA	NA	NA
Sodium	618.0	132.0	118.0	NA	12,000	NA
Thallium	38.0	0.3	0.5	NA	0.023	>2
Zinc	127000.0	987.4	1430.1	500	44-220	500-2,000
Cyanide	2.2	0.4	0.4	NA	NA	NA

NOTES:

a) The 95th Upper Confidence Limit (UCL) was calculated from the validated data.
Non-detects were taken at half value and detects at full value.
Rejected data was eliminated. Metals not statistically different, at the 95th % UCL, were deleted from further consideration.
Any compound with no detects in a given media was eliminated from the assessment of that media.
The MAX value is the maximum detected concentration.
NA = Not Available

b) Source: USEPA, 1983.

c) Concentrations reported as normal or background in soils in technical literature. Sources include Swaine, 1955; Bowen, 1966; Allaway, 1968; Gough et al., 1979; and Richardson, 1987.

d) Concentrations reported as phtotoxic in soils in technical literature. Sources include Gough et al., 1979; USEPA, 1983; and Beyer, 1990.

or recommended safety thresholds that are widely recognized as applicable for this type of impact evaluation. Toxicological threshold and phytotoxic concentrations are applied to the extent they were available in the literature.

Wildlife

There are NYSDEC guidelines to protect wildlife that consume aquatic life that is in contact with contaminated sediments (NYSDEC 1989). There are also toxicological testing data that relate known chemical dosages in either food or surface water to acute and chronic effects on specific species. These dosage values are important as reference points. However, dosage values cannot be used as absolute measurements of risk because other sophisticated site measurements required to credibly apply the dosage data (e.g.,proportion of a species' annual diet derived from the site) involve analyses of food chain dynamics and was not performed as part of this evaluation. For potential wildlife risk encountered through diet, toxic contaminant concentrations and resulting effects reported for laboratory animals, such as mallard ducks, and rats, are used as appropriate. Comparative values for rats and mallard ducks are summarized in Table 6-46 for chemicals of potential concern reported in soils and sediments on or near the OB grounds. The concentrations in soil that would result in chronic toxicity effects in wildlife were estimated in a two step process. First, literature values for dietary acute LC_{50} concentrations were converted to chronic toxicity concentrations by taking 10 percent of the LC_{50} value as the chronic toxicity value. This percentage was derived from a review of available literature and is believed to represent a conservative estimate. Mayer et. al. (1986) concluded that statistically significant effects on non-lethal endpoints occurred at concentrations within a factor of 5 of a lethal endpoint approximately 95% of the time. Tucker and Lietzke (1979) based on a review of insecticide effects on vertebrate wildlife and fish that "no sublethal effect reported in current literature tends to occur at a level less than a quarter or a sixth of the level producing a comparable percent mortality in equivalent tests." Finally, Henderson (1957) proposed a factor of oil as the ratio of the chronic threshold concentration to the acute LC_{50} concentration for fish.

The second step in the process was to convert the derived chronic toxicity dietary concentrations to chronic toxicity soil concentrations. This conversion was performed by estimating the percentage of total dietary intake that is soil. A literature review was performed to estimate this percentage. Values found for soil intake for cattle varied from 3 to 6% (Simmonds and Linsley, 1981) to 1 to 10% (Thornton and Abrams, 1983) of dry matter intake. Reported soil ingestion rates for sheep were 20% (Simmonds and Linsley, 1981) and

30% (Thornton and Abrams, 1983). The ecological risk assessment uses a value of 20% as a conservative assumption for the rat and mallard. This assumption was incorporated into the comparison table by multiplying the chronic concentration in food by 5. Thus, Table 6-46 compares maximum detected volume, the 95th UCL, and the mean of chemicals found in on-site surface soils and sediments to a calculated soil concentration that represents a chronic toxicity value.

For surface-water risks to wildlife, NYSDEC water quality guidelines for protecting wildlife consuming aquatic life (NYSDEC 1989) and aquatic water quality criteria to protect wildlife from adverse effects of drinking contaminated surface water (NAS 1977) were used in this risk assessment. Guidelines are presented in Table 6-47.

Wetlands

Wetland communities are not specifically protected by chemical-specific ARARs; instead, they are protected by a location-specific ARAR. If a wetland is considered to be under the jurisdictional review of the Clean Water Act, its damage or loss from discharges of dredged or fill materials is regulated under provisions of Section 404 of the Clean Water Act. Under these provisions, impacts to wetland acreages, functions, and values are to be avoided to the fullest extent possible, and mitigated if impacts are inevitable. Both the U.S. Army Corps of Engineers and USEPA are charged with enforcing provisions of Section 404. Although the jurisdictional status of the on-site wetlands has not been done, it appears that jurisdictional wetlands may occur on the site, Section 404 regulatory provisions will be used as evaluation criteria if remedial activities are required.

Section 404(b)(1) guidelines specify conditions permitting wetland alterations. These guidelines specifically prohibit activities that cause or contribute to violations of any applicable state water quality standard or that cause significant adverse effects to aquatic life or wildlife from the spread of pollutants through physical, chemical, or biological processes. A benefit evaluation involves deciding whether the environmental effects of altering a wetland to remove or prevent contamination outweigh the benefits of leaving the contaminated wetlands intact. Consequently, the risk assessment will be substantially influenced by findings of the aquatic life, wildlife, and vegetation assessments and the proposed remedial action alternative, especially those elements that could involve digging and/or filling of wetland areas.

General risks to the mallard, cattail, caddisfly and other wetland-associated receptors are used as indicators of possible population-level and habitat-level impacts from chemicals of potential concern. There are no chemical-specific ARARs established for the receptor species linking chemical concentrations in physical media (soils, sediments, or surface waters) directly to acute or chronic toxicological effects. Most toxicological data are for acute dosages and are derived from contaminant exposures delivered through foods. Risk judgments considered these test findings.

Aquatic Life

Under the authority of the Clean Water Act, USEPA has developed federal water-quality criteria (WQC), including criteria for protection of aquatic life, for each of more than 120 inorganic and organic compounds. Numerical ambient WQC are provided to protect freshwater animals and nonvascular plants from chronic and acute toxicities (USEPA, 1991a). These criteria, as well as analogous aquatic life protection criteria established by the State of New York (NYSDEC, 1991), are used as chemical-specific ARARs for receptors in the aquatic life group. These ARARs are listed in Table 6-48 for chemicals of potential concern.

Similarly, federal and state reference guidelines have been established for protection of aquatic life in sediments and are used as chemical-specific ARAR's for receptors in the aquatic life group. These ARARs are listed in Table 6-49 for chemicals of potential concern.

6.6.4.4 Exposure Pathways to Biological Receptors

This section identifies potential pathways of exposure of chemicals of potential concern to biota. The concepts of bioaccumulation and biomagnification are used throughout this report. Because these concepts have been historically applied in several ways, the following definitions describe their application in this study. Bioaccumulation is considered to be a process by which toxic substances are absorbed by organisms from the surrounding physical environment (e.g., fish absorbing mercury from water) or through consumption of another organism. Biomagnification refers to the resultant total process, by which tissue concentrations of bioaccumulated toxic substances increase as the substances pass up through two or more trophic levels (adapted from Brunge and Mount, 1978).

Chemical analyses of physical media samples suggest potential pathways exist between contaminant sources at the OB grounds and terrestrial, wetland, and aquatic receptors.

Ecological exposure pathways for biota may be direct or indirect. Direct exposure pathways include dermal contact, absorption, inhalation, and ingestion. Examples of direct exposure include animals incidentally ingesting contaminated soil or sediment or inhaling airborne contaminants (e.g.,during burrowing or dust-bathing activities); plants absorbing contaminants by uptake from contaminated sediments or soils; and dermal contact of aquatic organisms with contaminated surface water. Indirect exposure pathways for biota can occur when terrestrial or aquatic fauna consume previously-contaminated biota. Examples of indirect exposure include higher-order animals consuming plants or other animals that bioaccumulate chemicals.

Contamination of biota could result from exposure to one or more chemicals of potential concern at the OB grounds. Chemical bioavailability is an important contaminant characteristic that regulates a receptor's reaction to contaminant exposure. Bioavailable chemicals are in a chemical form that a receptor can accumulate and react to. Bioavailability, which is regulated by several physical and chemical environmental factors, is a concern with many inorganic chemicals, especially the metals. Pathway evaluations must account for this characteristic. In addition to bioavailability, exposure pathways for chemicals consist of four components: 1) source and mechanism of chemical release, 2) transport medium, 3) potential receptors, and 4) exposure route. All components were evaluated during this study. If either chemical bioavailability or the exposure pathway between media and the receptors are not complete, then chemicals in those media do not constitute an environmental risk at the OB grounds.

Potential sources of chemicals include surface soils, berms, surface water runoff and sediment. Mechanisms for release of chemicals include fugitive dust generation/deposition, surface water runoff, tracking, and burrowing. Primary transport media at the facility include surface water, sediment, soil, and biota. Exposure routes for chemicals of concern include ingestion (active and incidental), dermal contact, inhalation, and uptake (absorption of chemicals by flora). These pathway components are discussed below as they relate to the transport media sampled during the site investigation. Biota (i.e., indirect food chain) pathways are not addressed because this medium was not within the scope of the sampling program.

Soil

On-site soil represents a potential transport medium for the chemicals of concern. Potential sources include surface deposited waste, deposition of airborne contaminants, and migrating chemicals in surface water. The release mechanisms for chemicals in soil include leaching, surface runoff, tracking, and fugitive dust generation/deposition. Potential receptors in soil are terrestrial flora and fauna. Exposure routes include dermal contact by birds, mammals, and invertebrates; uptake by plants; and incidental ingestion or inhalation by birds and mammals while foraging and grooming. Consumption of contaminated biota by higher-order predators in the food chain can provide an indirect exposure pathway for some soil chemicals.

Soil exposure pathways are potentially important for terrestrial plants and wildlife at the OB grounds. Plants are directly exposed to chemicals in soil by absorption and assimilation of soluble chemical forms through the root system. This pathway would be the primary exposure route for vegetation at the site. Chemicals may be accumulated in different plant tissues, at different rates, or not at all depending on the specific chemical and plant species involved and prevailing soil chemical and physical conditions. In addition, environmental conditions such as soil moisture, soil pH, and cation exchange capacities significantly influence whether potential soil chemicals remain chemically bound in the soil matrix or whether they can be chemically mobilized (in a bioavailable form) and released for plant absorption. Generally, neutral to alkaline soils (soil pH of 6.5 or greater) restrict the absorption of toxic metals, making pathway completion to plants difficult. This appears to be the case at the site.

Chemical data from analysis of soil samples indicate some on-site soils have become impacted with residual amounts of explosives and heavy metals. The statistically significant increase of these chemicals above background soil levels suggests that a release at the OB ground area has occurred.

Sediment

The *Dictionary of Geologic Terms*, Revised Edition, (1976) defines sediment as "solid material settled from suspension in a liquid." Sediment represents a potential transport medium for chemicals from the OB grounds. Potential chemical sources for sediment include surface deposited waste, and contaminated surface water, and berms. The release mechanisms include surface-water run-off and airborne deposition. Potential receptors of chemicals in contaminated sediment include aquatic flora and fauna. Direct exposure routes for contaminated sediment include dermal contact by aquatic fauna, uptake by aquatic flora, and ingestion by aquatic fauna. Indirect exposure pathways from sediment include consumption by other consumers in the food chain of plants or animals in which chemicals have bioaccumulated. Chemical bioavailability of many nonpolar organic compounds, including

SVOCs and explosives is decreased with increasing concentrations of TOC in the sediment. Given the presence of SVOCs and explosives in the sediments, this factor becomes an important exposure consideration. The potential for chemical exposures through sediments appears significant at sampling stations.

Surface Water

Surface water represents a potential transport medium for the chemicals of concern. Potential sources for contaminated surface water include contaminated soils. The release mechanisms include surface runoff. Potential receptors of contaminated surface water include terrestrial and aquatic fauna and aquatic flora. Exposure routes for contaminated surface water include dermal contact, ingestion, and absorption. Specific exposure routes for contaminated surface water include ingestion by terrestrial fauna, uptake by aquatic flora, and dermal contact and ingestion by aquatic fauna. Consumption by other animals of flora or fauna in which chemicals have bioaccumulated constitutes a potential indirect exposure pathway for faunal receptors. Chemical bioavailability of some metals and other chemicals is controlled by water hardness and pH.

Ground Water

Chemical transport along the shallow ground-water pathway is considered a possible exposure route to aquatic life, wetlands, and some wildlife where the ground water mixes with surface water. This pathway is of importance to receptors located hydraulically downgradient from the OB grounds. The adjacent creeks, tributaries, and wetlands may be linked to this pathway. Receptors linked to surface water pathways are also indirectly affected by this pathway where the surface and groundwater systems mix.

6.6.4.5 Toxicological Effects of Chemicals of Potential Concern

This section compares detected concentrations of chemicals reported for various physical media at the OB grounds to ARARs, TBCs, and toxic doses for the biological groups and receptor species. The toxic effects of various chemicals on receptors and biological groups are evaluated. Toxic properties of some chemicals (e.g., metals) are assessed together because information is lacking for the specific chemicals, or the chemicals within the class act very similarly. Detailed toxicological profiles for additional chemicals discussed below are presented in Appendix H.

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Vegetation

This section discusses the toxicological effects of chemicals found in groundwater, surface water soils and sediments at the OB grounds on vegetation based not only on their concentrations, but also on other factors, such as bioavailability. Typically, in order for inorganic chemicals to produce toxic effects in terrestrial vegetation, the chemicals must be present in the soil matrix as soluble, plant-available forms, and must occur in concentrations many times greater than ambient or background concentrations. Plant-available forms are assimilated by a plant's root system and translocated to specific plant tissues (e.g., the leaves) where the actual toxic effect occurs. Chemicals of potential concern for vegetation that were analyzed in detail are summarized on Table 6-45.

Metals - Extensive information is available on the effects of metals, many of which were found in soils at the OB grounds, on terrestrial plants. This information supported formulation of guidelines for maximum allowable soil metals concentrations (Table 6-45). These guidelines are considered TBCs for protection of terrestrial vegetation from metals in soil.

Comparisons of soil metals concentrations to these guidelines and to background concentrations in uncontaminated soils indicate that inorganic chemicals exceeded background levels or levels considered detrimental or toxic to terrestrial plants. Therefore, metals and other inorganics detected in soils at the OB grounds were considered to represent potential chemicals of concern. The compounds considered to provide the most ecological concern to vegetation at the OB grounds are barium, copper, lead and zinc. The 95th % UCL concentration of these metals in soil are barium (1724 mg/kg), copper (1059 mg/kg), lead (2352 mg/kg) and zinc (2003 mg/kg). Maximum detected values were substantially higher, indicating a risk in localized "hot spots."

VOCs and SVOCs - 13 VOCs and 37 SVOCs were detected in soils from the OB grounds (Table 6-45). All of these compounds were eliminated from consideration as chemicals of concern because they or were detected at concentrations lower than those reported in the literature to be toxic to plants or were not available.

Wildlife

Because plant and animal tissue samples were not collected and chemically analyzed as part of this RI, inferences regarding wildlife toxicity were made from sediment, soil, and surface-water chemical data. To establish worst-case analytical conditions, assumptions were made that wildlife ingested and assimilated 100 percent of the chemical concentrations reported for the samples. The following evaluations are organized first by the type of medium, and second by major class of chemical. The discussion focuses on the individual chemicals that required detailed evaluation to resolve potential toxicological impacts.

<u>Surface Water</u> - Chemicals of potential concern that survived the surface-water screening for wildlife are summarized on Table 6-47.

Metals - Of the metals in surface-water samples, only aluminum was present in concentration potentially toxic to wildlife that may rely on surface water as a drinking supply. The maximum detected value of aluminum was 520 ug/l which slightly exceeded the recommended limit of 5000 ug/l. The mean concentration was 559 ug/l, indicating the risks may be localized, or may be due to one sample which had a large concentration of suspended soils. All other reported concentrations are below NYSDEC (1989) standards established to protect wildlife and/or below protective recommendations proposed by the NAS and NAE (1972) for the same use (Table 6-47).

Volatile and Semi-volatile Organics - Toxic effects on wildlife are not anticipated from the low concentrations of VOCs and SVOCs reported for surface-water samples. These compounds either volatilize rapidly, or they possess relatively low toxicities to birds and mammals. Potentially toxic conditions require much higher concentrations than those reported from the samples in order to induce effects on birds and mammals.

<u>Soil</u> - The chemicals of potential concern for wildlife are summarized on Table 6-46. Chronic toxicity values were computed for the rat and mallard by taking 10 percent of the reported acute LD_{50} value.

Metals - Lead exceeded dietary concentrations reported to cause toxic effects in both the rat and the mallard. Barium and copper exceeded the dietary concentration reported to be toxic in the rat and mercury exceeded the dietary concentration reported to be toxic in the mallard.

TABLE 6-46

ECOLOGICAL RISK ASSESSMENT
CHEMICALS OF POTENTIAL CONCERN TO WILDLIFE
IN SEDIMENT AND SOILS

SENECA ARMY DEPOT
OB GROUNDS

	CONCENTRATION (a)						SEDIMENT GUIDELINE (b)	SAFE DIETARY LEVEL (c)	TOXIC DIETARY LEVEL (d)	
	SOIL			SEDIMENT						
COMPOUND	MAX	95th UCL	MEAN	MAX	95th UCL	MEAN			RAT	MALLARD
Volatile Organics (ug/kg)										
Methylene Chloride	21.0	4.9	4.7	Deleted	Deleted	Deleted	NA	NA	210,000	NA
Acetone	230.0	6.8	7.4	34.0	10.2	8.7	NA	NA	11,200,000	4,000,000
1,2-Dichloroethene (total)	8.0	4.7	4.5	Deleted	Deleted	Deleted	NA	NA	400,000	NA
Carbon Disulfide				7.0	5.5	5.1	NA	NA	63,760,000	NA
Chloroform	10.0	4.9	4.7	20.0	6.8	5.9	NA	NA	3,750,000	NA
2-Butanone	11.0	6.1	6.0	Deleted	Deleted	Deleted	NA	NA	5,400,000	NA
1,1,1-Trichloroethane	6.0	4.7	4.6	Deleted	Deleted	Deleted	NA	NA	19,200,000	NA
Carbon Tetrachloride	8.0	4.7	4.6	Deleted	Deleted	Deleted	NA	NA	NA	NA
Trichloroethene	100.0	5.0	5.0	16.0	6.4	5.6	NA	NA	143,600,000	NA
Benzene	8.0	4.7	4.6	Deleted	Deleted	Deleted	NA	NA	10,000,000	NA
Tetrachloroethene	110.0	5.7	5.5	Deleted	Deleted	Deleted	NA	NA	5,258,000	NA
Toluene	8.0	4.7	4.5	Deleted	Deleted	Deleted	NA	NA	1,272,000	NA
Chlorobenzene	8.0	4.8	4.8	Deleted	Deleted	Deleted	NA	NA	4,580,000	NA
Xylene (total)	8.0	4.8	4.8	Deleted	Deleted	Deleted	NA	NA	8,600,000	NA
Semivolatiles (ug/kg)										
Phenol	425.0	296.1	285.1	Deleted	Deleted	Deleted	NA	NA	1,060,000	NA
2-Methylphenol	425.0	296.1	285.1	Deleted	Deleted	Deleted	NA	NA	NA	NA
4-Methylphenol	440.0	298.7	287.5	350.0	354.2	314.2	NA	NA	3,600,000	NA
2,4-Dimethylphenol	425.0	296.1	285.1	Deleted	Deleted	Deleted	NA	NA	NA	NA
Benzoic acid	2200.0	1839.4	1781.9	Deleted	Deleted	Deleted	NA	NA	3,400,000	NA
Naphthalene	440.0	290.3	277.2	24.0	351.4	304.7	NA	NA	980,000	NA
2-Methylnaphthalene	1300.0	298.8	280.9	12.0	356.0	313.1	NA	NA	3,260,000	NA
2-Chloronaphthalene	435.0	295.5	284.2	Deleted	Deleted	Deleted	NA	NA	NA	NA
2-Nitroaniline	2200.0	1247.3	1164.9	Deleted	Deleted	Deleted	NA	NA	NA	NA
Acenaphthylene	540.0	298.3	286.7	Deleted	Deleted	Deleted	NA	NA	NA	NA
2,6-Dinitrotoluene	2000.0	313.4	293.3	120.0	355.9	315.2	NA	NA	5,360,000	NA
3-Nitroaniline	2200.0	1248.2	1166.0	Deleted	Deleted	Deleted	NA	NA	NA	NA
Acenaphthene	435.0	295.2	283.9	Deleted	Deleted	Deleted	NA	NA	40,000,000(f)	NA
Dibenzofuran	435.0	295.0	283.5	Deleted	Deleted	Deleted	NA	NA	NA	NA
2,4-Dinitrotoluene	33000.0	736.1	893.1	1600.0	472.7	385.8	NA	NA	5,360,000	NA
Diethylphthalate	450.0	291.5	278.5	Deleted	Deleted	Deleted	NA	NA	NA	NA
Fluorene	440.0	296.3	285.1	Deleted	Deleted	Deleted	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)	7000.0	347.9	346.5	87.0	356.6	312.3	NA	NA	960,000	NA
Hexachlorobenzene	440.0	294.7	282.6	Deleted	Deleted	Deleted	NA	NA	NA	NA
Pentachlorophenol	2200.0	1243.0	1160.7	Deleted	Deleted	Deleted	NA	NA	NA	NA
Phenanthrene	2600.0	316.9	288.4	76.0	369.0	313.3	NA	NA	3,400,000	NA
Anthracene	700.0	298.8	288.4	77.0	361.5	320.1	NA	NA	1,700,000	NA
Carbazole	1200.0	243.9	221.4	27.0	232.9	208.0	NA	NA	10,000,000	NA
Di-n-butylphthalate	5800.0	459.1	362.9	330.0	375.5	330.6	NA	NA	2,400,000	500,000
Fluoranthene	4400.0	369.4	312.2	140.0	353.9	306.6	NA	NA	4,000,000	NA
Pyrene	5600.0	378.6	315.9	110.0	344.3	294.8	NA	NA	5,400,000	NA
Butylbenzylphthalate	435.0	295.6	284.3	Deleted	Deleted	Deleted	NA	NA	46,660,000	NA
Benzo(a)anthracene	3900.0	325.1	313.6	48.0	361.1	319.0	NA	NA	NA	NA
Chrysene	8900.0	352.9	342.5	62.0	357.1	311.5	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	1450.0	348.3	324.6	96.0	325.6	258.5	NA	NA	61,200,000	NA
Di-n-octylphthalate	425.0	293.7	282.7	Deleted	Deleted	Deleted	NA	NA	52,000,000	NA
Benzo(b)fluoranthene	11000.0	353.7	356.5	52.0	361.1	319.1	NA	NA	NA	NA
Benzo(k)fluoranthene	4500.0	333.8	318.1	54.0	361.2	319.2	NA	NA	NA	NA
Benzo(a)pyrene	3700.0	334.9	314.8	36.0	361.0	318.6	NA	NA	2,000,000	NA
Indeno(1,2,3-cd)pyrene	2300.0	328.5	304.4	37.0	361.0	318.5	NA	NA	NA	NA
Dibenz(a,h)anthracene	670.0	298.6	286.8	Deleted	Deleted	Deleted	NA	NA	1,600	NA
Benzo(g,h,i)perylene	960.0	304.7	290.9	Deleted	Deleted	Deleted	NA	NA	NA	NA

TABLE 6-46

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SENECA ARMY DEPOT
OB GROUNDS

	CONCENTRATION (a)						SEDIMENT GUIDELINE (b)	SAFE DIETARY LEVEL (c)	TOXIC DIETARY LEVEL (d)	
	SOIL			SEDIMENT						
COMPOUND	MAX	95th UCL	MEAN	MAX	95th UCL	MEAN			RAT	MALLARD
Pesticides/PCBs (ug/kg)										
beta-BHC	11.5	5.7	5.2	Deleted	Deleted	Deleted	NA	NA	NA	NA
delta-BHC	15.0	5.8	5.3	Deleted	Deleted	Deleted	NA	NA	NA	NA
gamma-BHC (Lindane)	11.5	5.7	5.2	Deleted	Deleted	Deleted	15	50,000	27,000	200,000
Heptachlor	32.0	5.9	5.3	Deleted	Deleted	Deleted	1	500	180,000	45,000
Aldrin	11.5	5.8	5.3	Deleted	Deleted	Deleted	7.7	500	3,800	52,000
Heptachlor epoxide	11.5	5.7	5.2	Deleted	Deleted	Deleted	1	NA	NA	NA
Endosulfan I	11.5	5.7	5.2	Deleted	Deleted	Deleted	NA	NA	NA	NA
Dieldrin	50.0	11.7	10.6	Deleted	Deleted	Deleted	7.7	500	74,000	15,300
4,4'-DDE	830.0	18.3	17.0	10.0	16.1	13.0	NA	NA	NA	357,200
Endrin	50.0	11.8	10.8	Deleted	Deleted	Deleted	8	5000	14,000	560
Endosulfan II	480.0	16.0	13.7	Deleted	Deleted	Deleted	NA	NA	NA	NA
4,4'-DDD	23.5	11.4	10.4	Deleted	Deleted	Deleted	10	NA	NA	481,400
Endosulfan sulfate	23.5	11.4	10.4	Deleted	Deleted	Deleted	NA	NA	NA	NA
4,4'-DDT	2800.0	18.6	27.8	13.0	16.2	13.0	10	5000	226,000	50
Endrin aldehyde	20.5	2.8	2.8	Deleted	Deleted	Deleted	NA	NA	NA	NA
alpha-Chlordane	270.0	194.9	46.8	Deleted	Deleted	Deleted	NA	2500	670,000	120,000
Aroclor-1254	430.0	116.0	105.6	Deleted	Deleted	Deleted	NA	NA	NA	318,200
Aroclor-1260	240.0	113.7	103.7	Deleted	Deleted	Deleted	NA	NA	NA	197,500
Explosives (ug/kg)										
HMX	1300.0	308.3	280.4	500.0	298.1	234.5	NA	NA	NA	NA
RDX	4800.0	93.5	125.9	500.0	78.6	74.2	NA	NA	NA	NA
1,3,5-Trinitrobenzene	7800.0	117.0	185.4	Deleted	Deleted	Deleted	NA	NA	NA	NA
1,3-Dinitrobenzene	440.0	70.7	66.6	Deleted	Deleted	Deleted	NA	NA	NA	NA
Tetryl	1000.0	153.7	140.8	Deleted	Deleted	Deleted	NA	NA	NA	NA
2,4,6-Trinitrotoluene	80000.0	141.7	668.8	100.0	63.4	61.3	NA	NA	NA	NA
4-amino-2,6-Dinitrotoluene	8900.0	140.0	194.7	180.0	68.5	63.2	NA	NA	NA	NA
2-amino-4,6-Dinitrotoluene	11000.0	155.7	228.5	180.0	71.1	64.7	NA	NA	NA	NA
2,6-Dinitrotoluene	125.0	60.9	80.4	Deleted	Deleted	Deleted	NA	NA	NA	NA
2,4-Dinitrotoluene	5100.0	413.3	433.0	98.0	66.0	63.1	NA	NA	NA	NA
Metals (mg/kg)										
Aluminum	Deleted	Deleted	Deleted	25800.0	15843.0	14492.0	NA	NA	20,000(f)	NA
Antimony	Deleted	Deleted	Deleted	28.3	8.8	6.4	NA	NA	14,000	NA
Arsenic	Deleted	Deleted	Deleted	9.5	5.6	5.0	5/33	NA	1,526	500
Barium	34400.0	1693.4	1610.5	1780.0	318.0	218.1	NA	NA	1,600	NA
Beryllium	Deleted	Deleted	Deleted	1.6	1.0	0.9	NA	18	172	NA
Cadmium	28.2	6.1	3.6	9.7	2.9	2.3	0.8/10	20	45	20
Calcium	Deleted	Deleted	Deleted	104000.0	35025.2	21409.4	NA	NA	NA	NA
Chromium	1430.0	32.4	37.2	41.8	25.1	23.0	26/111	NA	500(f)	NA
Cobalt	Deleted	Deleted	Deleted	17.7	11.8	10.8	NA	50	20	10
Copper	38100.0	762.1	856.2	3790.0	400.8	280.1	19/114	NA	240	NA
Iron	Deleted	Deleted	Deleted	40900.0	31352.6	29831.3	2.4/4%	NA	60,000	NA
Lead	56700.0	3185.2	2049.4	7400.0	652.3	391.1	27/250	NA	160	50
Magnesium	Deleted	Deleted	Deleted	12000.0	7029.6	6430.6	NA	NA	NA	NA
Manganese	Deleted	Deleted	Deleted	1520.0	542.9	476.4	428/1100	NA	2,000(f)	4800
Mercury	1.1	0.2	0.1	2.0	0.8	0.3	0.11/2	100	800(f)	0.064
Nickel	Deleted	Deleted	Deleted	64.4	38.2	34.9	22/90	1000	5,000(f)	NA
Potassium	3570.0	1820.3	1749.7	3530.0	1891.7	1664.5	NA	NA	NA	NA
Selenium	3.3	0.5	0.4	1.6	0.9	0.7	NA	NA	NA	NA
Silver	Deleted	Deleted	Deleted	1.9	0.7	0.6	NA	NA	5-10	NA
Sodium	618.0	132.0	118.0	191.0	90.6	77.4	NA	NA	NA	NA
Thallium	38.0	0.3	0.5	Deleted	Deleted	Deleted	NA	NA	31.6	NA
Vanadium	Deleted	Deleted	Deleted	37.9	24.9	22.5	NA	NA	25(f)	10
Zinc	127000.0	987.4	1430.1	1200.0	391.2	245.4	85/800	2500	5,000(f)	NA
Cyanide	2.2	0.4	0.4	0.8	0.4	0.4	NA	0.4	6-8	1.4

NOTES:

a) The 95th % Upper Confidence Limit (UCL) was calculated from the validated data.
Non-detects were taken at half value and detects at full value.
Rejected data was eliminated. Metals not statistically different from background, at the 95 % UCL, was deleted.
Any compound with no detects in a given media was eliminated from the assessment of that media.
The MAX value is the maximum detected concentration.

b) NYSDEC 1989 guidelines to protect wildlife that consumes aquatic life that is in contact with contaminated sediments.
The first value represents a safe concentration. The second value represents a concentration likely to significantly impact the benthic community.

c) Values based on the rat as presented by NAS and NAE (1972), Snyder and Snyder (1984), and McKee & Wolf (1963)

d) Concentrations that represent the chronic LD50 for the species. Chronic toxicity threshold values were calculated by taking 10 percent of the reported acute LD50 value unless otherwise noted. Sources include Gough et al.,1979;Micromedex,Inc.,1992; Hudson et al., 1984.

e) NA = Not Available.

f) Concentration in the diet that cause acute toxic effects to the species.

TABLE 6-46

ECOLOGICAL RISK ASSESSMENT
CHEMICALS OF POTENTIAL CONCERN TO WILDLIFE
IN SEDIMENT AND SOILS

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	CONCENTRATION (a)						SEDIMENT GUIDELINE (b)	SAFE DIETARY LEVEL (c)	TOXIC DIETARY LEVEL (d)	
	SOIL			SEDIMENT						
	MAX	95th UCL	MEAN	MAX	95th UCL	MEAN			RAT	MALLARD
Pesticides/PCBs (ug/kg)										
beta-BHC	11.5	5.7	5.2	Deleted	Deleted	Deleted	NA	NA	NA	NA
delta-BHC	15.0	5.8	5.3	Deleted	Deleted	Deleted	NA	NA	NA	NA
gamma-BHC (Lindane)	11.5	5.7	5.2	Deleted	Deleted	Deleted	15	50,000	27,000	200,000
Heptachlor	32.0	5.9	5.3	Deleted	Deleted	Deleted	1	500	180,000	45,000
Aldrin	11.5	5.8	5.3	Deleted	Deleted	Deleted	7.7	500	3,800	52,000
Heptachlor epoxide	11.5	5.7	5.2	Deleted	Deleted	Deleted	1	NA	NA	NA
Endosulfan I	11.5	5.7	5.2	Deleted	Deleted	Deleted	NA	NA	NA	NA
Dieldrin	50.0	11.7	10.6	Deleted	Deleted	Deleted	7.7	500	74,000	15,300
4,4'-DDE	830.0	18.3	17.0	10.0	16.1	13.0	NA	NA	NA	357,200
Endrin	50.0	11.8	10.8	Deleted	Deleted	Deleted	8	5000	14,000	560
Endosulfan II	480.0	18.0	13.7	Deleted	Deleted	Deleted	NA	NA	NA	NA
4,4'-DDD	23.5	11.4	10.4	Deleted	Deleted	Deleted	10	NA	NA	481,400
Endosulfan sulfate	23.5	11.4	10.4	Deleted	Deleted	Deleted	NA	NA	NA	NA
4,4'-DDT	2800.0	18.6	27.8	13.0	16.2	13.0	10	5000	226,000	50
Endrin aldehyde	20.5	2.8	2.8	Deleted	Deleted	Deleted	NA	NA	NA	NA
alpha-Chlordane	270.0	194.9	46.8	Deleted	Deleted	Deleted	NA	2500	670,000	120,000
Aroclor-1254	430.0	116.0	105.6	Deleted	Deleted	Deleted	NA	NA	NA	318,200
Aroclor-1260	240.0	113.7	103.7	Deleted	Deleted	Deleted	NA	NA	NA	197,500
Explosives (ug/kg)										
HMX	1300.0	308.3	280.4	500.0	298.1	234.5	NA	NA	NA	NA
RDX	4800.0	93.5	125.9	500.0	78.6	74.2	NA	NA	NA	NA
1,3,5-Trinitrobenzene	7800.0	117.0	185.4	Deleted	Deleted	Deleted	NA	NA	NA	NA
1,3-Dinitrobenzene	440.0	70.7	66.6	Deleted	Deleted	Deleted	NA	NA	NA	NA
Tetryl	1000.0	153.7	140.8	Deleted	Deleted	Deleted	NA	NA	NA	NA
2,4,6-Trinitrotoluene	80000.0	141.7	668.8	100.0	63.4	61.3	NA	NA	NA	NA
4-amino-2,6-Dinitrotoluene	8900.0	140.0	194.7	160.0	66.5	63.2	NA	NA	NA	NA
2-amino-4,6-Dinitrotoluene	11000.0	155.7	228.5	180.0	71.1	64.7	NA	NA	NA	NA
2,6-Dinitrotoluene	125.0	60.9	60.4	Deleted	Deleted	Deleted	NA	NA	NA	NA
2,4-Dinitrotoluene	5100.0	413.3	433.0	98.0	66.0	63.1	NA	NA	NA	NA
Metals (mg/kg)										
Aluminum	Deleted	Deleted	Deleted	25800.0	15843.0	14492.0	NA	NA	20,000(f)	NA
Antimony	Deleted	Deleted	Deleted	28.3	8.8	6.4	NA	NA	14,000	NA
Arsenic	Deleted	Deleted	Deleted	9.5	5.6	5.0	5/33	NA	1,526	500
Barium	34400.0	1693.4	1810.5	1780.0	318.0	218.1	NA	NA	1,600	NA
Beryllium	Deleted	Deleted	Deleted	1.6	1.0	0.9	NA	18	172	NA
Cadmium	28.2	6.1	3.6	9.7	2.9	2.3	0.8/10	20	45	20
Calcium	Deleted	Deleted	Deleted	104000.0	35025.2	21409.4	NA	NA	NA	NA
Chromium	1430.0	32.4	37.2	41.8	25.1	23.0	26/111	NA	500(f)	NA
Cobalt	Deleted	Deleted	Deleted	17.7	11.8	10.8	NA	50	20	10
Copper	38100.0	762.1	856.2	3790.0	400.8	280.1	19/114	NA	240	NA
Iron	Deleted	Deleted	Deleted	40900.0	31352.6	29831.3	2.4/4%	NA	60,000	NA
Lead	56700.0	3185.2	2049.4	7400.0	652.3	391.1	27/250	NA	160	50
Magnesium	Deleted	Deleted	Deleted	12000.0	7029.6	6430.6	NA	NA	NA	NA
Manganese	Deleted	Deleted	Deleted	1520.0	542.9	476.4	428/1100	NA	2,000(f)	4800
Mercury	1.1	0.2	0.1	2.0	0.6	0.3	0.11/2	100	800(f)	0.064
Nickel	Deleted	Deleted	Deleted	64.4	38.2	34.9	22/90	1000	5,000(f)	NA
Potassium	3570.0	1820.3	1749.7	3530.0	1891.7	1664.5	NA	NA	NA	NA
Selenium	3.3	0.5	0.4	1.8	0.9	0.7	NA	NA	NA	NA
Silver	Deleted	Deleted	Deleted	1.9	0.7	0.6	NA	NA	5-10	NA
Sodium	616.0	132.0	118.0	191.0	90.6	77.4	NA	NA	NA	NA
Thallium	38.0	0.3	0.5	Deleted	Deleted	Deleted	NA	NA	31.6	NA
Vanadium	Deleted	Deleted	Deleted	37.9	24.9	22.5	NA	NA	25(f)	10
Zinc	127000.0	987.4	1430.1	1200.0	391.2	245.4	85/800	2500	5,000(f)	NA
Cyanide	2.2	0.4	0.4	0.8	0.4	0.4	NA	0.4	6-8	1.4

NOTES:

a) The 95th % Upper Confidence Limit (UCL) was calculated from the validated data.
Non-detects were taken at half value and detects at full value.
Rejected data was eliminated. Metals not statistically different from background, at the 95 % UCL, was deleted.
Any compound with no detects in a given media was eliminated from the assessment of that media.
The MAX value is the maximum detected concentration.

b) NYSDEC 1989 guidelines to protect wildlife that consumes aquatic life that is in contact with contaminated sediments.
The first value represents a safe concentration. The second value represents a concentration likely to significantly impact the benthic community.

c) Values based on the rat as presented by NAS and NAE (1972), Snyder and Snyder (1984), and McKee & Wolf (1963)

d) Concentrations that represent the chronic LD50 for the species. Chronic toxicity threshold values were calculated by taking 10 percent of the reported acute LD50 value unless otherwise noted. Sources include Gough et al.,1979;Micromedex,Inc.,1992; Hudson et al., 1984.

e) NA = Not Available.

f) Concentration in the diet that cause acute toxic effects to the species.

TABLE 6-47

ECOLOGICAL RISK ASSESSMENT
CHEMICALS OF POTENTIAL CONCERN TO WILDLIFE
IN SITE SURFACE WATER

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	CONCENTRATION			RECOMMENDED LIMIT (c)
	MAX (a)	95th UCL (b)	MEAN	
Volatile Organics (ug/l)				
Methylene Chloride	8.0	4.1	3.7	NA/NA (d)
Acetone	35.0	8.2	6.5	NA/NA
Carbon Disulfide	3.0	4.0	3.6	NA/NA
1,2-Dichloroethane	2.0	4.0	3.6	NA/NA
Trichloroethene	17.0	4.8	4.0	NA/NA
Semivolatiles (ug/l)				
bis(2-Ethylhexyl)phthalate	71.0	7.6	7.4	NA/NA
Explosives (ug/l)				
RDX	9.4	0.6	0.6	NA/NA
Tetryl	0.5	0.1	0.1	NA/NA
Metals (ug/l)				
Aluminum	5220.0	1500.6	559.4	NA/5000
Arsenic	4.4	1.7	1.4	NA/200
Barium	523.0	137.3	105.2	NA/NA
Beryllium	1.4	0.6	0.4	NA/NA
Calcium	183000.0	105103.3	94433.3	NA/NA
Chromium	8.6	3.3	2.8	NA/1000
Copper	59.8	33.2	12.2	NA/500
Iron	8550.0	4480.0	1583.9	NA/NA
Lead	74.2	14.5	7.0	NA/100
Magnesium	59900.0	22446.6	18722.3	NA/NA
Manganese	1080.0	361.7	156.2	NA/NA
Mercury	0.2	0.1	0.0	NA/10
Nickel	17.6	9.4	7.6	NA/NA
Potassium	6050.0	4154.4	3529.4	NA/NA
Selenium	3.2	1.5	1.3	NA/50
Sodium	59100.0	18056.4	14292.1	NA/NA
Vanadium	39.2	31.1	10.8	NA/100
Zinc	13.4	8.2	6.8	NA/25,000
Cyanide	14.9	6.1	5.5	NA/NA

NOTES:
a) The MAX value is the maximum detected concentration.
b) The 95th Upper Confidence Limit (UCL) was calculated from the validated data.
Non-detects were taken at half value and detects, including estimated values, were taken at full value.
Rejected data was eliminated.
Any compound with no detects was eliminated from the assessment of that media.
c) The first value is the NYSDEC (1989) standard for protection of wildlife.
The second number is from the NAS and NAE (1972).
d) NA = Not Available.

Volatile and Semi-volatile Organics - This investigation was unable to locate criteria or guidelines that related soil concentrations of these chemicals to the welfare of wildlife species. However, the acute toxicity concentrations for these chemicals suggest that soil concentrations at the OB grounds are too low to induce toxic effects. Even if literature-reported acute concentrations were reduced by a factor of 0.1 (to approximate a chronic-effect concentration), none of the OB grounds soil concentrations would meet or exceed the toxic effect levels. For example, if the acute toxicity concentration for the rat for methylene chloride was reduced from 210,000 ug/kg to 21,000 ug/kg, it would be much greater than the maximum detected concentration of 21 ug/kg. Thus, it is anticipated that these compounds do not represent a toxic hazard to wildlife.

Sediment - Chemicals of potential concern for wildlife are summarized in Table 6-46. A discussion of each chemical group is presented below.

Metals - Recommendations and guidelines to specifically protect wildlife from sediments contaminated with metals were not located by this investigation. Although the proposed NYSDEC (1989) sediment guidelines for metals are intended to protect the benthic community, they can be useful in identifying potentially toxic indirect effects on wildlife species that may utilize aquatic and benthic invertebrates as a food supply. Two potential indirect effects include reducing benthic abundance and diversity and introducing biomagnifying toxic metals into food chains. Direct effects to benthic species are addressed in the aquatic life assessment which follows.

Volatile and Semi-Volatile Organics - None of the compounds belonging to these two chemical classes were present in the sediments at concentrations reported as being acutely toxic to rodents or the mallard. Toxic concentrations were usually several orders of magnitude greater than the chemical concentrations reported from sediment samples. Even if it is assumed that chronic concentrations are 0.1 times the acute concentrations, the chemicals still are not of concern because none of the concentrations reached or exceeded this level. None of these compounds are addressed in the proposed NYSDEC (1989) guidelines for protecting wildlife, and other specific guidelines to protect wildlife from contaminated sediments were not located by this ERA. Despite this lack of guidelines or standards, the small contaminant concentrations, the low inherent toxicities of these compounds, and the high tolerances of birds and mammals to these compounds suggest that these chemicals would not represent toxic hazard if they were ingested during feeding or grooming activities.

Wetlands

This toxicity evaluation addresses the small wetlands west of several former burn pads. This site would represent worst-case toxicological conditions for wetlands on or near the OB grounds. The state regulated wetlands were not considered an exposure point because these wetlands are not hydraulically connected to potentially contaminated surface or ground waters from the OB grounds.

Analytical results for surface water and sediment samples from the on-site wetlands of the OB grounds indicate the presence of PAHs, explosives and metals in the sediments. None of the sample concentrations approach levels reported in the literature as causing acute or chronic toxic effects to wetland plant (cattail), small mammal (rat and mouse), or waterfowl (mallard) receptors. Aquatic life receptors (Caddisfly, pumpkinseed, and fathead minnow) may be affected by the sediment PAH concentration ranges reported (see sediment PAH discussion for aquatic life receptors).

Sediment concentrations of metals in the wetlands are similar to site background soils at the 95th UCL except for four metals, and one explosive HMX. When the 95th UCL sediment concentrations are compared to NYSDEC (1989) sediment guidelines for protecting benthic biota, copper, and lead exceed the proposed criterion, while arsenic and zinc are at or below their respective criteria (NYSDEC, 1989). Barium is not addressed by the guidelines.

Aquatic Life

The following paragraphs describe projected toxicological effects on aquatic life from chemicals of potential concern in surface water and sediments. Toxicological evaluations consider surface water and sediment concentrations, bioavailability and biomagnification factors, and inherent chemical toxicity to selected aquatic life receptor species. The evaluation focuses on only the chemicals that survived the screening processes described earlier, and for which completed exposure pathways are likely. However, a spatial distribution analysis of individual chemical concentrations that also exceeded promulgated standards was also conducted to identify potential cumulative effect conditions that might also affect aquatic life conditions. These findings are discussed as appropriate. These chemicals and the screening results are summarized in Tables 6-48 and 6-49.

USEPA and NYSDEC have established acute and chronic aquatic-life protective water quality criteria for a number of the chemicals of potential concern (USEPA, 1991a; NYSDEC, 1989). Proposed federal (USEPA, 1991a) and NYSDEC (1991), sediment guidelines for the protection of aquatic life were used in the sediment evaluations. If contaminant concentrations at the maximum detected concentration in the media of concern were below the most stringent applicable criteria, and were below acute and chronic toxic concentrations and/or safe (no-effect) dietary concentrations reported in the technical literature, then the aquatic receptors were not considered to be at risk for toxic effects from a specific chemical.

Surface Water - Chemicals of potential concern to aquatic receptors in surface water are summarized in Table 6-48. The evaluation compared concentrations to acute and chronic toxicity values for specifically protecting aquatic life (i.e., aquatic life-based criteria). These criteria (listed in Table 6-48) were derived from the appropriate USEPA and NYSDEC WQC documents.

The primary metals of concern in surface water were aluminum and iron. The maximum detected, 95th UCL, and mean concentrations all exceeded the Federal and NYSDEC standards, indicating a potential risk. The actual risks in surface water are probably less than these numbers indicate. As shown in the human health risk assessment (Table 6-7), the concentrations of aluminum and iron in Reeder Creek, the only surface water body at the site which supports aquatic life, are much lower. For aluminum, the mean concentration in the wetlands in 882 ug/L, while in Reeder Creek the mean concentration is 93 ug/L which is below the NYSDEC AWQC, and only slightly greater than the Federal Chronic criteria. Iron concentrations were not reported in the human health risk assessment, but a review of Table 4-18 indicates a similar pattern. All of the samples with very high iron concentrations were collected in the on-site wetlands.

Other metals with potential risk were copper and lead. The maximum detected value for each exceeded the relevant federal chronic criterion. Again, the risk is lessened because the higher concentrations are in the onsite wetlands. As shown in Table 6-7, the maximum detected values for copper were 59.8 ug/L in the onsite wetlands and 9.85 ug/L in Reeder Creek. For lead, the maximum detected concentrations were 74.2 ug/L in the onsite wetlands and 2.2 ug/L in Reeder Creek.

TABLE 6-48

ECOLOGICAL RISK ASSESSMENT
CHEMICALS OF POTENTIAL CONCERN TO AQUATIC LIFE IN SITE SURFACE WATER

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	CONCENTRATION			REGULATORY STANDARD (c)		
	MAX (a)	95th UCL (b)	MEAN	FEDERAL ACUTE	FEDERAL CHRONIC	NYSDEC AWQC (d)
Volatile Organics (ug/l)						
Methylene Chloride	8.0	4.1	3.7	11000	NA	NA
Acetone	35.0	8.2	6.5	NA	NA	NA
Carbon Disulfide	3.0	4.0	3.6	NA	NA	NA
1,2-Dichloroethane	2.0	4.0	3.6	118000	20000	NA
Trichloroethene	17.0	4.8	4.0	45000	21900	NA
Semivolatiles (ug/l)						
bis(2-Ethylhexyl)phthalate	71.0	7.6	7.4	940	3	NA
Explosives (ug/l)						
RDX	9.4	0.6	0.6	NA	NA	NA
Tetryl	0.5	0.1	0.1	NA	NA	NA
Metals (ug/l)						
Aluminum	5220.0	1500.6	559.4	NA	87	100
Arsenic	4.4	1.7	1.4	360	190	360
Barium	523.0	137.3	105.2	NA	NA	NA
Beryllium	1.4	0.6	0.4	130	5.3	NA
Calcium	183000.0	105103.3	94433.3	NA	NA	NA
Chromium (III)	8.6	3.3	2.8	5407	644	5407
Copper	59.8	33.2	12.2	65.4	38.7	65.4
Iron	8550.0	4480.0	1583.9	NA	1000	300
Lead	74.2	14.5	7.0	476.8	18.6	476.8
Magnesium	59900.0	22446.6	18722.3	NA	NA	NA
Manganese	1080.0	361.7	156.2	NA	NA	NA
Mercury	0.2	0.1	0.04	9.6	0.012	NA
Nickel	17.6	9.4	7.6	5290	259.1	5290
Potassium	6050.0	4154.4	3529.4	NA	NA	NA
Selenium	3.2	1.5	1.3	20	5	NA
Sodium	59100.0	18056.4	14292.1	NA	NA	NA
Vanadium	39.2	31.1	10.8	NA	NA	190
Zinc	13.4	8.2	6.8	378.8	343	1015
Cyanide	14.9	6.1	5.5	22	5.2	22

NOTES:

a) The MAX value is the maximum detected concentration.

b) The 95th Upper Confidence Limit (UCL) was calculated from the validated data.
Non-detects were taken at half value and detects at full value.
Rejected data was eliminated.
Any compound with no detects in a given media was eliminated from the assessment of that media.

c) Based on a calculated water hardness of 400 mg/L $CaCO_3$, a mean pH of 7.8, and a water temperature of 20 degrees C. Sources: USEPA, 1991a; NYSDEC, 1991.

d) Based on state stream classification for Reeder Creek of "D".

TABLE 6-49

ECOLOGICAL RISK ASSESSMENT
CHEMICALS OF POTENTIAL CONCERN TO AQUATIC LIFE
IN SEDIMENTS

SENECA ARMY DEPOT
OB GROUNDS

COMPOUND	CONCENTRATION			REFERENCE GUIDELINES AQUATIC LIFE				
				NYSDEC (c)		NOAA		PROPOSED
	MAX (a)	95th UCL (b)	MEAN	CRITERIA	LOT (e)	ER-L	ER-M	FEDERAL (d)
Volatile Organics (ug/kg)								
Acetone	34.0	10.2	8.7	NA	NA	NA	NA	NA
Carbon Disulfide	7.0	5.5	5.1	NA	NA	NA	NA	NA
Chloroform	20.0	6.8	5.9	NA	NA	NA	NA	NA
Trichloroethene	18.0	6.4	5.6	NA	NA	NA	NA	NA
Semivolatiles (ug/kg)								
4-Methylphenol	350.0	354.2	314.2	6 (f)	NA	NA	NA	NA
Naphthalene	24.0	351.4	304.7	NA	NA	340	2100	1200 (g)
2-Methylnaphthalene	12.0	356.0	313.1	NA	NA	65	270	NA
2,6-Dinitrotoluene	120.0	355.9	315.2	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	1600.0	472.7	385.8	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)	87.0	356.6	312.3	NA	NA	NA	NA	NA
Phenanthrene	76.0	369.0	313.3	1390	NA	225	1380	1200 (g)
Anthracene	77.0	361.5	320.1	NA	NA	85	960	1200 (g)
Carbazole	27.0	232.9	208.0	NA	NA	NA	NA	NA
Di-n-butylphthalate	330.0	375.5	330.6	1197 (h)	NA	NA	NA	NA
Fluoranthene	140.0	353.9	306.6	NA	NA	600	3600	10200
Pyrene	110.0	344.3	294.8	NA	NA	350	2300	1200 (g)
Benzo(a)anthracene	48.0	361.1	319.0	NA	NA	230	1600	1200 (g)
Chrysene	62.0	357.1	311.5	NA	NA	400	2800	1200 (g)
bis(2-Ethylhexyl)phthalate	96.0	325.6	256.5	1197 (h)	NA	NA	NA	NA
Benzo(b)fluoranthene	52.0	361.1	319.1	NA	NA	NA	NA	1200 (g)
Benzo(k)fluoranthene	54.0	361.2	319.2	NA	NA	NA	NA	1200 (g)
Benzo(a)pyrene	38.0	361.0	318.6	NA	NA	400	2500	1200 (g)
Indeno(1,2,3-cd)pyrene	37.0	361.0	318.5	NA	NA	NA	NA	1200 (g)
Pesticides/PCBs (ug/kg)								
4,4'-DDE	10.0	16.1	13.0	500	NA	2.0	15	NA
4,4'-DDT	13.0	16.2	13.0	500	NA	1.0	7.0	NA
Explosives (ug/kg)								
HMX	130.0	298.1	234.5	NA	NA	NA	NA	NA
RDX	500.0	78.6	74.2	NA	NA	NA	NA	NA
2,4,6-Trinitrotoluene	100.0	63.4	61.3	NA	NA	NA	NA	NA
4-amino-2,6-Dinitrotoluene	160.0	68.5	63.2	NA	NA	NA	NA	NA
2-amino-4,6-Dinitrotoluene	180.0	71.1	64.7	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	98.0	66.0	63.1	NA	NA	NA	NA	NA
Metals (mg/kg)								
Aluminum	25800.0	15843.0	14492.0	NA	NA	NA	NA	NA
Antimony	28.3	8.8	6.4	NA	NA	2.0	25	NA
Arsenic	9.5	5.6	5.0	5	33	33	85	NA
Barium	1780.0	318.0	218.1	NA	NA	NA	NA	NA
Beryllium	1.6	1.0	0.9	NA	NA	NA	NA	NA
Cadmium	9.7	2.9	2.3	0.8	10	5.0	9.0	NA
Calcium	104000.0	35025.2	21409.4	NA	NA	NA	NA	NA
Chromium	41.8	25.1	23.0	26	111	80	145	NA
Cobalt	17.7	11.8	10.8	20	NA	NA	NA	NA
Copper	3790.0	400.8	280.1	19	114	70	390	NA
Iron	40900.0	31352.6	29831.3	24000	40000	NA	NA	NA
Lead	7400.0	652.3	391.1	27	250	35	110	NA
Magnesium	12000.0	7029.6	6430.6	NA	NA	NA	NA	NA
Manganese	1520.0	542.9	476.4	428	1100	NA	NA	NA
Mercury	2.0	0.6	0.3	0.11	2	0.15	1.3	NA
Nickel	64.4	38.2	34.9	22	90	3.0	5.0	NA
Potassium	3530.0	1891.7	1664.5	NA	NA	NA	NA	NA
Selenium	1.8	0.9	0.7	NA	NA	NA	NA	NA
Silver	1.9	0.7	0.6	NA	NA	NA	NA	NA
Sodium	191.0	90.6	77.4	NA	NA	NA	NA	NA
Vanadium	37.9	24.9	22.5	NA	NA	NA	NA	NA
Zinc	1200.0	391.2	245.4	85	800	120	270	NA
Cyanide	0.8	0.4	0.4	NA	NA	NA	NA	NA

NOTES:

a) The MAX concentration is the maximum detected concentration..

b) The 95th Upper Confidence Limit (UCL) was calculated from the validated data.
Non-detects were taken at half value and detects at full value.
Rejected data was eliminated.
Any compound with no detects in a given media was eliminated from the assessment of that media.

c) NYSDEC 1989 Guideline

d) Sources: USEPA , 1991b; 1991c; 1991d; 1991e; 1991f.

e) LOT = limit of tolerance. Represents point at which significant toxic effects on benthis species occur. (NYSDEC,1989)

f) NYSDEC (1989) guidelines for total phenols.

g) Used lowest proposed USEPA criterion for PAHs (phenanthrene).

h) Used NYSDEC (1989) guideline for phthalates (bis(2-Ethylhexyl)phthalate).

Sediment - Chemicals of potential concern that survived the sediment screening process are summarized in Table 6-49. This summary lists the classes and individual sediment chemicals retained for detailed evaluation for potential effects on sediment biota.

The NYSDEC guideline criteria for sediments represent an intermediate value between the no-effect and LOEL concentrations for several benthic species. A limit of tolerance (LOT) concentration establishes a sediment concentration that would be detrimental to the majority of species, potentially eliminating most (NYSDEC, 1989). If the LOT value is exceeded in significant portions of the ecosystem of concern, it is highly likely that benthic biota are impaired and remediation should be considered (NYSDEC, 1989). NOAA ER-L and ER-M values were also used.

For the organics, all the maximum detected values were below all the criteria, with the exception of 4-methylphenol and 4,4'-DDT. The maximum detected concentration (350 ug/kg) of methylphenol was much greater than the NYSDEC criteria of 6 ug/kg. For 4,4-DDT, the maximum detected concentration (13 ug/kg) was only slightly above the ER-M (7 ug/kg).

A number of metals exceeded the various criteria. The maximum detected values of antimony, cadmium, copper, lead, mercury, nickel, and zinc all exceeded the ER-M values. Copper, iron, lead, manganese, and zinc all had concentrations in excess of the LOT values.

6.6.4.6 Risk Assessment

This section describes potential risks to receptors, the major biological groups they represent, habitats of special interest, wetlands, and endangered and threatened species. Risk estimates are based on the preceding evaluation of exposure pathways, toxic concentrations and characteristics, and chemical concentrations in the physical media.

Vegetation

Comparison of concentrations considered toxic to plant life and above background indicates that barium, copper, lead and zinc are of concern and exhibit some degree of risk.

Wildlife

Ecological risks to wildlife were evaluated by examining a combination of surface-water, sediment, and soil exposure pathways and applying guidelines, recommendations, and toxicological dose results as TBCs. Surface water was evaluated by applying livestock drinking water guidelines and promulgated New York standards for some chemicals. Soils were evaluated by considering chemical quantities required to cause chronic effects in receptors or similar species by using 10 percent of the LD50 concentration as a general and conservative chronic threshold value. Sediments were evaluated by considering proposed protective guidelines for wildlife interactions with contaminated sediments developed by NYDEC.

Results of these evaluations suggest that no wildlife species are at risk from elevated concentrations of chemicals in surface waters if used as sources of drinking water (Table 6-47). None of the surface-water analytes are considered environmental risks to wildlife because their concentrations are less than acute and chronic toxic concentrations acquired through either oral doses or from dietary exposure routes.

For soils, barium, copper, lead, and mercury are considered potential environmental risks or hazards to wildlife. The reported concentrations in soils for these metals exceeded 10 percent of published LD50 concentrations for the rat, or mallard that were used to evaluate the small mammal and bird components (Table 6-46).

Exposure pathway and toxicity analyses of sediment contaminants suggest that there are potential indirect and direct risks to wildlife species associated with streams and other aquatic elements of the site from nine metals (antimony, cadmium, copper, iron, lead manganese, mercury, nickel and zinc), one semivolatile (4-methylphenol) and one insecticide (4-4'-DDT). Levels of concern range from low for 4-4'-DDT, 4-methylphenol arsenic, manganese, mercury and cadmium to moderate for copper, lead and zinc (Table 6-49).

Endangered, Threatened, and Special-Concern Species

OB grounds do not support any known uses by designated federal or state endangered or threatened species of plants, wildlife, or fish. Nor do the OB grounds support designated critical habitats for such species according to the January 1980, Installation Assessment of Seneca Army Depot, Report No. 157, January 1980, prepared by USATHAMA. Among the state and federally protected animals found in New York State, only the Indiana Bat (Myotis sodalis) and the American osprey (Pandion haliaetus carolinensis) are likely to be found at SEDA. However, none of these species would be anticipated to associate with locations on or near the OB grounds. State-designated species the bog turtle (Clemmys muhlenbergi) could occur north of Reeder Creek, in the "Duck Ponds" however, the habitat at the OB Ground is not expected to support this species.

Biological reconnaissance of the OB grounds area did not identify any biological communities of special interest other than wetlands (which are addressed separately), or communities of exceptional quality that might be at risk from chemicals of potential concern. Therefore, risks from chemicals of potential concern to these components of the environment are not believed to exist.

Wetlands

Wetlands occur at thirty-eight (38) locations on and near the OB grounds. These wetlands have occurred in small depressions which occurred as a result of OB operations. Small stands of cattails have developed in saturated depressions on the OB grounds. The jurisdictional status of these sites has not been formally determined. Although the current wetland vegetation and hydrology would probably satisfy wetland designation criteria, soils (consisting probably of clay materials) may not satisfy wetland soil criteria causing any future jurisdictional wetland determinations to be considered as atypical situations.

The potential risk to these OB grounds cattail stands from chemical contamination is considered to be slight. Of the 32 on-site wetlands, 8 were sampled for chemical analyses. Comparing lead, barium and copper concentrations obtained in the on-site wetlands to the phytotoxic concentrations presented in Table 6-45 indicates that two metals were above the phytotoxic concentrations of 150-1000 mg/kg for lead and 70-640 mg/kg for copper. The highest sample (SD-200) collected at on-site wetland number 5 contained lead at 7400 mg/kg (Duplicate 829 mg/kg) and copper at 3790 mg/kg (Duplicate 301 mg/kg). Sample SD-220 collected from wetland number 26 contained lead at 1120 mg/kg and copper at 445 mg/kg.

Aquatic Life

In surface waters, little risks to aquatic life are anticipated. From Table 6-48 the 95th UCL is below federal and state standards for all compounds with the exception of aluminum, iron and cyanide. With the exception of aluminum and iron, most exceedances were minor. The concentrations in Reeder Creek, the main surface water body capable of supporting aquatic life were mus lower. On-site sediments (Table 6-49) represent a moderate risk to aquatic receptors. Six of the eight metals of concern (arsenic, cadmium, manganese, nickel, zinc and mercury) are likely to pose little or no risk in sediments due to their relatively low bioavailability under prevailing site pH and colloidal-material conditions. None of these metals exceeded the respective LOT values proposed by NYSDEC for protection of benthic species. At the 95th% UCL copper and lead are higher than the NYSDEC LOT values.

6.6.4.7 Summary

This section summarizes the significant ecological impacts and risks posed by chemicals from OB grounds. Comments are based on the ERA findings discussed throughout the preceding sections. The risks potentially posed to the receptor species and biological groups at the OB grounds are summarized by the chemicals of potential concern. Final conclusions regarding those chemicals of concern that represent significant adverse ecological risks to the environment are presented as the last section of this summary. The preceding discussions provide the findings and rationales that support conclusions regarding the probabilities and magnitudes of biological risks.

The OB grounds ERA accomplished several objectives. These objectives include:

- Characterizing the biological and ecological properties of the OB grounds and the surrounding vicinity;
- Determining the presence, concentrations, and composition of chemicals of concern to receptor species and biological groups found on site;
- Identifying primary chemical exposure pathways from existing OB grounds sites to the receptor species and biological groups; and
- Determining the general level of biological risk associated with the OB grounds.

The results of achieving these objectives are summarized as follows.

Biological Characteristics

A combined literature review, site reconnaissance, biota characterization, and field sampling program was completed in April 1993, based on a USEPA-approved work plan. The program resulted in the ecological characterization of OB grounds, their immediate vicinity, and a 2-mile-wide buffer zone around the OB grounds. The characterization addressed plant cover types, wildlife, aquatic resources, wetlands, threatened and endangered species, and special-interest resources. A total of 34 sediment and surface sampling stations and upstream one background station, were established and investigated. Samples of soil, sediment, and surface water were collected from these locations to evaluate environmental risks and exposure pathways.

Site biological characterization activities revealed a mosaic of terrestrial, aquatic, and wetland communities. Terrestrial communities are represented by northern hardwood forest of maple, oak, and beech; and old fields and ruderal communities. Aquatic communities near the OB grounds are represented by small, shallow swales with intermittent flows that combine, and flow through a series of culvert pipes into Reeder Creek. Aquatic communities are warmwater systems dominated by minnow and sunfish species although the aquatic habitats of the OB grounds vicinity have been officially use-classified by NYSDEC, as Class C(T). Wetland communities are represented by cattail stands scattered throughout the property and an emergent flood plain wetland. There were no federal- and/or state-designated threatened or endangered species identified as being associated with the OB grounds or their immediate vicinities. Designated critical habitats for threatened or endangered species were not located on or within the near vicinity of the OB grounds. Except for wetlands previously discussed, there were no resources or habitats of special interest associated with the OB grounds.

Receptor species were selected to represent major biological groups of the OB grounds areas for the ERA. The vegetative species included cattail, and brome, and vegatative as representative of vascular vegetation. The mallard and white-footed deer mouse were chosen to represent wetland wildlife and terrestrial wildlife, respectively. The fathead minnow, pumpkinseed, and caddisfly were selected to represent several trophic levels of fish and invertebrate aquatic biota.

Chemicals of Potential Concern

Over one-hundred fifty chemicals were initially considered as candidate substances potentially linked to biological or ecological risks. The candidate chemicals were identified based on previous site work, chemical composition of waste products, and SEDA's interest in determining the current environmental status of these chemicals. The initial chemical database was evaluated using a series of environmental screening criteria and toxicity thresholds values that were compared to chemical concentrations reported from biological and physical media samples collected on site. The purpose of the screening process was to identify and eliminate those chemicals that were not detected in any sample on the site or was below background levels. Chemicals retained for more detailed evaluation following the screening process were designated as chemicals of potential concern. Following this screen each chemical's 95th% UCL concentration from each onsite location was compared to medium-specific federal and state promulgated standards, proposed criteria and guidelines established to be protective of the environment.

Exposure Pathways

Transport and exposure pathways were evaluated to determine how chemicals of potential concern might be endangering biota. Transport of these chemicals from the OB grounds into surrounding areas was reviewed. Primary direct exposure pathways involve the transfer of chemicals of concern from physical media to biota associated with the site. Indirect exposure pathways involved the potential transfer of chemicals through initially contaminated biota (i.e., plants, fish, invertebrates, or wildlife associated with the waste site) to higher levels in the terrestrial or aquatic food chains.

Exposure pathway analyses indicated that primary routes of exposure varied according to the specific biological group, individual site area and medium characteristics, and whether the site area is terrestrial or aquatic. The primary exposure pathways for terrestrial plants and animals at terrestrial or upland sampling stations are through soils. Primary exposure pathways at aquatic stations are through sediments and surface waters contaminated with stormwater run-off, snowmelt, or OB grounds leachates. Aquatic plants are exposed primarily through the sediment pathway. Most fish are exposed primarily through the surface-water pathway. Bottom-dwelling invertebrates, semi-aquatic wildlife, and fish are exposed through both sediment and surface water pathways. Upland plants, such as brome, can act as contamination pathways for transfer of some toxic contaminants from soil into species of wildlife that feed primarily on plants, without the plants themselves becoming affected. However, reported soil and sediment concentrations suggest that concentrations of chemicals of this type are within typical ranges and represent little risk to wildlife through this exposure pathway. The most prominent exposure pathway appears to be the sediment-to-aquatic life routes. Elevated concentrations of some metals in sediments and soils on-site at the OB grounds and sediment in Reeder Creek were detected. Sediment and soils containing elevated concentrations of copper and lead constitute exposure pathway to wildlife. The concentrations of these chemicals are greater than the NYSDEC sediment guidelines recommended to protect the benthic community. Both copper and lead exceed guidelines established by NYSDEC for the protection of aquatic life.

Significant Biological Risks

The risk assessment involved a qualitative and quantitative appraisal of the actual or potential toxic effects of hazardous waste sites on aquatic, wetland, and terrestrial biota. The risk assessment considered plant and animal exposures to acute chemical concentrations, chronic concentrations leading to potential lethal and sublethal effects, and food chain transfers of chemicals possessing biomagnification potential. Plants and animals that are or in the future could be experiencing lethal and sublethal effects from exposure to toxic substances were considered.

Determination of Risk - Risk evaluations were based on comparing the onsite chemical concentrations to background concentrations from local areas that are presumably unaffected by the OB grounds; federal and state criteria and promulgated water quality standards; proposed sediment (NYSDEC, 1989,) and general soil (USEPA, 1983) guidelines; and to toxic thresholds described in the technical literature. Table 6-48 compares the surface water chemical concentrations to federal water quality criteria protecting aquatic life and to New York aquatic life standards for modified warmwater habitat. Comparison of the concentrations of chemicals of potential concern to proposed sediment criteria and guidelines considered to be protective of aquatic life is presented in Table 6-49. The soil concentrations were compared to guidelines developed to avoid phytotoxic effects to plants and to chemical concentrations known to be phytotoxic (Table 6-49). Recommended guidelines for the protection of wildlife from surface water are summarized in Table 6-47. Safe and toxic contaminant concentrations in soils and sediments obtained as dietary components for small mammals and the mallard are presented in Table 6-46. Each of these comparison tables identifies chemical concentrations that exceeded concentrations considered potentially harmful to biota dependent on the respective medium.

Vegetation - A total of 85 chemicals reported in soils were evaluated for potential risks to vegetation. These chemicals were retained for detailed evaluation because they were determined to be present at concentrations statistically different from background concentration or were detected in at least one sample. Based on the detailed evaluation, copper and lead exceeded the range of concentrations which is considered to be phytotoxic to plants. Zinc did exceed the proposed value but only slightly.

Wildlife - A total of 27 chemicals retained for surface water, soil (84 chemicals), and sediment (54 chemicals) samples were evaluated for potential risks to wildlife. A detailed evaluation was performed comparing these analytes which were present at higher than recommended concentrations. Only barium, copper, mercury and lead at the 95th UCL were present at concentrations estimated at concentrations which would be chronic to rats or Mallards. Copper and lead at the 95th UCL exceeded the NYSDEC guidelines for protecting wildlife that consume aquatic life.

Exposure and toxicity analyses of sediment contaminants suggest that there are potential indirect risks to the aquatic food resources of wildlife species associated with streams and other aquatic areas from three metals; copper, lead and zinc. Subtle chronic effects are of concern, as none of these contaminants was reported at concentrations in surface water that would suggest acute effects for the receptor species. This is consistent with the field evaluation which found a normal population directly in the sediment and aquatic environment. Nonetheless, the occurrence of individual sample concentrations that exceeded NYSDEC Sediment Guidelines and NYSDEC Aquatic Life Criteria, are therefore reasons for concern.

Endangered and Threatened Species - Endangered and threatened species of plants, wildlife, and aquatic life are not at risk from OB grounds contaminants or remediation actions. The OB grounds and the immediate surroundings do not support any of these species, and there are no apparent completed exposure pathways to state-designated or candidate species.

Wetlands - Wetlands on or in the immediate proximity of the OB grounds are limited to several small areas. The largest wetland W-8 is about 0.92 acre and occurs southern portion of the OB grounds. Numerous small cattail stands occur on many of the OB grounds. Wetlands elsewhere in the study area do not appear to be hydraulically linked to potential OB grounds discharges, thus precluding potential chemical exposure pathways. Formal wetland jurisdictional determinations have not been conducted for these wetlands. State regulated wetlands do not exist within the OB grounds. Minimum NYSDEC wetland areas are approximately 12 acres, thereby excluding these on-site wetlands from consideration.

Two types of potential risks to wetlands at the OB grounds were identified. The first type includes direct physical loss from earthwork or filling activities associated with the OB grounds activity. The second type of potential risk involves chemical contamination from the OB grounds. Comparisons of sediment chemical concentrations to acute and chronic thresholds for plant, wildlife, and aquatic life receptors suggest that potential risks to wetland receptor species (i.e., cattail or mallard) from the chemicals are low. Risk to other aquatic receptors are addressed below.

Aquatic Life - A total of 27 different chemicals detected in surface water (Table 6-48) and 54 different chemicals were detected in sediment (Table 6-49) were evaluated for potential risks to aquatic life. At the 95th UCL only aluminum and iron exceeded the federal or state water quality standard to protect aquatic life. They were reported at concentrations known to produce chronic toxic effects.

Aluminum concentrations substantially exceeded the USEPA (1991a) chronic criterion, representing a moderate risk to aquatic invertebrates, which are more sensitive than fish to aluminum's toxic effects. The widespread distribution of elevated aluminum concentrations on-site suggests an increased risk; however, elevated the aluminum concentrations detected in Reeder Creek (Table 6-47) were substantially lower. The 95th UCL for aluminum in surface water in Reeder Creek was 139.4 ug/l which is less than the 95th UCL for aluminum 1500.6 ug/l for all SW samples. NYSDEC has not published aquatic life standards for total aluminum. The published 100 ug/L standard refers to ionic aluminum.

Comparing surface-water concentrations of the other metals to chronic criteria for protecting the receptor species (e.g., the pumpkinseed and fathead minnow) show that the 95th UCL and maximum contaminant concentrations in Reeder Creek were below chronic criteria, and therefore represent a low risk to aquatic biota. Iron and aluminum in surface water represent a moderate risk to aquatic life because concentrations of both metals in a large number of samples from throughout the drainage basins substantially exceeded aquatic life chronic toxicity standards.

Although 95th UCL concentrations of copper and lead did not exceed federal and state chronic aquatic life water quality standards protecting aquatic life (Table 6-48), the lead concentrations in four samples and the copper concentration in one sample exceeded their respective chronic federal aquatic life standards. These chemicals were considered to represent a low risk because of the small number of samples in which such conditions were observed; were all in the onsite wetlands, not Reeder Creek.

Regarding aquatic life in sediments, ten chemicals were of concern. These are considered to represent from two groups of chemicals present low risk (i.e., semi-volatiles and heavy metals), nine metals represent low to moderate risk (i.e., arsenic, cadmium, copper, iron, lead, manganese, mercury, nickel and zinc), and one semi-volatile represent a low risk (i.e., 4-methylphenol) to aquatic species. The 95th UCL concentrations for the listed semi-volatile, and metals concentrations, exceeded respective proposed state sediment guidelines. However, only copper and lead exceeded the state Limits of Tolerance Guidelines to protect aquatic life. The SVOC 4-methylphenol risk estimate is based on comparison of site sediment concentrations of this chemical to conservative sediment guideline for total phenols and its relatively low frequency of detection. Other than copper and lead which demonstrate moderate risks, the other metals have lower risk estimates due to their low 95th UCL concentrations which are below NYSDEC criteria.

Results of comparing the site's ecological characteristics with the results of the chemical screening process, pathway evaluation, and toxicity and uncertainty analyses, suggest that two chemicals (copper and lead) may represent adverse ecological risks to one or more biotic groups of the OB grounds area. These chemicals could be considered actual chemicals of ecological concern.

6.7 UNCERTAINTY ASSESSMENT

All risk assessments involve the use of assumptions, judgements, and imperfect data to varying degrees. This results in uncertainty in the final estimates of risk. There are several categories of uncertainties associated with risk assessments. One is the initial selection of substances used to characterize exposures and risk on the basis of the sampling data and available toxicity information. Other sources of uncertainty are inherent in the toxicity values for each substance used to characterize risk. Uncertainties are also inherent in the exposure assessments for individual substances and individual exposures. These uncertainties are usually driven by uncertainty in the chemical monitoring data, but can also be driven by population intake parameters. Finally, additional uncertainties are incorporated into the risk assessment when exposures to several substances across multiple pathways are summed.

6.7.1 Uncertainty in Data Collection and Evaluation

Uncertainties in the data collection/evaluation step of the risk assessment focus on determining whether enough samples were collected to adequately characterize the risk, and if sample analyses were conducted in a qualified manner to maximize the confidence in the results. Results of the sample analyses were used to develop a database which includes a complete list of the chemicals by media and their representative concentrations used in the risk assessment. Because this risk assessment is a part of the larger RI effort, the sampling and analysis plan was developed to meet the objectives of the other disciplines besides the risk assessment. Therefore, the samples were not collected randomly but were collected from areas of the site known to be contaminated, biasing the data collected toward overestimating representative chemical concentrations from the site. The judgmental bias in the sample collection also limits the applicability of statistics to the database. Because the statistics used to calculate the 95th UCL interval assume that the data represents a randomly distributed population, and the database does not, there is inherent uncertainty in the application of statistics. Collection of non-random, judgmental samples was necessary to adequately characterize the nature and extent of contamination which is an objective of the RI.

The use of data from all site groundwater monitoring wells in determining representative concentrations used in calculating risks versus using only the analytical data collected from a cluster of wells within the most contaminated area of the plume may result in an underestimation of risks to potential future residents.

All soil samples were screened in the laboratory for volatile organics, trinitrotoluene (TNT), and lead. From each boring the highest screened volatile result was analyzed for Level IV volatiles; the highest TNT sample was analyzed for Level IV semivolatiles, pesticides/PCB's and explosives and the highest lead sample was analyzed for Level IV metals. Thus for all analytes, the sample with the highest contaminant concentrations are the ones included in the risk assessment database. This bias will tend to overstate the true site risk.

For chromium, the valence state (e.g., III or VI) was not specifically determined. Assumptions made regarding the most probable valence state could over- or underestimate risks.

All chemicals detected which were potentially site related were retained in this assessment. Chemicals which were never detected were eliminated from the assessment. It is possible, but unlikely, that some chemicals were detected below the SQL and not retained in the assessment. These assumptions may slightly underestimate risks. Since samples were collected at areas where concentrations were expected to be high and the 95th-percentile upper confidence limits were used for the assessment, it is very unlikely that any chemicals were present at a site at health-significant levels and not detected in at least one sample. However, if this did occur, this assumption will underestimate risk. The 95th UCLs were used to calculate site-related risks. Since that assumption implies chronic exposure to the 95th UCL concentration, this assumption is likely to overestimate risk.

If a chemical was detected, it was retained in the risk assessment regardless of how frequently it was detected. To calculate the upper limit of the 95th-percentile confidence interval, chemicals were assumed to be present in all samples in a media. When the chemical was not detected in a sample, one-half of the SQL was used. Especially for chemicals that were detected in only a few samples, the upper limit of the 95th-percentile confidence interval probably greatly overestimates the amount of the chemical present and, consequently, the risk from the chemical.

A statistical anlaysis was performed to compare on-site soil and groundwater chemical concentrations to background conditions. Chemicals not statistically different from background were eliminated from the risk assessment. However, this evaluation was only performed for metals. Certain organic chemicals are often present from human (non-site) sources. These anthropogenic levels were not considered in this risk assessment.

RAGS guidance (USEPA, 1989b) states that if a small number of TICs are present relative to TCL compounds, they can be eliminated in the risk assessment. This process has the possibility of underestimating risk.

The database also includes a number of data validation flags, indicating uncertainty in the reliability of the performance of the analyses done by the laboratory. Flagged data were retained following RAGS guidance.

6.7.2 Uncertainty in Exposure Assessment

Inherent uncertainties exist in predicting future land uses including future chemical concentrations. Current land uses were used as a basis for predicting future land uses. Current land uses were identified by characterizing the site's physical setting.

A large part of the risk assessment is the estimation of risks that are conditional upon the existence of exposure conditions analyzed. If exposure does not occur, no risks are present. This assessment does not factor in the probability of the exposure occurring. For several pathways, exposure is extremely unlikely. For example, the future pathways implicitly assume the construction of residences near the site and the drilling of private wells in the overburden near the site as a sole source of domestic water. Site hydrogeologic conditions make this extremely unlikely.

Once pathways are identified, exposure point concentrations must be estimated. There is always some doubt as to how well an exposure model approximates the actual conditions receptors will be exposed to at a given site. Key assumptions in estimating exposure point concentrations and exposure assumptions and their potential impact on the assessment are described in the following paragraphs.

For some pathways, particularly fugitive dust in ambient air, a model was used to calculate exposure point concentrations. Use of this model has a degree of uncertainty associated with it which could over- or under-estimate risk.

Dermal exposure also had some further uncertainties. The USEPA dermal guidance (USEPA, 1992) suggests the use of 95th UCL skin surface areas for calculating dermal exposure, but RAGS (USEPA, 1989b) uses 50th-percentile values for area of exposed skin "because surface area and body weight are strongly correlated and 50th-percentile values are most representative of the surface area of individuals of average weight (e.g., 70 kg) which is assumed for this and all other exposure pathways." Further, dermal exposure to soil was based on a soil absorption factor taken from the literature. Several sources were checked and the most conservative value was chosen, so this is expected to over-estimate risk. Dermal exposure to water was based on the assumed permeability constant for water and not on chemical specific values.

For residential land use exposure scenarios, ingestion and dermal contact to soil used an exposure frequency of 350 days per year. This overstates actual risk since Seneca winters are long, cold and very frequently snow covered so that little to no ingestion or dermal contact can occur during this time.

6.7.3 Uncertainty in Toxicity Assessment

Of the chemicals of potential concern, a number had no reference doses or slope factors. They are:

- 1,1,1-trichloroethane
- trichloroethene
- Naphthalene
- 2-methylnaphthalene
- acenaphthylene
- 3-nitroaniline
- dibenzofuran
- phenanthrene
- benzo(g,h,i)perylene
- delta-BHC
- endrin aldehyde
- Aroclor-1254
- Aroclor-1260
- tetryl
- 2,6-4-amino-dinitrotoluene
- 4,6-2-amino-dinitrotoluene
- aluminum
- calcium
- cobalt
- iron
- lead
- magnesium
- nickel
- potassium
- sodium
- thallium

Of these, several have toxicity information such as weight of evidence classification indicating a strong potential for adverse health effects particularly lead which is a major constituent of concern at the site. The absence of toxicity values for these chemicals tends to underestimate risks.

Some uncertainty is inherent in the toxicity values for the duration of exposure assessed. Many of the studies are based on animals and extrapolated to humans, and in some cases, subchronic studies must be used to assess chronic effects. As stated in the toxicity assessment section, several uncertainties apply in these extrapolations. Because toxicity constants are generally based on the upper limit of the 95th-percentile confidence interval, chemical-specific risks may be overestimated.

Toxicity information was not available for dermal exposure; hence, several assumptions had to be made which may tend to over- or underestimate risk. Oral toxicity values were used without adjustment to calculate risks from dermal exposure because the USEPA has not derived toxicity values for this route of exposure. This is due to the lack of scientific studies available to quantify dermal toxicity and carcinogenic potential for the vast majority of priority pollutants and because chemical-specific information needed to convert ingested dose to absorbed dose is not available.

6.7.4 Uncertainty in Risk Characterization

Uncertainties in the toxicity assessment are compounded under the assumption of dose additivity for multiple substance exposure. That assumption ignores possible synergisms and antagonisms among chemicals, and assumes similarity in mechanisms of action and metabolism. Overall, these assumptions would tend to overestimate risk. Similarly, risks summed for chemicals having various weight-of-evidence classifications as well as different target organs may also tend to overestimate risk.

6.8 SUMMARY

6.8.1 Human Health Risk Assessment

Human health risk assessments were calculated for three receptors:

1) current on-site OB grounds workers;
2) current off-site residents; and
3) future on-site residents.

Potential future residents of the site are the only receptors exhibiting a potential for adverse noncarcinogenic health threats. As shown on Table 6-33, the non-carcinogenic risk of 1.2 is slightly above the USEPA-defined target of unity and is due primarily to exposure of receptors to on-site soils. The risk of cancer for these receptors is 5.0×10^{-5} which is within the USEPA-defined target range of 10^{-6} and 10^{-4}.

Current on-site workers do not exhibit cancer risk above the target risk range or potential for adverse noncarcinogenic health threats as shown in Table 6-32. The cancer risk level at 1.6×10^{-5} is within the USEPA's target risk range, and the hazard index at 0.2 is less than one.

Current off-site residents who could be exposed to surface water and sediments do not exhibit risk of cancer in excess of the target risk range or adverse noncarcinogenic health threats as shown in Table 6-33. Cancer risks at 3.2×10^{-6} are within the USEPA's target risk range, and the hazard index at 0.03 is less than one.

Although risks are exhibited by potential future residents exposed to onsite soils, consideration should be given to the likelihood of residential development on the site due to the presence of UXO's. If the pathway is not completed, there are no risks.

6.8.2 Ecological Risk Assessment

The OB grounds ecological risk assessment has included both a qualitative and quantitative assessment of the ecological status of the OB grounds. During Phase I and Phase II, field evaluations included fish trapping and counting, benthic macroinvertebrate sampling and counting and small mammal species sampling and counting. In addition, a vegetation survey was performed, identifying major vegetation and understory types. The conclusions determined from these field efforts indicated a diverse and healthy aquatic and terrestrial environment. No overt acute toxic impacts were evidenced during the field evaluation. Additionally, quantitative soil, sediment and surface water analytical data was compared to NYSDEC guidelines for the protection of aquatic and macroinvertebrate life in sediments and surface water. As a supplement to specific NYSDEC guidelines, criteria, where available, has been presented which is considered to be protective of terrestrial wildlife and vegetation in soils.

The quantitative evaluation which involved comparison of the 95th UCL of site data with the media specific criteria, suggested potential chronic risk from heavy metals, specifically lead and copper. The acute effects from these metals have not been observed during fieldwork, i.e. the ecological community appears diverse and normal, however long term chronic impacts are more subtle. For example, from Table 6-46, the NYSDEC guideline to protect wildlife that consumes aquatic life in contact with copper contaminated sediments in 19 mg/kg. The 95th UCL for sediments is 502.7 mg/kg. For lead the NYSDEC guideline is 27 mg/kg; the 95th UCL is 770.0 mg/kg. For the protection of aquatic life in contact with contaminated sediments, Table 6-49 the 95th UCL for both copper and lead exceed both the NYSDEC guidelines and the LOT criteria for the protection of benthic macroinvertebrates. For protection of terrestrial vegetation, soil concentrations considered to be phytotoxic to terrestrial vegetation were obtained from the scientific literature. Copper and lead at the 95th UCL exceed the range of concentrations considered to be phytotoxic to vegetation in soils. Surface water criteria for the protection of aquatic life were not exceeded for copper and lead.

In summary, on-site soils and sediment suggest the site conditions may pose an elevated ecological risk due to the presence of heavy metals, especially copper and lead. This risk is increased in the low lying areas where sediment from runoff accumulates. Although the risk is present it is probably small, since the field evaluation observed a healthy ecological community to be present at the OB ground site.

7.0 SUMMARY AND CONCLUSIONS

7.1 SUMMARY

7.1.1 Nature and Extent of Contamination

The nature and extent of the constituents of concern at the OB Grounds were evaluated through a comprehensive field investigation program. Primary media investigated at the OB grounds included soil (from grid and pad borings, berm and low hill excavations, and downwind and burn kettle surface samples), surface water and sediment (from Reeder Creek and on-site wetlands and drainage swales), and groundwater (from monitoring wells). The primary contaminants of concern at the OB grounds are explosive compounds, metals and semivolatile organics, mainly PAHs and phthalates. These are believed to have been released to the environment during former open burning activities conducted on the nine burn pads.

Concentrations of explosives, metals and semivolatiles are generally highest in the soil from the surface of the burn pads and the berms when compared to the concentrations in the areas around the burn pads. This is not unexpected given that the pads and the berms were used to physically contain the open burns. Generally, only the upper two feet of the burn pads are impacted while the berms are believed to be impacted throughout. There are defined areas outside the pads which contain anomalous concentrations of explosives, metals and semivolatiles. The most significant area of impacts, off the pads, is between Pads B and C. In the southern portion of the site there is one section of the low hill which also contains anomalously high concentrations of explosives, metals and semivolatiles. Since the low hill was formed by bulldozing the surface soils from and near the burn pads, the presence of contaminants in the berms is not unexpected.

The analytical data from the downwind sampling indicated that there has been no impact to the surface soils collected along the azimuth of the prevailing wind direction at the OB grounds.

The geographic distribution of the contaminants in the surface water and sediment samples is explained by the surface water runoff patterns defined by the topographic contours at the site. The highest concentrations of the contaminants of concern are present in the topographic lows (i.e. the drainage swales and wetlands) which drain major portions of the site encompassing the burn pads. While most of the surface water at the OB grounds drains to the east toward Reeder Creek, little, if any, contamination is carried to Reeder Creek due to the elevated roads and the invert elevations of the drainage pipes. With the exception of a localized area in Reeder Creek downgradient of the Open Detonation Grounds (at SW300), the concentrations of the metals in Reeder Creek are low.

Groundwater was found to be only minimally impacted by metals. There is no continuous distribution of metals in the groundwater. The higher concentration of metals in the groundwater do not correlate with the location of the most severly impacted burn pads or the areas beyond the burn pads which also have been impacted. Additionally, only low concentrations (<1.0 ug/L) of RDX, TNT and DNT were detected in 4 of 39 monitoring wells on-site.

7.1.2 Fate and Transport

The fate and transport of the contaminants of concern at the OB grounds considered site specific factors and the chemical/physical properties of the target analytes. Soil, sediment, and surface water samples collected off-site, downstream, and/or downwind of the site showed no evidence of an observed release. There was also no evidence of a substantial release to groundwater, though only on-site groundwater samples were collected.

In general, the primary constituents of concern, explosives and metals, tend to be persistent in the soil. This is also true of the secondary contaminants of concern, PAH's, phthalates, and pesticides. All these organic contaminants tend to adsorb readily in the organic fraction of the soil. The metals are likely present in the insoluble oxide forms.

Since the forms of these contaminants precludes migration via water, two particular migration mechanisms, sediment transport and wind erosion, were evaluated in detail. In both of these mechanisms, chemicals migrate as adsorbed species to the soil particulates which are then suspended in either water or air.

The results of the sediment transport evaluation indicated a low potential for off-site migration. While there is movement of sediment across the site, runoff flows are generally low, and the surface water and sediment is contained in the low lying areas and wetland, on the site. Soil and sediment samples collected in the low lying areas on the site indicate elevated concentrations, while sediment samples collected in Reeder Creek show little or no impacts.

An analysis of wind erosion also showed little potential for off-site migration. In addition, SEDA worker exposure associated with windborne particulates was shown to be insignificant.

7.1.3 Risk Assessment

7.1.3.1 Human Health Risk Assessment

Human health risk assessments were calculated for three exposure scenarios:

1) Current on-site OB grounds workers;
2) Current off-site residents; and
3) Future on-site residents.

Potential future residents of the site do not exhibit a risk of cancer above the EPA target risk range of 1 x 10^{-4} to 1 x 10^{-6} or a noncarcinogenic risk above the EPA target value of a Hazard Index (HI) of 1.0. As shown on Table 6-41, the excess cancer risk is 1.0 x 10^{-5}, whereas the non-cancer risk is 0.33.

Current on-site workers do not exhibit cancer or non-carcinogenic risk above the established EPA target risk ranges as shown in Table 6-41. The carcinogenic risk level for this exposure group is 6.4 x 10^{-6} which is within the USEPA's target risk range. The HI is 0.23 and is therefore below the EPA target value of 1.0.

Current off-site residents who could be exposed to surface water and sediments during swimming in Reeder Creek do not exhibit risk of cancer or non-carcinogenic health risks in excess of the EPA target risk ranges or adverse noncarcinogenic health threats as shown in Table 6-41. Carcinogenic risks is 3.9 x 10^{-7} and is below the USEPA's target risk range. The non-carcinogenic hazard index is 0.007 and is less than the EPA target level of 1.0.

Since published risk factors are not available for lead, one of the main analytes of concern, an alternative lead risk evaluation was used. This involved the use of the EPA Biokinetic Uptake model (version 0.9) which considers children's blood lead level as a function of environmental concentrations, such as soil or groundwater concentrations. The results of this analysis suggests a blood level greater than the EPA target level of 10 ug/dL.

Although risks are exhibited by potential future residents using groundwater for drinking, consideration should be given to the small likelihood of residential development and groundwater use on the site. If the pathway is not completed, there are no risks.

7.1.3.2 Ecological Risk Assessment

The OB grounds ecological risk assessment has included both a qualitative and quantitative assessment of the ecological status of the OB grounds. During Phase I and Phase II, field evaluations included fish trapping and counting, benthic macroinvertibrate sampling and counting and small mammal species sampling and counting. In addition, a vegetation survey was performed, identifying major vegetation and understory types. The conclusions determined from these field efforts indicated a diverse and healthy aquatic and terrestrial environment. No overt acute toxic impacts were evidenced during the field evaluation. Quantitative soil, sediment and surface water analytical data was compared to NYSDEC guidelines for the protection of aquatic and macroinvertebrate life in sediments and surface water. Additionally, as a supplement to specific NYSDEC guidelines criteria is presented which is protective of terrestrial wildlife and vegetation in soils.

The quantitative evaluation, which involved comparison of the 95th UCL of site data with the media specific criteria, suggested potential chronic risk from heavy metals, specifically lead and copper. The acute effects from these metals have not been observed during fieldwork, i.e. the ecological community appears diverse and normal, however long term chronic impacts are more subtle. For example, the NYSDEC guidelines to protect wildlife that consumes aquatic life in contact with copper contaminated sediments in 19 mg/kg. The 95th UCL for sediments is 319 mg/kg. For lead the NYSDEC guidelines is 27 mg/kg, the 95th UCL is 458 mg/kg.

For the protection of aquatic life in contact with contaminated sediments, the 95th UCL for both copper and lead exceed both the NYSDEC guidelines and the Limits of Tolerance (LOT) criteria for the protection of benthic macroinvertebrates.

For protection of terrestrial vegetation, soil concentrations considered to be phytotoxic to terrestrial vegetation were obtained from the scientific literature. Copper and lead at the 95th UCL exceed the range of concentrations considered to be phytotoxic to vegetation in soils.

Surface water criteria for the protection of aquatic life are not exceeded for copper and lead.

In summary, soils and sediment, in particular on-site soils and sediment, suggest the site conditions may pose an elevated ecological risk due to the presence of heavy metals, especially copper and lead. This risk is increased in the low lying areas where sediment from runoff accumulates. Although the risk is present, it is probably small, since the field evaluation observed a healthy ecological community to be present at the OB ground site.

7.2 CONCLUSIONS

This section provides conclusions based upon the previous evaluation of the nature and extent of known impacts and the risk evaluation. Site conditions are generally as expected, the investigation provided both sufficient quality and quantity of data to adequately assess human health and ecological risk. Residual materials from the former activity of the open burning of munitions and PEPs include heavy metals, most notably barium, copper, lead, zinc in addition to explosives. These constituents exceed NYSDEC guidelines for soil and sediment. Heavy metals, semivolatiles and explosives contribute to a total site human health risk which is within the acceptable range of carcinogenic risk established by the EPA, (i.e. $1x10^{-4}$ to $1x10^{-6}$ for carcinogens). Only the exposure scenario, on-site residential use, is the EPA non-carcinogenic target risk exceeded at 1.2. The EPA non-carcinogenic target value is < 1.0 for non-carcinogens.

This investigation has determined that the majority of residuals are located within the berms that surround each burn pad and are concentrated at the surface of the pads. Following a significant rainfall event these materials are likely removed as particulates to low lying areas on the site where sedimentation of the suspended particulates occur. The impacts appear to be localized to the berms, pads and the low lying areas of the site. Impacts to the nearby stream, Reeder Creek, do not appear significant.

7.2.1 Data Limitations and Recommendations for Future Work

Section 4 of this report presents the results from the geostatistical evaluation of the soils database. The conclusions indicate that sufficient grid spacing was performed as part of this investigation in order to adequately assess the conditions on this site. Further, since all the collected samples were analyzed using NYSDEC CLP ASP protocols and validated following EPA Region 2 Functional Guidelines, the quality of the data meets the requirements established by the project data quality objectives. Accordingly, no further investigatory work is required for this site.

7.2.2 Recommended Remedial Action Objectives

As a prelude to the follow-up feasibility study, ES believes any remedial action objective should focus upon mitigating the potential for overland transport of heavy metals originating in the berms and the surface of the pads. These materials are transported to the low lying areas of the site and possibly could be transferred into Reeder Creek under high rainfall conditions. Potential remedial actions may include capping, excavation and on-site landfilling, or possibly consolidation of selected highly impacted areas.

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