U.S. ARMY ENGINEER DIVISION
HUNTSVILLE, ALABAMA

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DRAFT FINAL

ASH LANDFILL
RECORD OF DECISION (ROD)

SENECA ARMY DEPOT ACTIVITY (SEDA)

PARSONS
AUGUST 2003

DRAFT FINAL
RECORD OF DECISION
FOR

ASH LANDFILL

SENECA ARMY DEPOT ACTIVITY
ROMULUS, NEW YORK

Prepared for:

SENECA ARMY DEPOT ACTIVITY
ROMULUS, NEW YORK

and

UNITED STATES ARMY CORPS OF ENGINEERS
4820 UNIVERSITY SQUARE
HUNTSVILLE, ALABAMA

Prepared By:

PARSONS
100 Summer Street, 8th Floor
Boston, Massachusetts

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or Relevant and Appropriate Requirement
AWQS	Ambient Water Quality Criteria
BCT	Base Cleanup Team
BRA	Baseline Risk Assessment
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Responsibility, Compensation and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CLP	Contract Laboratory Program
cm^2	square centimeter
COC	Contaminant of concern
CWA	Clean Water Act
cy	cubic yards
DCE	Dichloroethene
DOT	Department of Transportation
DQO	Data Quality Objective
DWQS	Drinking Water Quality Standard
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
ES	Engineering Science, Inc.
F-Listed	RCRA F-Listed Hazardous Waste
FFA	Federal Facilities Agreement
FOST	Finding of Suitability Transfer
FS	Feasibility Study
GA	NYSDEC groundwater classification for a source that is suitable for drinking water
HEAST	EPA Health Effects Summary Table
HI	Hazard Index
hr	hour
IAG	Interagency Agreement
IC	Institutional Controls
IRM	Interim Remedial Measure
L	Liter
LRA	Seneca Army Depot Local Redevelopment Authority
LDR	Land Disposal Restriction
LOT	Limit of Tolerance
LTTD	Low Temperature Thermal Desorption

LUC/IC	Land Use Controls/Institutional Controls
LUCAP	Land Use Control Assurance Plan
LUCIP	Land Use Control Implementation Plan
MAIN	Charles T. Main, Inc. (now known as Parsons)
MC	Migration Control
MCL	Maximum Contaminant Level
MDL	Minimum Detection Limit
mg	milligrams
mg/L	milligrams per liter
mg/kg	milligrams per kilogram
mL	milliliters
MSL	Mean Sea Level
NA	Not Available
NCFL	Non-Combustible Fill Landfill
NCP	National Contingency Plan
ND	Not Detected
NPL	National Priorities List
NTU	Nephelometric Turbidity Unit
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules, Regulations
O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
pH	pH Standard Units
PM10	Particulate Matter with a diameter ≤ 10um
POTW	Publicly-Owned Treatment Works
ppb	parts per billion
ppm	parts per million
QA/QC	Quality Assurance/Quality Control
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments Reauthorization Act
SC	Source Control

SCG	Standards, Criteria, or Guidelines
SEAD	Former acronym for the Seneca Army Depot used to designate SWMU numbers
SEDA	Seneca Army Depot Activity
SF	Slope Factor
SPDES	State Pollution Discharge Elimination System
SVE	Soil Vapor Extraction
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TAGM	Technical and Administrative Guidance Memorandum
TBC	To be Considered
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TOGS	Technical and Operational Guidance Series
tph	tons per hour
TRC	Technical Review Committee
µg/l	micrograms per liter
UCL	Upper Confidence Limit
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency
USATHAMA	U.S. Army Toxic and Hazardous Materials Agency
USFWS	U.S. Fish and Wildlife Service
UST	Underground Storage Tank
UV	Ultraviolet
VC	Vinyl Chloride
VOCs	Volatile Organic Compounds
1,2-DCE	1,2-Dichloroethene, same as DCE

1.0 DECLARATION OF THE RECORD OF DECISION

Site Name and Location

Ash Landfill Operable Unit
Seneca Army Depot Activity
CERCLIS ID# NY0213820830
Romulus, New York

Statement of Basis and Purpose

This decision document presents the United States Army's (Army's) selected remedy for soil and groundwater at the Superfund site known as the Ash Landfill Operable Unit located within the Seneca Army Depot Activity (SEDA or the Depot). It was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended, 42 USC 9601 *et seq.* and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, to the extent practicable. The SEDA Base Realignment and Closure (BRAC) Environmental Coordinator, the Chief of Staff at Army Materiel Command, the Director of the Office of Site Remediation and Restoration, and the U.S. Environmental Protection Agency (EPA) Region II have been delegated the authority to approve this Record of Decision (ROD). The New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) have been consulted on the planned remedial action in accordance with CERCLA 121(f), 42 U.S.C. 9621 (f), and concur with the selected remedy.

An administrative record for the site, established pursuant to the NCP, 40 CFR 300.800, contains the documents that form the basis for the Army's selection of the remedial action. This ROD is based on the Administrative Record that has been developed in accordance with Section 113(k) of CERCLA. The Administrative Record is available for public review at the Seneca Army Depot Activity, 5786 State Route 96, Building 123, Romulus, New York, 14541-0009. The Administrative Record Index identifies each of the items considered during the selection of the remedial action. This index is included in **Appendix A**.

The State of New York, through the NYSDEC, has concurred with the selected remedy. The NYSDEC Declaration of Concurrence is provided in **Appendix B** of this ROD.

Site Assessment

The goal of the selected remedy for the Ash Landfill Operable Unit, which is summarized in this ROD, is to ensure that potential human health and ecological risks from hazardous substances in soils, sediment, and groundwater are within acceptable criteria established by EPA and NYSDEC for current and anticipated future uses of the Ash Landfill site.

The Ash Landfill Operable Unit includes SEADs 3, 6, 8, 14 and 15, which are described in **Section 2.0** of this ROD.

Description of the Selected Remedy

The selected remedy for the Ash Landfill Operable Unit consists of a combination of one source control alternative and one migration control alternative. The selected remedy removes potential sources of soil and groundwater contamination and addresses residually contaminated soil and groundwater. The selected remedy for the Ash Landfill Operable Unit consists of the following elements:

- Excavation and off-site disposal of Debris Piles, and establishment and maintenance of a vegetative soil cover for the Ash Landfill and the Non-Combustion Fill Landfill (NCFL) for source control;
- Installation of three in-situ permeable reactive barrier walls filled with 100% zero valence iron, and maintenance of the proposed walls and the existing wall for migration control of the groundwater plume;
- Backfilling and re-grading the Ash Cooling Pond (SEAD-3) to fill the pond during the excavation of the debris piles;
- Contingency plan including additional monitoring and air sparging, as necessary;
- Land Use Controls (LUCs) to attain the remedial action objectives, including ensuring that the integrity of the 12 inch vegetative soil layer is maintained to limit ecological contact and preventing future owners from ingesting site groundwater until Applicable or Relevant and Appropriate Requirements (ARARs) are achieved; and,
- Five-year reviews to evaluate whether the response actions remain protective of public health and the environment.

Since this alternative will result in contaminants remaining at the site that are above levels that allow unlimited use and unrestricted exposure, LUCs (*e.g.,* deed restrictions such as easements and covenants, deed notices, land use restrictions such as zoning and local permitting, groundwater use restrictions, five-year reviews) will be required to ensure that the integrity of the 12 inch vegetative soil layer is maintained to limit ecological contact with materials below the cover, and a temporary LUC will be required to ensure no withdrawal and/or use of groundwater until ARARs are achieved. For this site, the Army's selected LUCs will include supplemental measures that will be documented in detail in the Remedial Design. An implementation and enforcement plan detailing implementation actions will be provided in the Remedial Design. Entities expected to be responsible for implementing and maintaining the remedy are the Army and any other entity (*e.g.,* a transferee) who the Army subsequently identifies to the regulators through timely written notice, which shall include the entity's name, address, and general remedial responsibility.

The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment, and they would consist of document review, ARAR review, interviews, inspection/technology review, and reporting.

State Concurrence

NYSDOH forwarded a letter of concurrence regarding the selection of a remedial action to NYSDEC, and NYSDEC, in turn, forwarded to EPA a letter of concurrence regarding the selection of a remedial action in the future. This letter of concurrence has been placed in **Appendix B**.

Declaration

The selected remedy is consistent with CERCLA and, to the extent practicable, with the NCP, and it is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost effective. The remedy uses a permanent solution for soil and for groundwater contamination.

Because the remedy would result in hazardous substances, pollutants or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, CERCLA requires that the lead agency review the remedial action no less than every five years after its initiation. If justified by the review, remedial actions may be implemented to remove or treat the remaining contaminated materials.

The foregoing represents the selection of a remedial action by the U.S. Department of the Army and the U.S. Environmental Protection Agency, with the concurrence of the New York State Department of Environmental Conservation.

Concur and recommend for immediate implementation:

______________________________ ____________

Stephen M. Absolom Date
BRAC Environmental Coordinator

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The foregoing represents the selection of a remedial action by the U.S. Department of the Army and the U.S. Environmental Protection Agency, with the concurrence of the New York State Department of Environmental Conservation.

Concur and recommend for immediate implementation:

______________________________ ____________

NAME Date
Major General, USA
Chief of Staff
U.S. Army Materiel Command

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The foregoing represents the selection of a remedial action by the U.S. Department of the Army and the U.S. Environmental Protection Agency, with the concurrence of the New York State Department of Environmental Conservation.

Concur and recommend for immediate implementation:

_______________________________ _______________

Ms. Jane Kenny, Regional Administrator Date
Director Office of Site Remediation and Restoration
U.S. Environmental Protection Agency, Region II

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2.0 SITE NAME, LOCATION, AND DESCRIPTION

Ash Landfill Site Operable Unit
Seneca Army Depot Activity
Romulus, New York

The Ash Landfill Operable Unit (or site), referred to as the Ash Landfill, occupies approximately 130 acres within the 10,587 acres of land that comprise SEDA in Romulus, New York. SEDA is located between Seneca and Cayuga Finger Lakes (**Figure 2-1**), on an upland area, at elevations of between 600 and 750 feet above mean sea level (MSL). This upland area forms an elongated divide separating these two Finger Lakes. New York State Highways 96 and 96A bound SEDA on the east and west, respectively. Sparsely populated farmland covers most of the surrounding area. The Ash Landfill site is located along the western boundary of SEDA (**Figure 2-2**). The site is bounded on the north by Cemetery Road, on the east by a SEDA railroad line, on the south by open grassland and brush, and on the west by the Depot's boundary. Beyond the Depot's western boundary are farmland and residences on Smith Farm Road and along Route 96A. Sampson State Park, which is on the shore of Seneca Lake, is located immediately to the west of Route 96A.

The Ash Landfill site was initially estimated to encompass an area of approximately 130 acres. This larger area was investigated to ensure that no previously unknown waste disposal areas were overlooked. Following the remedial investigation, the area of the Ash Landfill site was refocused to an area of approximately 23 acres. This area is comprised of five Solid Waste Management Units (SWMUs) including: the Ash Cooling Pond (SEAD-3), the Ash Landfill (SEAD-6), the Non-Combustible Fill Landfill (NCFL) (SEAD-8), the Refuse Burning Pits (SEAD-14), and the Abandoned Solid Waste Incinerator Building (SEAD-15) (**Figure 2-3**). SEAD-14 is also known as the Debris Piles. The Ash Landfill (SEAD-6) also includes a groundwater plume that emanates from the northern western side of the landfill area.

The Ash Cooling Pond is a circular-bermed area approximately 50 feet in diameter. The Ash Landfill (SEAD-6) is a kidney-shaped landfill approximately 550 feet by 300 feet (4 acres) in area. The groundwater plume associated with the Ash Landfill is approximately 18 acres. The NCFL is an area approximately 400 feet by 400 feet (3 acres) in area. The Refuse Burning Pits were originally thought to be two pits approximately 40 feet by 80 feet each; however, further investigation showed it to be three piles of burned trash. The Abandoned Incinerator Building is approximately 25 feet by 40 feet. The area that comprises the remainder of the 130 acres of the Ash Landfill site is a grassy shrub-covered area.

The stratigraphy of the Ash Landfill site generally consists of between 6 and 10 feet of till, below which is a thin zone (1 to 3 feet) of weathered shale, which grades into competent shale at depth. Generally, the depth to groundwater in the till/weathered shale aquifer varies seasonally between approximately 2 and 6 feet below the ground surface; the depth to groundwater is similar in the competent shale aquifer. Infiltration of precipitation is the sole source of groundwater for the overburden aquifer, and run-off on the site is controlled by a network of engineered drainage ditches. The direction of groundwater flow in the till/weathered shale aquifer is generally to the west toward Seneca Lake; the flow direction in the competent shale aquifer is also to the west. No significant vertical gradients exist between the overburden and bedrock aquifers, and no substantial vertical connection exists between these two aquifers.

The site groundwater is classified as Class GA groundwater by NYSDEC, which means that it is designated as a suitable source of potable water, as is almost all groundwater in the State of New York. Seneca Lake, which is west of the site, is a source of drinking water for SEDA and many surrounding communities. A more comprehensive description of the site is presented in the Remedial Investigation (RI) Report (Parsons ES, 1994).

3.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

3.1 LAND USE AND RESPONSE HISTORY

SEDA was constructed in 1941 and has been owned by the United States government and operated by the Department of Defense since this time. Prior to construction of the Depot, much of the land, including that occupied by the Ash Landfill site, was used for farming. From 1941 to 1974, household trash and depot refuse was burned in a series of Refuse Burning Pits (SEAD-14) near the Abandoned Incinerator Building (Building 2207) (SEAD-15). According to a U.S. Army Environmental Hygiene Agency (USAEHA) Interim Final Report, Groundwater Contamination Survey No. 38-26-0868-88 (July 1987), during approximately this same period of time (1941 until the late 1950s or early 1960's) the ash from the Refuse Burning Pits was buried in the Ash Landfill (SEAD-6).

The Incinerator Building was built in 1974. Between 1974 and 1979, materials intended for disposal were transported to the incinerator. The incinerator was a multiple chamber, batch-fed 2,000 pound per hour capacity unit, which burned rubbish and garbage. The incinerator unit contained an automatic ram-type feeder, a refractory-lined furnace with secondary combustion and settling chamber, a reciprocating stoker, a residue conveyor for ash removal, combustion air fans, a wet gas scrubber, an induced draft fan, and a refractory-lined stack (USAEHA, 1975). Nearly all of the approximately 18 tons of refuse generated per week on the Depot were incinerated. The source for the refuse was domestic waste from Depot activities and family housing. Large items that could not be burned were disposed of at the NCFL (SEAD-8). The NCFL is located southeast of the Incinerator Building (immediately south of the SEDA railroad line). The NCFL was used as a disposal site for non-combustible materials, including construction debris, from 1969 until 1977.

Ashes and other residues from the incinerator were temporarily disposed of in the Ash Cooling Pond (SEAD-3) immediately north of the Incinerator Building. The Ash Cooling Pond consisted of an unlined depression approximately 50 feet in diameter and approximately 6 to 8 feet deep. When the pond filled (approximately every 18 months), the fly ash and residues were removed, transported, and buried in the adjacent Ash Landfill (SEAD-6), east of the Cooling Pond. The refuse was dumped in piles and occasionally spread and compacted. No daily or final cover was applied during operation. The active area of the Ash Landfill extended at least 500 feet north of the Incinerator Building, near a bend in a dirt road ("Bend in the Road"), based on an undated aerial photograph of the incinerator during operation. A fire destroyed the incinerator on May 8, 1979, and the landfill was subsequently closed. A vegetative cover, comprised of native soils and grasses, was observed over the Ash Landfill during the RI.

A grease pit disposal area near the eastern boundary of the site was used for disposal of cooking grease. Burn areas, surrounding the Ash Landfill, included areas of blackened soil, charred debris, and areas of stressed or dead vegetation.

Response History

Below is a summary of the more significant response actions that were performed at the Ash Landfill site, or that had a significant impact on its response history.

Previous investigations that pertain to the environmental history of the Ash Landfill site were completed between 1979 and 1989 by various Army agencies. These investigations were performed primarily to investigate the release of chlorinated volatile organic compounds (VOCs) to soil and groundwater at the Ash Landfill site.

SEDA was proposed for the National Priorities List (NPL) in July 1989. In August 1990, SEDA was finalized and listed in Group 14 on the Federal Section of the NPL. Following finalization on the NPL, it was agreed that any corrective actions that would be required for any targeted problem sites would become regulated under CERCLA guidelines. The EPA, NYSDEC and the Army entered into an agreement called the Federal Facility Agreement (FFA), also known as the Interagency Agreement (IAG). The FFA was developed, in concert with the EPA Region II and NYSDEC, to integrate the Army's Resource Conservation and Recovery Act (RCRA) corrective action obligations with CERCLA response obligations in order to facilitate overall coordination of investigations mandated at SEDA. Therefore, any required future investigations were to be based on CERCLA guidelines. RCRA was considered to be an ARAR pursuant to Section 121 of CERCLA. This agreement became effective in January 1993.

In early 1995, under the Base Realignment and Closure (BRAC) process, the Department of Defense recommended closure of SEDA. This recommendation was approved by Congress, and the Depot was closed in July 2001.

In accordance with the requirements of the BRAC process, in October 1995, the Seneca County Board of Supervisors established the Seneca Army Depot Local Redevelopment Authority (LRA). The LRA is a voluntary committee comprised of select community leaders that represent the interests of the local community in determining the future reuse of SEDA. The LRA community membership includes persons with a broad range of backgrounds including local businesspersons, Native Americans, community-at-large representatives and local and county government representatives. The primary responsibility assigned to the LRA is the preparation of a plan for the redevelopment of the Depot. The Reuse Plan and Implementation Strategy for Seneca Army Depot was adopted by the LRA and approved by the Seneca County Board of Supervisors on October 22, 1996. Under this plan and subsequent amendment, the Ash Landfill site is located within an area that has been designated as a Conservation/Recreation area, as shown in **Figure 3-1**.

3.2 ENFORCEMENT HISTORY

The following list summarizes the significant dates relative to environmental studies and remediation at the Ash Landfill site, and closure of SEDA under BRAC:

- Under Army Pollution Abatement Program Study No. D-1031-W, a Landfill Leachate Study, No. 81-26-8020-81, was conducted by USAEHA in 1979.
- An Installation Assessment of Seneca Army Depot, Report No. 157, was conducted by the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) in 1980.
- An Interim Final Report Groundwater Contamination Survey, No. 35-26-0568-88, Evaluation of Solid Waste Units was conducted by USAEHA in 1987.
- Geohydrologic Study No. 38-26-0313-88 was conducted by USAEHA in 1987.
- A Remedial Investigation/Feasibility Study (RI/FS) was conducted by USATHAMA/ICF, Inc. and a Site Investigation was conducted by Hunter/ESE in 1989.
- Groundwater has been monitored at the Ash Landfill site since 1987.
- In 1989, SEDA was proposed for inclusion on the National Priorities List (NPL) under Superfund; the site was added to the NPL in August 1990.
- A Federal Facilities Agreement (FFA) under CERCLA Section 120 between the U.S. Environmental Protection Agency Region II, the U.S. Department of the Army, and the NYS Department of Environmental Conservation became effective in January 1993.
- A Remedial Investigation Report, Ash Landfill, Seneca Army Depot, Romulus, New York, was prepared by Parsons ES, Inc. in July 1994.
- A non-time critical removal action was performed at the Ash Landfill site to remove the source of VOCs in soils between August 1994 and June 1995.
- SEDA was selected for closure under the 1995 Base Realignment and Closure (BRAC) process.
- A Draft Final Environmental Baseline Survey Report was prepared for the SEDA under BRAC in October 1996.
- A Reuse Plan and Implementation Strategy for Seneca Army Depot was prepared in December 1996.
- A Feasibility Study Report , Ash Landfill, Seneca Army Depot was prepared by Parsons ES, Inc. in 1996.
- Draft Feasibility Memorandum for Groundwater Remediation Alternatives using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill, Seneca Army Depot was prepared by Parsons ES, Inc. in August 2000.
- A Final Proposed Plan for the Ash Landfill at the Seneca Army Depot was prepared by Parsons in December 2002.

Two removal actions have been performed at the Ash Landfill site since SEDA's listing on the NPL. The first action was the removal of a former 1000-gallon underground storage tank (UST) that was used to store heating oil and was located on the east side of the Abandoned Incinerator Building (SEAD-15). The UST was investigated and removed in April 1994 in accordance with the protocols outlined in the NYSDEC STARS memo (August 1992). According to the UST closure report that documented this tank removal, the tank was intact and there was no visual or olfactory evidence of tank leakage in the soil surrounding the UST. This UST removal was not related to the Superfund process.

The second action, a non-time critical removal action, also known as an Interim Remedial Measure (IRM), was conducted by the Army between August 1994 and June 1995, under the requirements of the CERCLA. The IRM consisted of excavation and thermal treatment of VOCs impacted soils using the Low Temperature Thermal Desorption (LTTD) process. The objectives of the IRM were to thermally treat VOCs and polycyclic aromatic hydrocarbons (PAHs) in soils at two source areas near the "Bend in the Road" where sampling identified elevated concentrations of VOCs and PAHs. The non-time critical removal action reduced risk due to future exposure to these soils and prevented continued leaching of VOCs to groundwater associated with this operable unit. Cleanup requirements for soils were adopted from the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) No. 4046 soil cleanup objectives. The scope of the removal action is described in the "Action Memorandum, Ash Landfill Removal Action" (Parsons ES, 1993). In July 1995, the final report for the Ash Landfill Immediate Response was prepared by IT Corporation. The treatment of soils involved two distinct source areas at the "Bend in the Road" area. Approximately 35,000 tons of soil were excavated from the two source areas and heated to 800-900°F in the LTTD system. After the soil was heated and cooled, soil was tested prior to backfilling into the excavation area. Following backfilling and proper grading for drainage control, a vegetative cover was established to prevent erosion. Sampling and analysis of the excavated and treated soil material indicated that these soils were successfully treated and met the VOC cleanup criteria (NYSDEC TAGM values) for the project. Also, concentrations of VOCs in soils after the IRM were below NYSDEC TAGM values. In the several years that have passed since the IRM, the positive benefits of the IRM have been observed as the concentrations of VOCs in groundwater in the removal area have decreased by more than 95 percent.

4.0 COMMUNITY PARTICIPATION

Throughout the Remedial Investigation/Feasibility Study (RI/FS) process, community concern and participation has been high. The SEDA Public Affairs Office was active in responding to requests for information, concerns, and questions from the community. The status of CERCLA activities at SEDA were summarized in Technical Review Committee (TRC) meetings open to the community that occurred every three months between 1991 and 1995, prior to the beginning of the BRAC closure process.

The Seneca Army Depot LRA was established in October 1995 to address employment and economic impacts associated with the closure of the Depot. To support the LRA in matters pertaining to environmental issues at the Depot, a committee was formed, designated the Restoration Advisory Board (RAB). The RAB includes representatives from the Army, EPA, NYSDEC, NYSDOH, and members of the community, many of whom were members of the TRC. Since the objectives of the Base Cleanup Team (BCT) and the RAB were similar to the TRC, the TRC was discontinued when the RAB was formed. The goal of the RAB is to represent community interests, interface with the Army, and report the progress of environmental cleanup to the LRA in support of the future planned development at SEDA. The RAB provides the opportunity to facilitate the exchange of information between the Depot and the community. To encourage this exchange, meetings and presentations, occurring at approximately a bi-monthly basis, have been made to the RAB regarding the overall CERCLA progress that has been made at several sites within the Depot, including the Ash Landfill site. Presentations have also been made on other applicable topics such as remedial technologies, risk assessment and the site classification process. The Base Cleanup Team (BCT) was formed to develop and implement strategies for resolution of site cleanup activities. The BCT is comprised of Army and regulatory representatives that have been meeting on a regular monthly basis since the inception in 1995.

The RI report, the FS report, and the Proposed Plan for the Ash Landfill site have been released to the public for comment. These documents are made available to the public in the administrative record file at the following repository:

Seneca Army Depot Activity
Building 123, PO Box 9
5786 State Route 96
Romulus, NY 14541-0009
(607) 869-1309
Hours are Monday through Thursday 8:30 am to 2:30 pm

The notice of availability for the above-referenced documents was published in the Finger Lake Times and the Seneca Citizen on January 9, 10, and 12, 2003. The public comment period on these documents was held from January 9, 2003 to February 7, 2003. On January 21, 2003, the Army, EPA and NYSDEC conducted a public meeting at the Seneca County Board of Supervisors Room, located at the Seneca County Office Building in Waterloo, NY to present the conclusions of the RI/FS, to elaborate further on the reasons for recommending the selected remedial option, and to receive public comments. There were no public comments, as noted in the Responsiveness Summary (see **Appendix C**).

In addition, a community presentation was given on August 17, 1994 to present the non-time critical removal action to address VOCs in soil at the Ash Landfill. The notice of the public comment period was published in the Finger Lake Times and the Seneca Citizen on August 10, 1994. The public comment period on the removal action was held from August 10, 1994 to September 10, 1994.

5.0 SCOPE AND ROLE OF RESPONSE ACTION

Based upon an evaluation of the various alternatives, the Army, EPA, and NYSDEC have selected a remedy for the Ash Landfill site. The selected remedy includes the following items:

- Excavation and off-site disposal of approximately 770 cubic yards of soil comprising the Debris Piles, and establishment and maintenance of a 12-inch vegetative soil cover for the Ash Landfill and the Non-Combustion Fill Landfill (NCFL) for source control;
- Installation of three in-situ permeable reactive barrier walls filled with 100% zero valence iron, and maintenance of the proposed walls and the existing wall for migration control of the groundwater plume;
- Backfilling and re-grading the Ash Cooling Pond (SEAD-3) to fill the pond during the excavation of the debris piles;
- Contingency plan including additional monitoring and air sparging, as necessary;
- Land Use Controls (LUCs) to attain the remedial action objectives, including ensuring that the integrity of the 12 inch vegetative soil layer is maintained to limit ecological contact and preventing future owners from ingesting site groundwater until ARARs are achieved; and,
- Five-year reviews to evaluate whether the response actions remain protective of public health and the environment.

The selected remedy is discussed in greater detail in **Section 11.0**.

The selected remedy was chosen as the most effective means to ensure that the human health and environmental risks from potential exposures to contaminants in soils and groundwater are mitigated for both present and future site-use conditions.

The Army, EPA, and NYSDEC believe that the selected remedy will be protective of human health and the environment, will comply with ARARs, will be cost effective, and will use permanent solutions and treatment technologies to the maximum extent practicable.

6.0 SITE CHARACTERISTICS

This section provides an overview of the site impacts. A complete description of the site characteristics is included in Section 4.0 of the RI report.

The primary media investigated at the Ash Landfill site included soil (from soil borings and test pits), groundwater, and surface water and sediment (from Kendaia Creek and on-site wetlands and drainage swales). On the basis of these investigations, soil and groundwater were found to be the media that were the most significantly impacted by a release of chemicals on-site.

The primary contaminant of concern (COCs) at the Ash Landfill site are VOCs (primarily chlorinated and aromatic compounds), semivolatile organics (SVOCs) (mainly PAHs), and, to a lesser degree, metals. The COCs are believed to have been released to the environment during former activities conducted at the Ash Landfill Operable Unit. The source of the VOCs was most likely the three alleged solvent dump areas located at the bend in the access road ("Bend in the Road") northwest of the Ash Landfill site. The source of the VOCs that were allegedly disposed in this area is unknown.

6.1 IMPACTS TO SOIL

Guidelines for soil cleanup are presented in the NYSDEC Technical Administrative Guidance Memorandum (TAGM) HWR-94-4046. This guidance was used to compare site soil concentrations in order to provide an initial indication of site conditions. Details of this comparison are presented in Chapter 4 of the RI. Concentrations above these guidance values imply that conditions at the site may pose a threat to human health and the environment. **Tables 6-1a, 6-1b, 6-1c,** and **6-1d** present a summary of all the soil data collected during the RI.

The primary chlorinated VOCs in soils at the Ash Landfill site were 1,2-dichloroethene (1,2-DCE) (maximum=79 mg/kg), trichloroethene (TCE) (maximum=540 mg/kg), and vinyl chloride (VC) (maximum=14.5 mg/kg). The highest concentrations of these compounds were measured in a two-acre area, located in the northwestern corner of the Ash Landfill, at the "Bend in the Road". The primary aromatic VOCs were xylene (maximum=17 mg/kg) and toluene (maximum=5.7 mg/kg). The SVOCs of principal concern were PAHs. PAHs were measured at concentrations above the NYSDEC TAGM 4046 cleanup guidelines. The metals that were detected at elevated concentrations in soils were copper (maximum=836 mg/kg), lead (maximum=2,890 mg/kg), mercury (maximum=1.2 mg/kg) and zinc (maximum=55,700 mg/kg). The highest concentrations of metals were detected in the surface soils of the Debris Piles. The extent of the aromatic VOCs in the horizontal direction was smaller than that for the chlorinated VOCs (approximately one-half acre). The vertical impacts extended from the land surface to 4 feet below the surface (above the water table).

As part of the Ash Landfill RI, a soil-boring program was conducted in the area around the Abandoned Incinerator Building (SEAD-15), including the adjacent Ash Cooling Pond (SEAD-3) during November 1991. Results from this investigation indicated that concentrations of 29 of the 30 SVOCs were below TAGM criteria. One compound was detected at concentrations exceeding the TAGM criteria. Benzo(a)pyrene was detected at concentrations of 760 J µg/kg and 120 µg/kg in two surface soil samples collected adjacent to the cooling pond. The TAGM value for benzo(a)pyrene is 61 µg/kg. Benzo(a)pyrene was not detected in samples collected below these two surface soil samples indicating that these concentrations were limited to the surface. Benzo(a)pyrene concentrations in surface and subsurface soils were below the TAGM in several other borings in the immediate vicinity of the Cooling Pond. No pesticides or polychlorinated biphenyls (PCBs) were detected in the soil borings, and measured metal concentrations were consistent with background values developed as part of USAEHA Waste Study 37-26-0479-85.

6.2 IMPACTS TO GROUNDWATER

The primary impact to the groundwater is a plume containing dissolved concentrations of TCE, 1,2-DCE, and VC that originated in the "Bend in the Road" area near the north western edge of the Ash Landfill. Quarterly monitoring in 1996, 1997 and 1998 detected 1,2-DCE between 1 µg/L and 2 µg/L at monitoring well MW-56, which is 225 feet past the Depot boundary. More recent sampling of MW-56 in January 2000 did not detect 1,2-DCE above the detection limit of 1 µg/L. The NYSDEC GA groundwater quality standard for 1,2-DCE is 5 µg/L. It is likely that the boundary of the plume extends westward to slightly beyond the Depot boundary. Exceedances over the NYSDEC GA groundwater standard, beyond the Depot boundary, have not been observed. **Table 6-2** lists the total chlorinated ethene concentrations for five sampling rounds in the site wells.

The maximum VOC concentration was detected in monitoring well MW-44, located within the area considered to be the source area prior to the soil removal action. In November 1993, the concentrations of TCE, 1,2-DCE, and VC were 51,000, 130,000, and 23,000 µg/L, respectively, for a total chlorinated ethene concentration of 204,000 µg/L in MW-44. The nearest exposure points for groundwater are the three farmhouse wells, located approximately 1,250 feet from the leading edge of the plume. At least one of the farmhouse wells draws water from the till/weathered shale aquifer and the remaining two wells derive water from the bedrock aquifer. The location of the farmhouse is provided in **Figure 3-2**. Vertically, the plume is believed to be restricted to the upper till/weathered shale aquifer and is not present in the deeper competent shale aquifer.

Although exceedances of the NYSDEC Class GA groundwater standards for the metals chromium, lead, nickel, zinc, antimony, barium, beryllium, and copper were observed in several wells during the RI , the data appears to be related to the elevated turbidity of the sample. It was noted that wells with high turbidity have high metals concentrations. Subsequent improvements to the sampling techniques provided less turbid samples with a corresponding decrease in the concentration of metals. For example, lead in MW-44, with a turbidity of 100 Nephelometric Turbidity Unit (NTU), was detected during the second round of the RI at a level of 147 μg/L, which was above both the EPA criteria of 15 μg/Land the NYSDEC GA standard of 25 μg/L. During the quarterly sampling conducted following the RI, the concentration of lead in MW-44 was non-detectable at less than 2 μg/L. This same trend was observed for other wells. During these post-RI sampling events, the EPA Region II Low Stress (low flow) Purging and Sampling Method was used to reduce the turbidity in the groundwater samples. As a result, the turbidity of the samples was less than 10 NTUs. Furthermore, the locations of the exceedances did not correlate to form a continuous plume; rather, they were random and were not related to a source. This supports the contention that the exceedances were related to sample turbidity rather than a release from a point source. As a result of this data, concern over exceedances of metals in groundwater was resolved and attributed to turbidity.

Although the non-time critical removal action successfully removed VOCs and SVOCs from soil, positive affects have been observed in the groundwater concentration in the area of the removal action. For example, prior to the removal action, the concentration of total chlorinated ethenes in MW-44 was 204,000 μg/L. In October 1999 and January 2000, the concentrations in MW-44a, the replacement well for MW-44, were 1,104 μg/L and 399 μg/L, 99.5% and 99.8% reductions in concentrations, respectively. **Figure 6-1** depicts the groundwater VOC plume based on the results of the January 2000 groundwater sampling and analysis.

In December 1998, a 650-foot long permeable reactive iron wall was installed approximately 100 feet east of the railroad tracks near the property line. The wall was installed as a demonstration project to show that the reactive iron wall could be effective in reducing the concentrations of chlorinated ethenes through reductive dechlorination. The wall was constructed by placing a mixture of 50 percent zero valent reactive iron granules and 50 percent sand in a trench with a width of 14 inches and a depth ranging from 7 to 12 feet. Eleven monitoring wells were installed upgradient, downgradient and within the wall to monitor its effectiveness. Groundwater sampling has been performed at these wells since the wall installation.

The first four rounds of groundwater sampling in the vicinity of the wall were evaluated to determine if the reactive iron wall technology was effective in destroying TCE in groundwater and whether a reactive iron wall would be appropriate for full-scale remediation (Draft Feasibility Memorandum for Groundwater Remediation Alternatives Using Zero Valent Iron Reactive Wall at the Ash Landfill, Parsons, August 2000). The report concluded that the technology was viable, however, future applications would require longer reactive iron residence times in order to meet the targeted groundwater standards.

Column and batch testing was performed in August 2001 using site groundwater and reactive iron to determine if the retention time in the existing wall was sufficient to allow for complete destruction of the TCE. As detailed in the Bench-Scale Treatability Report for the Ash Landfill, Seneca Army Depot Activity, Romulus, NY (Envirometal Technologies, Inc., September 25, 2001), the reactive iron wall would degrade chlorinated ethenes below NYSDEC Class GA standards if sufficient reaction time is allowed. Future walls would be designed to allow sufficient reaction time within the wall.

Three additional rounds of sampling have been conducted on the Ash Landfill wells (Groundwater Monitoring Reports, Ash Landfill, Parson, March 2002, July 2002 and November 2002). The results have been generally consistent with the previous two rounds.

6.3 IMPACTS TO SURFACE WATER

The New York State Ambient Water Quality Criteria Standards (NYSAWQCS) were considered as an appropriate screening criteria for surface water. Surface water data was collected from on-site surface water and from Kendaia Creek, which has been classified by NYSDEC as a Class C stream. The on-site drainage ditches and wetlands have not been classified by NYSDEC, since the on-site wetlands and drainage ditches do not contain surface water throughout the entire year.

No VOCs or SVOCs were detected in any of the on-site surface waters or in Kendaia Creek. Metals concentrations were also low in surface water with only iron exceeding NYSAWQCS in three of the six on-site locations. The concentrations of iron in these three samples ranged from 2.08 mg/L to 8.75 mg/L. The NYSAWQCS for iron in a Class C surface water body is 0.3 mg/L.

6.4 IMPACTS TO SEDIMENT

The NYSDEC Sediment Criteria are guidelines that were used to compare sediment data collected from Kendaia Creek and on-site sediment found in the drainage ditches and wetlands. Since background for sediment at Kendaia Creek was not determined, comparisons to background could not be performed and the NYSDEC Sediment Guidelines were used instead. Concentrations of chemicals above the NYSDEC Sediment Guidelines were used to determine if impacts to sediment were likely to have occurred. The list of COCs was then refined during the data evaluation portion of the risk assessment.

The sediments found in the wetland adjacent to the "Bend in the Road" (Wetland W-B) contained elevated concentrations of 1,2-DCE (640 µg/kg). No other on-site sediment samples contained concentrations of VOCs or SVOCs. Metals concentrations in several sediment samples exceeded the NYSDEC Sediment Criteria guidelines. For arsenic, the NYSDEC Sediment Criteria of 5 µg/kg was exceeded in 9 of the 16 sample locations. The highest concentration of arsenic, 12 µg/kg, was detected at the on-site wetland SD-WB. For chromium, the NYSDEC Sediment Criteria of 26 µg/kg was exceeded in 2 of the 16 sample locations. The highest chromium concentration of 33 µg/kg was detected at the off-site location SW-600. For copper, the NYSDEC Sediment Criteria of 19 µg/kg was exceeded in 15 of the 16 sample locations. The highest concentration of copper, 59 μg/kg, was detected at SW-100. For iron, the NYSDEC Sediment Criteria of 24,000 μg/kg was exceeded in 10 of the 16 sample locations. The highest concentration of iron, 36,800 μg/kg, was detected at the off-site location SW-800. For lead, the NYSDEC Sediment Criteria of 27 μg/kg was exceeded in 9 of the 16 sample locations. The highest concentration of lead, 219 μg/kg, was detected at the off-site location SW-600. For manganese, the NYSDEC Sediment Criteria of 428 μg/kg was exceeded in 10 of the 16 sample locations. The highest concentration of manganese, 1,050 μg/kg, was detected at the off-site location SW-800. For mercury, the NYSDEC Sediment Criteria of 0.11 μg/kg was exceeded in 4 of the 16 sample locations. The highest concentration of mercury, 0.81 μg/kg, was detected at location SD-WE. For nickel, the NYSDEC Sediment Criteria of 22 μg/kg was exceeded in 10 of the 16 sample locations. The highest concentration of nickel, 46 μg/kg, was detected at SD-WF. For zinc, the NYSDEC Sediment Criteria of 85 μg/kg was exceeded in 15 of the 16 sample locations. The highest concentration of zinc, 834 μg/kg, was detected at the on-site wetland SD-WB.

7.0 SUMMARY OF SITE RISKS

A baseline risk assessment (BRA) was conducted to estimate the risks associated with current and future site conditions. The BRA estimated the human health and ecological risk that could result from the site if no remedial action were taken. Environmental sampling has shown that SEAD-3 (Ash Cooling Pond) and SEAD-15 (Abandoned Incinerator Building) are not of health or environmental concern; however, as part of the remedy, during the excavation of the debris piles, the Ash Cooling Pond (SEAD-3) will be backfilled and re-graded to fill the pond. As such, the baseline risk assessment was focused on the Ash Landfill (SEAD-6), NCFL (SEAD-8), and Debris Piles (SEAD-14).

7.1 HUMAN HEALTH RISK ASSESSMENT

The baseline human health risk assessment followed the EPA guidance and New York State guidance, where appropriate, to calculate carcinogenic and non-carcinogenic human health risks. A four-step process was used for assessing site-related human health risks for a reasonable maximum exposure scenario:

- *Hazard Identification*--identified the contaminants of concern based on several factors such as toxicity, frequency of occurrence, and concentration.
- *Exposure Assessment*--estimated the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways by which humans are potentially exposed.
- *Toxicity Assessment*--determined the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of adverse effects (response).
- *Risk Characterization*--summarized and combined the outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks (for example, one-in-a-million excess cancer risk).

The methodology is shown in **Figure 7-1.**

The baseline risk assessment considered chemicals in groundwater, soils, sediment and surface water at the Ash Landfill site that may pose a significant risk to human health and the environment. These contaminants included VOCs (primarily chlorinated and aromatic compounds), SVOCs (mainly PAHs), and to a lesser degree, metals, such as cadmium, chromium, copper, lead, and zinc. A summary of the COCs for potential human health receptors in sampled matrices is provided in **Table 7-1a, 7-1b, 7-1c, 7-1d** and **7-1e**.

The baseline risk assessment addressed the potential risks to human health by identifying several potential exposure pathways by which the public may be exposed to contaminant releases at the site under current and future land use scenarios. **Figure 7-2** shows the exposure pathways considered for the media of concern. For the baseline risk assessment, the reasonable maximum exposure was evaluated.

Based on the current and future land use scenarios, the baseline risk assessment evaluated the health effects that may result from exposure for the following four-receptor groups:

1. Current off-site residents;
2. Current on-site deer hunters;
3. Future on-site construction workers; and
3. Future on-site residents.

The following exposure pathways were considered:

1. Dermal contact to surface water in Kendaia Creek and on-site wetlands while wading (current off-site residents, future on-site residents, current on-site deer hunters);
2. Dermal contact to sediments in Kendaia Creek and on-site wetlands while wading (current off-site residents, future on-site residents, current on-site deer hunters);
3. Ingestion of groundwater from off-site wells (current off-site residents);
4. Ingestion of groundwater from on-site wells (future on-site residents);
5. Dermal contact with groundwater from off-site wells while showering or bathing (current off-site residents);
6. Dermal contact with groundwater from on-site wells while showering or bathing (future on-site residents);
7. Inhalation of VOCs released from groundwater from off-site wells while showering (current off-site residents);
8. Inhalation of VOCs released from groundwater from on-site wells while showering (future on-site residents);
9. Inhalation of VOCs in ambient air emitted from on-site soils and transported downwind to the Depot fence line (current off-site residents);
10. Ingestion of on-site surface soils; dermal contact with on-site surface soils (future on-site residents, current on-site deer hunters, future on-site construction workers); and
11. Inhalation of VOCs in ambient air emitted from on-site soils (future on-site residents, current on-site deer hunters, future on-site construction workers).

Under current EPA guidelines, the likelihood of carcinogenic and non-carcinogenic effects due to exposure to site-related chemicals are considered separately. Non-carcinogenic risks were assessed by calculating a Hazard Index (HI), which is an expression of the chronic daily intake of a chemical divided by its safe or Reference Dose (RfD). An HI that exceeds 1.0 indicates the potential for non-carcinogenic effects to occur. Carcinogenic risks were evaluated using a cancer Slope Factor (SF), which is a measure of the cancer-causing potential of a chemical. Slope Factors are multiplied by daily intake estimates to generate an upper-bound estimate of excess lifetime cancer risk. For known or suspected carcinogens, EPA has established an acceptable cancer risk range of 10^{-6} to 10^{-4} (one-in-one million to one-in-ten thousand).

Table 7-2 summarizes the results for total carcinogenic and non-carcinogenic risks. The results of the baseline risk assessment indicate that none of the receptors are in danger of exceeding the EPA target risk range under the current and expected receptor scenarios. The current receptors include site workers, occasional hunters, and off-site residents. Future receptors include construction workers and on-site residents. The cancer risks for the on-site hunter and the on-site construction worker scenarios were 9.5×10^{-6} and 3.8×10^{-7}, respectively, which are also within the EPA target ranges. The HIs for these receptors were 0.0075 and 0.06, respectively, which are less than the EPA defined non-carcinogenic HI target risk value of 1.0

The carcinogenic risk for current off-site receptors is 1.5×10^{-5} and the HI is 0.15. The carcinogenic risks for the off-site receptor ingesting groundwater were found to be 6×10^{-6}, which is within the EPA's target risk range. Additionally, the HI of 0.14 is less than the EPA defined non-carcinogenic HI target risk value of 1.0. Groundwater sampling performed as part of this investigation, in addition to several years of quarterly groundwater monitoring, has confirmed that the current off-site residents do not exhibit an increased risk of cancer in excess of the target risk range or adverse non-carcinogenic health threats. The off-site residences obtain water from a bedrock well, and the well has been tested for several years and chlorinated ethenes have never been detected.

Currently, there is no evidence of concentrations of VOCs exceeding the New York State GA groundwater quality standards at the leading edge of the plume. The edge of the plume is located at the western boundary of the Ash Landfill Operable Unit. The nearest off-site exposure points for groundwater are the three farmhouse wells, located approximately 1,250 feet from the leading edge of the plume. Groundwater monitoring of these three monitoring wells has been ongoing for approximately eight to ten years, and the results have not indicated any VOC contamination in the water supply. The land located off-site and adjacent to the Ash Landfill is currently used as farmland. The till/weathered shale aquifer is unlikely to yield sufficient quantities of water for residential use.

There are no on-site residences and there is no intended future use of the site for residential purposes. The on-site residential scenario was considered as a worst-case condition. Currently, there are no drinking water wells at the Ash Landfill Operable Unit. Site workers and hunters obtain drinking water from other sources, including water from the Depot water supply, which is distributed by the Varick Water District, which obtains water from Seneca Lake.

The carcinogenic risks for potential future residents using groundwater for drinking at SEDA is 1.4×10^{-3}, and the HI is 3.2. Although risks exist for potential future residents using groundwater for drinking at SEDA, the LRA does not intend to use this land for residential purposes. The future intended use for the site has been determined by the LRA as a conservation/recreation area. As part of the BRAC process, the future land use has been determined by the LRA in conjunction with the Army. As of July 1996, the LRA recommended to the Army specific reuse alternatives for several areas at SEDA. Accordingly, it is unreasonable to establish remedial action objectives and to remediate to conditions inconsistent with such land use. Any decisions pertaining to implementing a remedial action would be based upon the current and intended future land use. This includes the risk to the receptor groups: the current off-site residents, the current on-site hunters, the future on-site residents, current on-site hunters and the future on-site construction workers. Should the intended future land use become residential, then in accordance with U.S. Army regulations and CERCLA, the U.S. Army would notify all appropriate regulatory bodies and perform any remedial action necessary to meet the risk requirements for this land use scenario.

7.2 ECOLOGICAL RISK ASSESSMENT

A four-step process was used for assessing site-related ecological risks for a reasonable maximum exposure scenario:

- *Problem Formulation*--a qualitative evaluation of contaminant release, migration, and fate. Identification of contaminants of concern, receptors, exposure pathways, and known ecological effects of the contaminants; and selection of endpoints for further study.
- *Exposure Assessment*--a quantitative evaluation of contaminant release, migration, and fate; characterization of exposure pathways and receptors; and measurement or estimation of exposure point concentrations (EPCs).
- *Ecological Effects Assessment*--literature reviews, field studies, and toxicity tests linking contaminant concentrations to effects on ecological receptors.
- *Risk Characterization*--measurement or estimation of current and future adverse effects.

The ecological risk assessment did not calculate a quantitative total site risk value; rather, ecological risks were determined by a comparison of soil, sediment, and surface water analytical data to established NYSDEC criteria and literature values that are considered to be protective of the ecological community. In all instances of risk calculation and ARAR/TBC comparison, the lower of the 95^{th} UCL of the mean of site data and the maximum detected concentration was used as either the value of comparison or the exposure dose for calculation of the risk.

Exposure to terrestrial ecological species was assumed to occur from soil within the top 2 feet of surface soil. The maximum concentration of lead in surface soil was 2,890 mg/kg. However, for the ecological risk assessment, the 95^{th} Upper Confidence Limit (UCL) of the mean for lead in surface soils, 265 mg/kg, was used as the EPC. For cadmium, the maximum concentration in surface soil was 43.1 mg/kg. The 95th UCL of the mean for cadmium in surface soils was 5.5 mg/kg, which was used as the EPC. The maximum concentration of zinc in surface soil was 55,700 mg/kg, and the 95th UCL of the mean for zinc in surface soils, 1,580 mg/kg, was used as the EPC. The maximum concentration of the PAH compound acenaphthene in surface soil was 2.2 mg/kg, and the 95th UCL of the mean for acenaphthene in surface soils, 0.538 mg/kg, was used as the EPC.

The evaluation of on-site soils, surface water, and sediment suggested a slightly elevated ecological risk due to the presence of heavy metals. However, the criteria for these media are not considered ARARs since none of the criteria are promulgated standards. NYSDEC and federal Ambient Water Quality Criteria (AWQC), which are promulgated standards for Kendaia Creek, are considered ARARs. No exceedances of the AWQCs were observed for downstream samples from Kendaia Creek, which is classified by NYSDEC as a Class C stream.

Metal exceedances were identified for ecological guidelines and reported literature values for on-site soil, sediment, and surface water. The actual ecological risk caused by these exceedances is not readily observable. Phase I and Phase II field evaluations for the RI included fish trapping and counting, benthic macroinvertibrate sampling and counting, and small mammal species sampling and counting. 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. In addition, a vegetation survey was performed, identifying major vegetation and understory types. Site ecological characterization activities included a site reconnaissance by field biologists in 1992, terrestrial trapping, fish captures, qualitative evaluation of plant communities, quantitative sorting of the macroinvertibrate data, and identification and descriptions of visible evidence of environmental stresses. Sampling of sediments and macroinvertibrate identification and counting was used to identify the macroinvertibrate biological community. The conclusions determined from these field efforts indicated a diverse and healthy aquatic and terrestrial environment. The results of the phase I data collection did not indicate stressed biological or plant communities. Furthermore, the use of the on-site wetlands and surface waters by aquatic species is unlikely since these wetlands are small and dry during a large portion of the year.

8.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives have been developed that consist of media-specific objectives for the protection of human health and the environment. These objectives are based on available information and standards such as ARARs and risk-based levels established in the risk assessment. The cleanup goals for soil and groundwater at the Ash Landfill are presented in **Table 8-1**. The following sections describe how these remedial objectives were determined.

Remedial action objectives are specific goals to protect human health and the environment; they specify the contaminant(s) of concern, the exposure route(s), receptor(s), and acceptable contaminant level(s) for each exposure route. These objectives are based on risk levels established in the risk assessment and comply with ARARs to the greatest extent possible. A list of ARARs is provided in **Appendix D**.

Site-specific remedial action objectives were established for the Ash Landfill site between NYSDEC, EPA (Region II), and the Army. The remedial action objectives for soil are the following:

- Mitigate exposure pathways for dermal contact and ingestion of VOCs, metals, and PAHs for current and intended future site use scenarios, thereby decreasing risk to human health and ecological receptors.

The remedial action objectives for groundwater are the following:

- Comply with ARARs for New York State Class GA groundwater quality standards and federal Maximum Contaminant Levels (MCLs).

- Reduce and improve non-carcinogenic and cancer risk levels for current and intended future receptors.

- Prevent exposure to off-site receptors through possible off-site migration of the VOC plume.

9.0 DESCRIPTION OF ALTERNATIVES

CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that a remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions that employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a level or standard of control of the hazardous substances, pollutants, and contaminants, which at least attains ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

The remedial action objectives for soil focus on mitigating exposure pathways for dermal contact and ingestion of VOCs, metals, and PAHs. To achieve these objectives for soil, three areas of the site, the Ash Landfill, Debris Piles, and NCFL, must be excavated, treated, or covered. For groundwater, the Removal Action conducted for source soils at the "Bend in the Road" was performed to mitigate the source of VOCs, which continue to leach into the groundwater. This Removal Action involved treatment of VOCs and PAHs in soils at the two areas designated as Areas A and B. Because the source of the groundwater plume has been removed, the remedial action objectives for groundwater now involve management of the VOC plume, which includes improving the quality of the existing plume and managing the migration of the plume off-site. Therefore, assembling and screening of alternatives have been conducted separately in terms of Source Control (SC) for soil/sediment and Migration Control (MC) for the groundwater plume because the technologies, remedial actions, and COCs for Source Control and Migration Control are clear and distinct for each media. Furthermore, separation of Source Control actions and Migration Control actions provides a more effective means of implementing a remedial action as evidenced by the non-time critical removal action performed by the Army for soils at the "Bend in the Road." That is, remedial action objectives for each media may be achieved more effectively by developing and conducting the alternatives independently of one another.

Completion of the removal action for the source of the groundwater plume has minimized the interaction between the soil and the groundwater media. According to Section 4.2.6 of the CERCLA RI/FS Guidance Manual (EPA, 1988), if interactions between the two media are not significant, an FS may describe options by media instead of on a site-wide basis. This approach permits greater flexibility in developing alternatives.

As discussed in Section 6 of the RI Report, the human health risk assessment conducted during the RI determined that the site hazard index and total cancer risk for exposure to sediment in on-site wetlands are within the acceptable EPA risk range. However, the ecological risk assessment suggested that, based upon a comparison with all available state and federal guidelines, in addition to literature information, there may exist a slight threat due to the presence of nine metals (arsenic, cadmium, copper, iron, lead, manganese, mercury, nickel, and zinc). During the 1994 IRM for the Ash Landfill, the sediments representing the potential slight risk were excavated. These materials were thermally treated with soil excavated from the "Bend in the Road" area. Following treatment, post-remediation sampling showed that the soils and sediments met the project-specific cleanup goals and were used as backfill at the "Bend in the Road" area and in the excavated wetland areas. Further remediation for wetland sediments is not required.

9.1 SOURCE CONTROL (SC) REMEDIAL ALTERNATIVES

Five source control options were identified for soil contamination at the Ash Landfill site. These options are as follows:

- SC-1: The No-Action Alternative;
- SC-2: Excavation of the Ash Landfill, NCFL and Debris Piles/Disposal in an Off-Site, Non-Hazardous Subtitle D landfill;
- SC-3: Excavation of Various Areas of the Ash Landfill and Debris Piles/Consolidation at NCFL/Cap the NCFL;
- SC-4: Excavation of the Ash Landfill, NCFL, and Debris Piles/Soil Wash/Backfill Coarse Fraction/Landfill and Solidify Fine Fraction; and
- SC-5: Excavation of Debris Piles/Disposal in an Off-Site, Non-Hazardous Subtitle D Landfill/Vegetative Cover over the Ash Landfill and NCFL.

9.1.1 Alternative SC 1: The No-Action Alternative

The Superfund program requires that the "No-Action" option be considered as a baseline for comparison to other options. There are no costs associated with the No-Action option. The No-Action option means that no remedial activities would be undertaken at the site. No monitoring or security measures would be undertaken. Any attenuation of the threats posed by the site to human health and the environment would be the result of natural processes. Current security measures would be eliminated or modified so that the property may be transferred or leased as appropriate.

9.1.2 Alternative SC-2: Excavation of the Ash Landfill, NCFL, and Debris Piles/Disposal in an Off-Site Subtitle D Landfill

Capital Cost: $17.5 million
O & M Cost: $0
Present Worth Cost: $17.5 million
Construction Time: Construction would take 12 to 18 months depending on the weather.

This option consists of excavating contaminated soils from the Ash Landfill, NCFL, and Debris Piles and consolidating them at the NCFL. The results of the RI indicate that these areas are well-defined and localized. The depth of the NCFL is less than 10 feet, and the depths of the Ash Landfill and Debris Piles are less than 2 feet. Based on this finding, the expected depth of excavation at the Ash Landfill and Debris Piles would be 2 feet, and the expected depth of excavation at the NCFL would be 10 feet or less. The results from the RI further indicate that contaminated soils in all three locations could be removed with standard construction equipment. Following consolidation of contaminated soils at the NCFL, the excavated materials would be transported to an off-site Subtitle D landfill for disposal. Clean backfill materials would then be transported to the site and used to fill the excavated areas. A vegetative cover would be established over the backfilled area. A Subtitle D landfill refers to a solid waste landfill that meets NYSDEC and EPA Subtitle D landfill construction specifications.

Excavation would involve removal of approximately 68,700 cubic yards of material. Once excavated, soil and solid waste would be stockpiled and tested for the Toxicity Characteristic Leaching Procedure (TCLP). If results indicate that the soil is above the TCLP limits for hazardous waste, then the material would be treated, and the soil would be disposed of in a Subtitle D landfill.

Alternative SC-2 is protective, implementable, and effective for managing the COCs (i.e., metals and PAHs) that remain following the elimination of the VOCs. This alternative is considered to be the best for long-term protectiveness since none of the COCs would remain on-site. However, from the perspective of short-term protectiveness, this alternative would not be ranked high due to the impacts to nearby residents and on-site workers from truck traffic and dust. Ecological receptors would be impacted during the construction phase. Maintenance and monitoring would not be required since all the materials would have been removed. Since this alternative also involves transferring waste from one landfill to another, there would be a decrease in available landfill space. Landfills are used by several municipalities for management of solid waste.

9.1.3 Alternative SC-3: Excavation of the Ash Landfill and Debris Piles/Consolidation at the NCFL/Cap the NCFL:

Capital Cost: $1.4 million
O & M Cost: $490,000
Present Worth Cost: $1.89 million
Construction Time: Construction would take 4 to 6 months depending on the weather.

This option consists of excavating contaminated soils from the Ash Landfill area, the "Bend-in-the-Road" area, and the Debris Piles; and consolidating them at the NCFL. The residual materials from the non-time critical removal action would be used as replacement fill material. Due to the NCFL's current use and proximity to the other areas, it is an ideal on-site area to consolidate the non-volatile waste material. Because the soils at the "Bend-in-the-Road" have been remediated, no volatile organic contaminated source soils exist at the site, and the most likely exposure pathway is from dermal contact or ingestion of soils impacted with heavy metal contaminants. Isolating these materials in the NCFL would prevent the potential for this type of exposure. The final cap would consist of a 12-inch thick barrier such as clay or a geomembrane, covered with a vegetative layer.

The first step in this option is excavation. An excavation plan would be developed using previous RI data to delineate the extent of removal. A wetland mitigation plan would also be developed. The maximum volume to be excavated is approximately 32,400 cubic yards, which includes all the soils except those in the NCFL. The expected depth of the excavation in soils outside of the NCFL would be approximately 2 feet. Under this alternative, excavation would not be performed on soils in the NCFL, as soil in the NCFL would remain in-place and be capped. The excavation would be accomplished with standard construction equipment, such as a front-end loader or bulldozer. The excavated soil would be immediately transported to the NCFL where it would be consolidated and eventually capped.

There are also areas at the site, such as the Debris Piles, the refuse burning pits, and the Ash Landfill, that contain elevated concentrations of heavy metals, pesticides, and PAHs. Although leaching and migration into groundwater are not currently occurring, erosion and overland transport could be a potential transport mechanism. Alternative SC-3 would mitigate this concern.

Alternative SC-3 is effective, implementable, and would be relatively cost effective for managing the COCs (metals and PAHs) that remain following the elimination of the VOCs. Because the COCs remain on-site, capping is a necessary technology requiring future maintenance and monitoring to ensure the stability of the landfill, prevent runoff or erosion of the landfill contents, and prevent leaching of the COCs to groundwater.

Since this option would result in contaminants remaining on-site at levels that do not allow for unlimited use and unrestricted exposure, land use controls and five-year reviews would be required.

Under this alternative, the types of institutional controls that would be implemented would include a combination of administrative and physical controls in order to ensure that the integrity of the cap is maintained to limit ecological contact with the material under the cover at the NCFL. Physical controls that may be implemented include posting of signs and markers to identify these areas. An implementation and enforcement plan detailing implementation actions will be provided in the Remedial Design Plan. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment.

9.1.4 Alternative SC-4: Excavation of the Ash Landfill, NCFL and Debris Piles/Soil Washing/Backfill Coarse Fraction/Solidify Fine Fraction/Cap:

Capital Cost: $31.5 M
O & M Cost: $490,000
Present Worth Cost: $32 M
Construction Time: Construction would take 3 to 6 months.

The SC-4 option involves five unit operations: excavation, soil washing, backfilling of the coarse fraction, solidification of the fine fraction, and capping. The volume to be processed for this option is approximately 68,700 cubic yards.

For this option, the sediments and soils would be excavated and processed to segregate the coarse fraction of soil from the fine fraction. Due to the increased surface area, fine particles tend to accumulate COCs more than other size fractions, but they are also more difficult to clean. By segregating the fine particles from the coarse soil particles, the majority of the impacted soil would be removed. The coarse fraction would then be backfilled as clean fill, providing the remedial action objectives are met. Fine particles would be treated through solidification.

Acid leaching and biological treatment of the fine particles were also investigated for this option, minimizing the volume of soil that would require off-site disposal. Soil washing is an effective alternative, due to the high percentage of fines at the Ash Landfill (30 to 70%). The success of acid leaching is improbable since the concentrations of the metals are not high enough to warrant this aggressive process. The added cost and safety issues associated with using acid are also negative factors. The efficiency of removing the organic contaminants with acid is also of concern, and it is likely that many organic contaminants would remain with the acid extracted soil. For these reasons, acid extraction was not considered further.

Segregated fines can be biologically treated using a slurry reactor. This process is specific for degradation of the organic portion of the washed fine fraction but would have little effect on the heavy metal contaminants. Due to the difficulties associated with washing a soil matrix composed primarily of fines, with organic and inorganic contamination, this unit operation was not considered further.

The more attractive option would be to render the segregated fine soil particles non-reactive by solidification. Solidification/stabilization is a process that converts components to less toxic, less mobile, and/or more insoluble forms. The primary goals of solidification are to improve the handling and physical characteristics of the waste, decrease the solubility and mobility of soil metals, and decrease the surface area of the soil matrix. The physical properties of the soil or waste are not necessarily changed by this process (EPA 1990). Solidification of inorganic constituents is achieved with cement or pozzolanic additives. Organic solidification/stabilization is often accomplished with thermo-plastic or organic polymerization additives (EPA, 1989). For soils containing both organic and inorganic contaminants, a combination of these processes can be used.

Solidification/stabilization has been used primarily for the treatment of soils containing inorganic contaminants and has been shown to be effective for heavy metals. If organics are present in large concentrations (such as in oily wastes) the setting process may be adversely affected and may not bind up in the finished product. Although the soil from the Ash Landfill does contain organic contaminants, the concentrations are not expected to cause solidification problems. Bench-scale treatability tests would be conducted to assess the adequacy of a given additive to a specific soil mixture. Cement-based stabilization is the likely choice for the Ash Landfill. Portland Cement is a typical solidification technology.

The coarse fraction of the soils that exceed the TCLP requirements would also be solidified prior to land filling in the NCFL. Coarse soils that do not exceed TCLP requirements would be backfilled on-site.

Solidification/stabilization can be conducted either in-situ or in a batch mode. For in-situ solidification/stabilization, the mixtures are injected into the soil and then mixed. In batch operations, the material is removed from the ground with standard earthmoving equipment and mixed in units such as standard cement trucks. Batch processes require more area than in-situ processes because space is necessary to store the untreated soil when it is removed from the ground. At the Ash Landfill, a batch operation would be used. The contaminated soil is shallow, and is easily removed. In addition, there is plenty of space available to set up a stockpile area and cement plant. The solidified soil/additive matrix would prevent leaching of these residual materials through both chemical and physical barriers. The chemical barrier is due to the insoluble forms of metals that would be created when mixed with the soil/additive matrix. This mass would then be land filled on the site in the location from where the excavation was originally performed and capped to further reduce adverse effects of long term exposure.

This process decreases constituent mobility by binding constituents into a leach-resistant, concrete-like matrix while increasing the waste material volume by approximately 50%. Solidification is expected to be completed at 75 ton/hour (tph) or approximately 50 cubic yards per hour (cy/hr).

Because this option would result in contaminants remaining on-site at levels that do not allow for unlimited use and unrestricted exposure, land use controls and five-year reviews would be required. Under this alternative, the types of land use controls that would be implemented would include a combination of administrative and physical controls that are implemented to ensure that the integrity of the cover is maintained to limit ecological contact with the material under the cover. Physical controls that may be implemented include posting signs and markers to identify these areas. An implementation and enforcement plan detailing implementation actions will be provided in the Remedial Design Plan. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment.

9.1.5 Alternative SC-5: Excavation of Debris Piles/Disposal in an Off-Site, Subtitle D Landfill/Vegetative Cover over Ash Landfill and NCFL:

Capital Cost: $237,000
30-Year O & M Cost: $490,000 (maintenance of cover)
Present Worth Cost: $727,000
Construction Time: Construction would take 4 to 6 months depending on the weather.

This option consists of excavating soils from the Debris Piles and transporting the soil to an off-site landfill. The rationale for this option is that the Debris Piles represent the areas with the highest concentrations of metals and PAHs. The removal of these piles represents an approach that is effective, easily implementable and cost-effective. Off-site disposal at a Subtitle D landfill eliminates any threat that these constituents may pose at the Ash Landfill site. Excavation, hauling, and disposal are proven and readily available remedial technologies. Selective excavation of the Debris Piles would effectively remove the highest concentrations of metals and PAHs at the site and essentially lower the risk levels associated with on-site soils.

An excavation plan would be developed using previous RI data to delineate the extent of removal. This plan would include a wetland mitigation plan that would provide protection of the existing wetlands. The maximum volume to be excavated is approximately 770 cubic yards, which includes all the soils associated with the Debris Piles. The soils in the NCFL and the Ash Landfill would remain in-place and be covered with a vegetative soil cover of 12 inches. The excavation would be accomplished with standard construction equipment. The excavated soil would be temporarily stockpiled in a secure area, tested for disposal requirements, and disposed of off-site in a secure, non-hazardous waste, Subtitle D landfill, assuming that the soils meet the criteria for disposal. If testing indicates that the soils are not suitable for disposal in a Subtitle D landfill, then other options, such as disposal in a Subtitle C landfill, would be considered. As part of the remedy, during the excavation of the debris piles, the Ash Cooling Pond (SEAD-3) will be backfilled and re-graded to fill the pond.

Because this option would result in contaminants remaining on-site at levels that do not allow for unlimited use and unrestricted exposure, land use controls and five-year reviews would be required. Under this alternative, the types of land use controls that would be implemented in order to ensure that the integrity of the 12 inch vegetative soil layer at the NCFL and at the Ash Landfill is maintained to limit ecological contact with the material under the cover. An implementation and enforcement plan detailing implementation actions will be provided in the Remedial Design Plan. The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment.

9.2 MIGRATION CONTROL ALTERNATIVES

Eight remedial options were identified for addressing the contamination associated with migration control at the Ash Landfill site. These options are as follows:

- MC-1: The No-Action Alternative;
- MC-2: Natural Attenuation and Degradation of Plume/Institutional Controls/Alternative Water Supply;
- MC-3: Air Sparging of Plume;
- MC-3a: In-Situ Treatment Using Zero Valence Iron;
- MC-4: Interceptor Trenches/Tank Storage/Filtration/Liquid-Phase Activated Carbon/Discharge to Surface Water;
- MC-5: Interceptor Trenches/Tank Storage/Filtration/Air Stripping/Discharge to Surface Water;
- MC-6: Interceptor Trenches/Tank Storage/Filtration/Hardness Removal/UV Oxidation/Liquid-Phase Carbon/Discharge to Surface Water; and
- MC-7: Interceptor Trenches/Tank Storage/Filtration/Two-Stage Biological Treatment/Discharge to Surface Water.

Since these alternatives would result in contaminants remaining at the site that are above levels that allow unlimited use and unrestricted exposure, temporary LUCs (*e.g.*, deed restrictions such as easements and covenants, deed notices, land use restrictions such as zoning and local permitting, groundwater use restrictions, five-year reviews) would be required to ensure no withdrawal and/or use of groundwater until ARARs are achieved. For this site, the Army's selected LUCs will include supplemental measures that will be documented in detail in the Remedial Design Plan. Land use controls to prevent groundwater use would be implemented over the area of the groundwater plume, shown on **Figure 2-3**. An implementation and enforcement plan detailing implementation actions will be provided in the Remedial Design Plan. Entities expected to be responsible for implementing and maintaining the remedy are the Army and any other entity (*e.g.*, a transferee) who the Army subsequently identifies to the regulators through timely written notice, which shall include the entity's name, address, and general remedial responsibility.

The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment, and they would consist of document review, ARAR review, interviews, inspection/technology review, and reporting.

9.2.1 Alternative MC-1: No-Action

The Superfund program requires that the "No-Action" alternative be considered as a baseline for comparison of other options. There are no costs associated with the No-Action option. The No-Action option means that no remedial activities and no monitoring or security measures would be undertaken at the site. Any attenuation of the threats posed by the site to human health and the environment would be the result of natural processes. Current security measures would be eliminated or modified depending upon if the property is transferred or leased. The future land use of the Ash Landfill Operable Unit has been determined by the LRA as conservation/recreation. Access to the Ash Landfill could be limited depending upon the requirements of the LRA.

Although current and intended land uses do not indicate unacceptable risks, groundwater quality standards have been exceeded. Detections of low levels of 1,2-DCE in an off-site well suggest that the plume may extend as far as 225 feet beyond SEDA property; however, these detections have not been confirmed in recent quarterly monitoring samples. The off-site detections of 1,2-DCE have not been observed above the NYSDEC Class GA groundwater standard. Since these values are promulgated by the State of New York and the federal government, these groundwater quality requirements are considered to be ARARs, and, therefore, additional measures may be required if 1,2-DCE is detected over the standard.

9.2.2 Alternative MC-2: Natural Attenuation with Institutional Controls and Alternative Water Supply

Capital Cost: $160,000
30-Year O & M Cost: $794,000
Total Present Worth Cost: $954,000
Construction Time: Construction would take 6 to 9 months

This option is different than the No-Action Alternative, MC-1, since MC-2 includes: installation of an alternate water supply to the off-site receptors, land use controls, and a monitoring program. Land use controls would be included to prevent exposure to on-site groundwater due to ingestion. The groundwater-monitoring program, started in 1987, would continue.

With the addition of the zero valence iron reactive barrier wall along the boundary of the Ash Landfill, off-site migration of the groundwater plume has been mitigated. Under this alternative, the remaining on-site groundwater plume would be removed via natural biological degradation and attenuation processes. Although the time required to attain cleanup goals would be extended compared to an active engineered treatment scenario, these processes would reduce the concentration of chlorinated ethenes in groundwater to the required levels. If the natural processes cannot reduce the levels to the targeted goals, the existing barrier wall would prevent further off-site migration of the chlorinated ethenes.

As stated at the beginning of this section, temporary land use controls for the Ash Landfill site would be required to ensure no withdrawal and/or use of groundwater at the site until ARARs are achieved. An alternate water supply, involving the installation of a water line, would supply drinking water to downgradient receptors. An existing water supply line is located near the former incinerator at the Ash Landfill Operable Unit. This water line is currently not in use but would be extended from SEDA, westerly, down West Smith Farm Road, to the farmhouse. Following base closure, the water supply system would be operated by the Varick Water District. This line would be installed with conventional trenching techniques, extending to below the frost line.

Option MC-2 considers natural processes sufficient to reduce the concentration levels in the plume. As an additional level of protection, land use controls such as a deed restriction, groundwater monitoring and an alternate water supply may be implemented. NYSDEC groundwater standards for heavy metals and VOCs have been exceeded in on-site wells. Three SVOCs exceeded Class GA groundwater standards in one well. This well and the soil and groundwater surrounding it was excavated, treated, and replaced. No SVOCs were detected in the replacement well following the IRM. Metals in groundwater did not contribute significantly to the risk from groundwater ingestion. This option would monitor groundwater for VOCs.

To prevent migration and to protect off-site receptors, monitoring wells would be monitored along the SEDA boundary. Monitoring activities have included quarterly monitoring of over 30 wells, including private wells at the off-site Farm House and wells between the farmhouse and the SEDA boundary. The wells located between the farmhouse and the SEDA boundary have been used as sentry wells to provide an early detection warning for plume migration. No exceedances of the Class GA standards have been detected in the sentry wells. This program has been recently reduced to semi-annual monitoring program. Monitoring would continue under this option to ensure that natural attenuation was effective in reducing the groundwater concentrations on-site, and the reactive barrier wall was effective in preventing off-site migration. If the groundwater data from the monitoring program indicated a statistically significant rising trend in the concentrations of the targeted VOCs, then a contingency plan would be initiated. Depending upon the rate of degradation, groundwater modeling has suggested that the on-site concentrations could require nearly 75 to 150 years before Class GA groundwater standards are attained.

The contingency plan would include an evaluation of applicable treatment technologies. At this time, the preferred contingency treatment option for removing VOCs in groundwater is air sparging. The plan would involve installation of a line of air sparging points, placed perpendicular to the plume. The aquifer would be sparged until the concentrations of VOCs are reduced to acceptable levels.

The combination of a long-term monitoring strategy and an alternative water supply makes this an option for protecting human health. This option does not require any additional technologies to meet the remedial action objectives for the Ash Landfill site and, therefore, is easy to implement as it involves only monitoring and an alternative water supply. This is a low-cost option to meet these objectives. The long duration of treatment and the concern about operational issues associated with a dead end public water line makes this option least desirable.

9.2.3 Alternative MC-3: Air Sparging of Plume

Capital Cost: $668,000
30-Year O & M Cost: $1.79M
Present Worth Cost: $2.46M Construction time: Treatability testing would take 2 to 3 months. Construction and startup would take 2 to 3 months.

Option MC-3 uses an in-situ treatment process (air sparging) to achieve reduction in groundwater concentrations. In-situ air sparging is becoming a widely used technology for remediating sites contaminated by VOCs. An air sparging system would provide a cost-effective method for groundwater remediation. The advantages of in-situ air sparging are: (1) a small volume of water must be treated per unit of time, (2) groundwater is not removed from the aquifer, and (3) the process does not draw large volumes of uncontaminated water into the zone of contamination. The treatment uses the concept of air stripping to remove VOCs. Air sparging of groundwater can be conducted using interceptor trenches or air injection wells.

Combining an interceptor trench and air sparging of the VOC plume would provide an effective in-situ remedial option. The trench would allow for the efficient collection of water through which air could be injected, thus assuring sparging of the VOCs.

Air injection wells are often used instead of interceptor trenches. Wells are generally placed a few meters below the groundwater table to induce lateral spreading of air away from the injection well. As air moves through the groundwater zone, VOCs partition into the gas phase and are swept out of the groundwater zone to the vadose zone. At the same time, the oxygen in the sparged air partitions into the groundwater. The oxygen stimulates aerobic microbial degradation of contaminants. If required, sparging systems can be integrated with a vapor recovery system. Vertical wells that have been used for air sparging applications have a very limited radius of effectiveness. Because of the low permeability of the soils, standard sparging of groundwater through air injection wells would not be as effective a treatment option as the trench. Site geology is considered to be the most important design parameter. The use of vertical wells is limited to coarser grained materials because coarse soils have lower air entry pressure requirements and provide a medium for more even air distribution.

This allows better mass transfer efficiencies and more effective VOC removal. Air sparging using vertical wells would not be cost effective. Even if artificial fracturing of the soils was performed on these soils, the true effectiveness and extent of the fracturing, and thus the sparging, would not be assured. For this reason, Alternative MC-3 would employ air sparging trenches.

Alternative MC-3 would involve the installation of two air sparging trenches and two vapor extraction trenches above the sparging trenches to collect the sparged volatiles. The system would consist of a sparging trench in the saturated soil and a vapor recovery trench above the sparging trench. A trench for air sparging would be constructed in cohesive soils by direct excavation and backfilling with coarse gravel. Greater efficiencies using in-situ trenched air sparging could be achieved by constructing a trench perpendicular to the groundwater flow direction, so that groundwater is forced to flow through the trench. The trenches could be installed to a depth of 30 feet. Two trenches, one located just down gradient of the former source areas and the other located at the toe of the existing plume, would be installed to the top of impermeable bedrock. Horizontal piping would be used in the trench to act as air injection and vapor extraction points. The air promotes volatilization of the organic contaminants in the groundwater and also promotes aerobic biodegradation. The VOCs would be captured by the vapor recovery wells, in much the same manner as a soil vapor extraction system. In order to meet the requirements of air quality standards, the air stream would be passed through vapor-phase carbon or some other vapor treatment technology. Periodic groundwater monitoring would be used to assess the progress of the treatment. This option has a treatment time of up to 30 years.

As stated at the beginning of this section, temporary land use controls for the Ash Landfill site would be required to ensure no withdrawal and/or use of groundwater at the site until ARARs are achieved. An alternate water supply, involving the installation of a water line, would supply drinking water to downgradient receptors. An existing water supply line is located near the former incinerator at the Ash Landfill Operable Unit. This water line is currently not in use but would be extended from SEDA, westerly, down West Smith Farm Road, to the farmhouse. Following base closure, the water supply system would be operated by the Varick Water District. This line would be installed with conventional trenching techniques, extending to below the frost line.

9.2.4 Alternative MC-3a: In-Situ Treatment using Zero Valence Iron

Capital Cost: $2.05 M
15-Year Present Worth O & M Cost: $656,000
Total 15 Year Present Worth Cost: $2.71 M
30 Year Present Worth O & M Cost: $813,000
Total 30 Year Present Worth Cost: $2.86 M
Construction time: Construction and startup would take 4 to 6 months.

Alternative MC-3a, a modification of MC-3, involves destruction of chlorinated organic compounds, in situ, via a chemical reaction with a reactive zero valence iron wall. The reactive zero valence iron would be placed in direct contact with dissolved chlorinated organics in the groundwater. As part of Alternative MC-3a, three additional reactive barrier walls would be installed. Compliance with NYSDEC Class GA standards and federal MCLs for chlorinated organics in groundwater is expected to be achieved in 15 years. However, for comparison purposes, O&M has been estimated for 30 years

As stated at the beginning of this section, land use controls for the Ash Landfill site would be required to ensure no withdrawal and/or use of groundwater at the site. An alternate water supply, involving the installation of a water line, would supply drinking water to downgradient receptors. An existing water supply line is located near the former incinerator at the Ash Landfill Operable Unit. This water line is currently not in use but would be extended from SEDA, westerly, down West Smith Farm Road, to the farmhouse. Following base closure, the water supply system would be operated by the Varick Water District. This line would be installed with conventional trenching techniques, extending to below the frost line.

Reactive iron filings have been demonstrated to be effective in treating chlorinated solvents. The reaction chemistry involves the simultaneous oxidative corrosion of the reactive iron metal by both water and reductive dechlorination of the chlorinated compounds. Alternative MC-3a has advantages over using air to remove volatile chlorinated organics from groundwater because there is no need to recover and remove organics from the sparged air. Alternative MC-3a would continuously treat groundwater, regardless of the thickness of the aquifer, and would require minimal O&M costs.

The FS considered two trenches, described in Alternative MC-3. The trenches, arranged perpendicular to groundwater flow, were considered to function in a funnel and gate configuration. This configuration involved installing an impermeable cut-off wall (funnel), along the trench wall, that would be used to divert groundwater flow to an in situ reaction zone (gate). Reactive iron would be placed into the gate. Chlorinated organics would be destroyed as the dissolved organics passed through the reactive zone (gate). Under the original configuration, four gates would be located in each wall. Granular iron mixed with sand would be placed within the gate. The primary factors affecting the capital costs for this system were the plume dimension, the upgradient VOC concentrations and the groundwater velocity. The thickness of the reactive zone is critical to ensure sufficient treatment. The thickness of the reactive zone, and therefore the residence treatment time, can be determined by knowing the groundwater velocity and the degradation rates that are obtained from either modeling or bench-scale testing. Residence times can vary from 5-50 hours for chlorinated solvents such as trichloroethene, vinyl chloride and cis-1,2-dichloroethene

Another variation of this trench configuration is as a continuous reactive barrier wall. In this configuration, the trench is backfilled with a mixture of reactive iron and sand. As groundwater flows through the trench, the zero valence iron chemically destroys chlorinated organics. This configuration produces less hydraulic mounding of groundwater than the funnel and gate configuration because there is no restriction of groundwater flow. At the Ash Landfill Operable Unit, groundwater mounding was identified as a potential problem that could lead to breakout of groundwater at the ground surface.

The FS assumed that Alternative MC-3a would involve two trenches, configured as a funnel and gate, and the FS assumed that the time for treatment of the plume was 10 years.

Following the FS, Alternative MC-3a was identified as a promising and innovative alternative but was considered new and unproven. However, since the proposed treatment was in-situ, no operation of an aboveground treatment plant was required, treatment would operate continuously, and minimal maintenance was required, a demonstration study was authorized to determine the effectiveness of this emerging technology and to obtain additional constructability and costing data.

The Army selected to pursue a zero valence iron demonstration study for a continuous permeable trench, instead of a funnel and gate configuration due to the concern over groundwater mounding. Using VOC concentrations and groundwater velocities obtained from the RI and degradation rates obtained from vendor modeling, the required residence time that the groundwater must be in contact with the iron was determined. The required thickness of the reactive zone was determined to be 14 inches. A residence time of 1.25 days was estimated to be sufficient for destruction of the chlorinated solvents such as TCE, vinyl chloride, and cis-1,2-dichloroethene.

The demonstration study has been ongoing since December 1998 when a 650-foot long permeable reactive wall was installed near the Depot fence line at the downgradient portion of the dissolved chlorinated organic plume. The trench bottom was placed into the competent bedrock to avoid short-circuiting of groundwater. The trench width was 14 inches and was backfilled with a 50-50 mixture of zero valence iron and imported clean sand. The final depth of the trench was between 7 and 12 feet below ground surface. In addition, a total of eleven monitoring wells were installed upgradient, in the trench and downgradient of the trench and at both ends of the trench to monitor the effectiveness of the technology. Groundwater monitoring of the reactive barrier wall has been ongoing. Although some breakthrough of 1,2-DCE was observed, TCE was consistently degraded by the wall below the detection limit of 1 μg/l confirming the effectiveness of the treatment technology. The design of the three walls for Alternative MC-3a would be developed using a more conservative approach than the design of the existing reactive wall. The conservative approach is based on the complex hydraulics and inconsistent degradation half-lives encountered during the treatability study with the zero valent iron continuous reactive wall.

During the demonstration study, groundwater modeling was also performed to further refine the estimated treatment time for the aquifer to reach the Class GA groundwater standards and federal MCL target concentrations. With only one reactive wall in-place at the boundary of the site, the length of treatment time was estimated to be as long as 60 years. The 60-year compliance time was based upon the slow process of diffusion of chlorinated ethenes from the soil as the limiting factor. The goal for treatment was to obtain compliance in a quicker timeframe, approximately 10 to 15 years. The length of treatment time is dependent upon the number of reactive barrier walls. In order to achieve compliance in 15 years, wall design modeling presented in the Feasibility Memorandum showed that the addition of two more walls, located upgradient of the existing wall, would segment the plume and minimize the travel distances needed before the groundwater passes through the reactive wall. A third continuous reactive wall may be required to control movement of chlorinated ethenes past the existing boundary trench that was installed during the demonstration study. Theoretical calculations show that carbonate precipitation could reduce the porosity of the wall to the porosity of the surrounding aquifer in approximately 18 years. The reduced porosity would limit groundwater flow through the wall resulting in groundwater mounding behind the wall. Groundwater mounding would cause groundwater to pass around the ends of the wall. The iron/aquifer interface would be agitated with overlapping 1-foot augers if groundwater elevation monitoring shows that groundwater mounding is occurring. The agitation would break up the precipitation and increase porosity. This effort would be expected if the projected treatment time of 15 years is exceeded and mounding is found to occur.

Alternative MC-3a in the Proposed Plan is the same as Alternative 2 developed in the Draft Feasibility Memorandum for Groundwater Remediation Alternatives using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill (Parsons, August 2000). This report presents a conceptual design based on the results and conclusions of the demonstration study for the reactive iron wall and the groundwater and transport modeling of different treatment wall configurations. Alternative 2 in the Feasibility Memorandum included the excavation and filling of three trenches with 100% iron filings. One wall would be installed approximately 300 ft east of the boundary wall (Middle Wall), the second one would be installed close to the former source area of the plume (Source Wall), and the third one would be installed downgradient from the existing wall, on the furthest point of the Army property, past the fenceline (Compliance Wall).

The costs for Alternative 3a in this Proposed Plan were developed in the Feasibility Memorandum for Groundwater Remediation Alternatives using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill (Parsons, August 2000). These costs were updated based on information collected after completion of the FS. The costs in the Feasibility Memorandum were developed assuming compliance in 15 years as indicated by the groundwater modeling study. However, for comparison purposes, the O&M cost was expanded to 30 years, so that the O&M period for all alternatives in this Proposed Plan is 30 years. The 15-year cost developed in the Feasibility Memorandum and the 30-year comparative cost are presented above.

9.2.5 Alternative MC-4: Interceptor Trenches/Tank Storage/Filtration/Liquid-Phase Activated Carbon /Discharge to Surface Water

MC-4 was not considered further in the detailed analysis because activated carbon is not considered to be effective for vinyl chloride treatment.

9.2.6 Alternative MC-5: Interceptor Trenches/Tank Storage/Filtration/Air Stripping/Discharge to Surface Water

Capital Cost: $543,000
30-Year Present Worth O & M Cost: $1.2 million
Total Present Worth Cost: $1.8 million
Construction Time: Treatability testing would take 2 to 3 months. Construction and startup would take 2 to 4 months.

The MC-5 alternative consists of diverting the impacted groundwater from interceptor trenches to an aboveground treatment system employing an air stripping unit. This option is easily implementable and proven to be effective for removing dissolved VOCs in water. Option MC-5 uses what is commonly referred to as a "pump-and-treat" method of decontaminating groundwater.

One interceptor trench would be located as close as possible to the fence, which runs along the western boundary of SEDA. This trench would prevent off-site migration of the plume. The other trench would be located in the middle of the plume, and constructed in a "V" shape, with a collection sump in the bottom of the "V." Each trench would be approximately 1,000 feet long by 3 feet wide by 8 feet deep. The trenches would extend from the ground surface to the competent shale bedrock. These trenches are ideal for conditions at this site since the groundwater movement is slow, i.e., less than 20 feet per year, and the aquifer thickness is small, i.e. between 2 to 6 feet depending upon the time of year.

The collection trenches would discharge to a collection sump and be pumped to an aboveground on-site treatment facility. At the treatment facility, the collected water would accumulate in a tank that functions as a flow equalizer. Flow fluctuations are expected over the year due to varying aquifer thickness. This tank would be used as a buffer to allow the subsequent treatment unit operations to operate continuously and uniformly.

Filtration would be provided to remove any collected sediment and precipitated metals. It is common for dissolved metals, especially iron, to precipitate as insoluble oxides as the dissolved oxygen content of the collected groundwater increases due to exposure to ambient air. Clogging and coating of unit processes reduces treatment effectiveness, and, therefore, sediment or precipitated metal oxides should be controlled via filtration.

For this option, air stripping would be used as the treatment process that would reduce the concentration of dissolved chlorinated organics to the remedial action objectives, which are to meet NYSDEC Class GA groundwater quality standards and federal MCLs. Air stripping is a common groundwater treatment process, which is effective in treating TCE, 1,2-DCE, and vinyl chloride. Groundwater is passed through a stripping tower, where it is contacted by a countercurrent air stream. Trays or column packing are used to increase the surface area of the air/water contact area to improve the efficiencies of mass transfer operations. The organic contaminants are transferred from the water to the air. Depending on the air emissions requirements, the air phase may be treated or directly discharged to the atmosphere. Air emission control technologies include: vapor- phase activated carbon, thermal oxidation, or catalytic oxidation. Vapor-phase carbon could be used to treat the off-gas in order to minimize air emissions. Vapor-phase carbon is efficient in capturing TCE and heavier organics but is less efficient at capturing 1,2-DCE, and lighter organics. Carbon is inefficient in capturing vinyl chloride.

Thermal oxidation is another off-gas control technology, which can be used to minimize air emissions. A thermal oxidizer works by combusting the off-gas. Thermal oxidizers are effective in treating all of the chlorinated compounds present in the Ash Landfill groundwater.

Catalytic oxidization is another off-gas treatment technology that could be considered for off-gas control. Catalytic oxidation is similar to thermal oxidation in that the organic compounds are thermally destroyed. An advantage of catalytic oxidizers over thermal oxidizers is that catalytic oxidizers operate at lower temperatures and, therefore, have lower operating costs. Like thermal oxidizers, catalytic oxidizers are effective in treating all the organics present in the site groundwater. Catalytic oxidizers may have higher O&M costs than thermal oxidizers, though the day-to-day operation costs are lower.

Following treatment, the effluent would be discharged to the nearby drainage ditches that exist along the sides of the patrol roads. Eventually the water drains to Kendaia Creek. In this case, the effluent would need to meet the requirements for NYSDEC Class C surface water, which is the classification of Kendaia Creek. This option has a estimated treatment time of 30 years.

As stated at the beginning of this section, temporary land use controls for the Ash Landfill site would be required to ensure no withdrawal and/or use of groundwater at the site until ARARs are achieved. An alternate water supply, involving the installation of a water line, would supply drinking water to downgradient receptors. An existing water supply line is located near the former incinerator at the Ash Landfill Operable Unit. This water line is currently not in use but would be extended from SEDA, westerly, down West Smith Farm Road, to the farmhouse. Following base closure, the water supply system would be operated by the Varick Water District. This line would be installed with conventional trenching techniques, extending to below the frost line.

9.2.7 Alternative MC-6: Interceptor Trenches/Tank Storage/Filtration/ Hardness Removal/UV Oxidation/Liquid-Phase Carbon/Drainage Ditch Surface Water Discharge

Capital Cost: $556,000
30-Year Present Worth O & M Cost: $1.3 Million
Total Present Worth Cost: $1.9 Million
Construction Time: Treatability testing would take 2 to 3 months. Construction and startup should take 6 to 9 months.

Similar to Alternative MC-5, this option involves collecting groundwater using interceptor trenches and pumping the collected groundwater to an on-site treatment facility. The collected groundwater receives pretreatment including flow equalization from temporary storage and filtration to remove suspended sediment and any precipitated metal oxides.

Following the pretreatment of groundwater, this option uses liquid phase chemical oxidation from hydroxyl radicals, produced from the interactions of ultraviolet (UV) radiation and hydrogen peroxide, H_2O_2. Ozone may be added if treatment effectiveness is lower than required. This treatment process is proven to be effective in achieving greater than 99 percent destruction efficiency. Generally, by using metering pumps, the contaminated groundwater is mixed with peroxide, and enters the UV reaction chamber. If required, ozone is added to the reaction chamber, and hydroxyl radicals are formed. The formation of the hydroxyl radicals is catalyzed by the UV light. The hydroxyl radicals react rapidly with the chlorinated organics, generating carbon dioxide, chloride and water. If ozone is added, any ozone not reacted is decomposed in an ozone treatment unit prior to discharge.

The effluent from the UV treatment process is then discharged to the drainage ditches that exist along the edge of patrol roads. The surface water eventually would flow to Kendaia Creek. This surface water discharge would need to meet the NYSDEC Class C stream classification quality standards for Kendaia Creek. This option has an estimated treatment time of 30 years.

As stated at the beginning of this section, temporary land use controls for the Ash Landfill site would be required to ensure no withdrawal and/or use of groundwater at the site until ARARs are achieved. An alternate water supply, involving the installation of a water line, would supply drinking water to downgradient receptors. An existing water supply line is located near the former incinerator at the Ash Landfill Operable Unit. This water line is currently not in use but would be extended from SEDA, westerly, down West Smith Farm Road, to the farmhouse. Following base closure, the water supply system would be operated by the Varick Water District. This line would be installed with conventional trenching techniques, extending to below the frost line.

9.2.8 Alternative MC-7: Interceptor Trenches/Tank Storage/Filtration/ Two-Stage Biological Treatment/ Discharge to Surface Water

MC-7 was not considered further in the detailed analysis because of the concern over the reliability of biological treatment with intermittent flow.

10.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

In selecting a remedy, several factors set out in CERCLA § 121, 42 U.S.C. §9621 were considered. Based on these specific statutory mandates the NCP, 40 CFR §300.430(e)(9) and OSWER Directive 9355.3-01, presents nine evaluation criteria to be used in assessing the individual alternatives.

A detailed alternative analysis using the nine evaluation criteria was performed to select a site remedy. This section presents a summary of the comparison of each alternative's strengths and weaknesses with respect to the nine evaluation criteria.

10.1 SUMMARY OF EVALUATION CRITERIA

The nine criteria are summarized as follows:

Threshold Criteria - The following two threshold criteria must be met for the alternatives to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or land use controls.
2. **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)** addresses whether a remedy would meet all of the ARARs of other federal and state environmental laws and/or would provide grounds for invoking a waiver.

Primary Balancing Criteria - Once an alternative satisfies the threshold criteria, the following five criteria are used to compare and evaluate the elements of the alternative.

1. **Long-term effectiveness and permanence** addresses the criteria that are used to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they would prove successful.
2. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives use recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principle threats posed by the site.
3. **Short-term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until the cleanup goals are achieved.
4. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services to implement a particular option.
5. **Cost** includes estimated capital, operation and maintenance (O&M), and present worth costs.

Modifying Criteria - The modifying criteria are used in the final evaluation of remedial alternatives, generally after the lead agency has received public comments on the RI/FS and Proposed Plan.

1. **State acceptance** addresses the state's position and key concerns related to the selected remedy and other alternatives, and the state's comments on ARARs or the proposed use of waivers.
2. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS.

The assembled alternatives were screened as described in the EPA guidance. These alternatives were evaluated against short-term and long-term aspects of three broad criteria: effectiveness, implementability, and cost. Because the purpose of screening is to reduce the number of alternatives that would undergo detailed analysis, the screening conducted in this section is of a general nature. Although this is necessarily a qualitative screening, care has been taken to ensure that screening criteria are applied consistently to each alternative and that comparisons have been made on an equal basis, at approximately the same level of detail.

10.2 COMPARISON OF ALTERNATIVES

The following presents the nine criteria, summaries of the alternatives, and identifies the relative advantages and disadvantages of each according to the detailed comparative analysis. **Table 10-1** provides a summary of each source control alternative and how each alternative complies with these requirements. **Table 10-2** provides a similar summary for each migration control alternative and how each alternative complies with these requirements.

10.2.1 Overall Protection of Human Health and the Environment

Alternative SC-1, the No-Action alternative for soil, is protective of human health from exposure to soil for on-site residents, hunters, and construction workers. The non-carcinogenic risks from exposure to soil, following the IRM are 0.01, 0.0075, 0.064, respectively, which are below the EPA target level of 1. The carcinogenic risks from exposure to soil, following the IRM, have been calculated as $1x10^{-5}$, $9.4x10^{-6}$, $3.7x10^{-6}$ for on-site residents, hunters, and construction workers, respectively. All carcinogenic risk values are within the EPA target level of $1x10^{-4}$ and $1x10^{-6}$.

In addition to risk calculation, NYSDEC also considers exceedances of TAGM guideline values as a factor in determining protectiveness for human health. Following the IRM, instances remain where soils are found to exceed the NYSDEC TAGM guideline limits for PAHs and metals. Overall, these exceedances do not cause the various site risks to exceed the EPA target levels.

An ecological survey, performed during the RI, reported no observable ecological damage. Concentrations of selected metals in soil samples collected from the Ash Landfill, Debris Piles and NCFL were detected at levels above guideline values considered to be protective for ecological receptors from long-term exposure. Therefore, ecological receptors were considered to be at an increased risk and not protected.

Alternative MC-1, the No-Action alternative, would not be protective of human health if groundwater were ingested. The non-carcinogenic risk due to ingestion of groundwater, calculated during the RI, was 3.2, which is above the EPA target value of 1. The carcinogenic risk from ingestion of groundwater, calculated during the RI is 1.4×10^{-3}, which is above the EPA target range of 1×10^{-4} and 1×10^{-6}. The updated risk calculation from ingestion of groundwater has not been performed following the RI or the IRM but the risk would be expected to be less, since the concentrations in groundwater have decreased, in some instances almost 100-fold, as a result of the IRM.

Ingestion of groundwater would occur if residential use were permitted. However, residential use of the Ash Landfill Operable Unit is not the current or planned intended future use. The groundwater plume has migrated beyond the SEDA boundary. At monitoring well MW-56, which is located 225 feet beyond the SEDA boundary, 1,2-DCE has been detected at levels as high as 2 μg/L. The NYSDEC GA and federal MCL for 1,2-DCE is 5 μg/L. This compound has not been detected in the last sampling rounds in October 1999, January 2000, September 2001, April 2002, and August 2002.

As a means to control further migration, to evaluate an innovative technology, and to expedite site remediation, the Army conducted an in-situ demonstration study of the zero valence iron technology. Zero valence iron has been shown to be effective in chemically destroying chlorinated ethene compounds through a process known as reductive dechlorination. In December 1998, the Army installed a 650-foot long permeable reactive barrier trench at the boundary of the Depot, perpendicular to the flow of the groundwater plume and spanning the entire width of the plume. The trench extended from one foot below the ground surface to the top of the competent bedrock and was backfilled with a 50/50 mixture of clean sand and zero-valence iron. Eleven monitoring wells, three clusters of three wells, were installed immediately upgradient, within and immediately downgradient of the reactive wall, with one well being added at each end of the trench. Groundwater monitoring of the trench performance went on for approximately one year. The results of the study indicated that the trench was successful in reducing the concentrations of chlorinated ethenes to non-detectable or low levels. However, there was some field evidence (such as complex hydraulics and inconsistent degradation half-life) that had to be considered in the selection of the final design parameters. This trench is associated with Alternative MC-3a.

Upgradient of the reactive barrier trench, there would be little immediate reduction in risk or in the toxicity, mobility, or volume of the contaminants. The risk assessment indicated that the majority of the site risk is due to ingestion of groundwater for on-site residents. The primary source of the groundwater impacts has been eliminated via thermal treatment during the IRM. Natural attenuation would reduce the contaminant concentrations to federal and state drinking water standards, however, this would take many years. The volume of groundwater contaminated would also not increase appreciably with time, due to the zero valence iron trenches that would prevent continued migration of contaminants. Land use restrictions would prevent on-site ingestion of groundwater. Human exposure could occur due to off-site migration of contaminated groundwater that was present downgradient beyond the trench. Groundwater modeling has indicated that the concentration of groundwater would be below NYSDEC Class GA standards and federal MCLs.

Alternative SC-2 was ranked high for long-term protectiveness, since no waste would remain on-site. However, the short-term protectiveness of this alternative was ranked the lowest, since the increased number of trucks transporting the waste would increase the risks associated with collisions, injury and dust. MC-2, the alternative water supply, affords protection of human health since an alternative potable water supply would ensure clean water to the off-site residents. Since the existing reactive barrier wall would mitigate continued off-site migration, only the groundwater beyond the reactive wall would potentially affect the downgradient receptor. Therefore, some contaminated water would likely continue to migrate into other portions of the aquifer system and increase the volume of contaminated groundwater. In Alternative MC-2, there would be minimal on-site reduction in risk and in the toxicity, mobility, or volume of the contaminants. Natural attenuation to reduce the contaminant concentrations to federal and state drinking water standards would take many years.

Alternative SC-3 was ranked moderately protective for long and short-term protectiveness. Since this alternative involves excavation, consolidation at the NCFL and capping the NCFL, truck traffic would be a concern even though traffic would be reduced compared to SC-2. Truck traffic would be necessary since clean backfill and capping material would have to be transported on-site. Dust would also be a short-term concern during construction. Long-term, the risk following consolidation of soils contaminated with metals and PAHs at the NCFL would require that the cap be maintained to prevent exposure to humans and to ecological receptors. This alternative is considered to be protective since exposure to metals and PAHs would require excavation into the landfill, which is considered unlikely.

MC-3 and MC-3a were ranked high for protectiveness, since treatment would prevent off-site migration and additional trenches would reduce on-site concentrations. Active pumping alternatives are limited in effectiveness since the groundwater fluctuates dramatically during the year, meaning that at certain times of the year the pumping system would likely be dry or minimal. Migration of contaminated groundwater beyond the trenches would be a concern for protectiveness. Modeling has shown that the concentrations would be reduced to levels that are protective by the time the groundwater reached the downgradient supply well. Monitoring would be performed to ensure that exposure is not above state and federal standards for drinking water.

Overall, Alternative SC-4, soil washing, ranks the highest for long-term protection of human health and the environment by actively treating soil on-site, thereby decreasing risks due to off-site transportation. Contamination would be concentrated by washing, and it would be treated for eventual disposal off-site. The amount of off-site disposal required is the smallest for this alternative and, therefore, would require the least number of trucks for transport.

Alternatives MC-5 and MC-6 were ranked equally high as MC-3 and MC-3a for protectiveness, because all these alternatives remove VOC contamination from the groundwater. For Migration Control Alternatives, protectiveness is a function of capturing and preventing migration of groundwater to off-site receptors. Each of these alternatives collects groundwater through trenches located at the boundary of the site and at locations within the site; therefore, all are ranked equally high. MC-4 and MC-5 involve active removal but would not be effective during dry periods of the year. Further, these alternatives would be affected by fouling of treatment systems due to iron and hardness. If the fouling were severe, treatment would not be effective and the alternative would not be protective. MC-4 was not considered further in the detailed analysis since carbon is not considered to be effective for vinyl chloride treatment, and sufficient treatment can be expected for VOCs via MC-5 by air stripping. Alternative SC-5 was ranked high for protectiveness, but ranked lower than SC-4, since contaminated material would remain on-site. Since this alternative would involve minimal excavation and off-site disposal for Debris Piles only, no excavation of the landfill would be required.

10.2.2 Compliance with ARARs

Federal and state MCLs are chemical-specific ARARs. Federal MCLs were selected as the remedial requirements for groundwater remediation, except when more stringent NYSDEC GA standards existed. Compliance with ARARs would be considered for migration control alternatives only since the IRM has treated and eliminated the source of VOCs in groundwater. There are no soil standards. NYSDEC TAGM values are guidelines, not standards. However, the NYSDEC TAGM values are To Be Considered (TBC) criteria. Alternatives MC-1 and MC-2 are not expected to meet chemical-specific ARARs in groundwater as neither involves active, continuous remediation methods. Natural degradation and flushing of groundwater may eventually result in achievement of ARARs; however, the time frame has been estimated as over 100 years. The active extraction system required under Alternatives MC-5 and MC-6 would provide the best possible containment system for the groundwater contaminant plume. The groundwater extraction scheme in Alternatives MC-5 and MC-6 would create a capture zone slightly more extensive than MC-3 or MC-3a. It would allow less contamination to migrate off-site and extract a greater volume of contamination since active pumping would be used. Additionally, removal of contaminants to achieve the MCLs in such situations would also be difficult due to long-term diffusion of contamination from the glacial till. Hydrologic modeling and aquifer tests performed during the RI indicate that properly placed extraction trenches would create a capture zone; however, these models overestimate the time to achieve cleanup goals, since all models cannot account for diffusional aquifer matrix effects accurately. The time frame for Alternatives MC-3, MC-5 and MC-6 to achieve compliance with chemical-specific ARARs in the glacial till aquifer are likely to be between 30 to 50 years. Alternative MC-3a is likely to stimulate natural biodegradation, since the chemical reactions in the iron wall release hydrogen, a substance that is used up in microbial dechlorination. This would decrease contaminant levels, which can be expected to significantly reduce the time to achieve ARAR compliance compared to Alternatives MC-3, MC-5 and MC-6.

Alternatives MC-5 and MC-6 include surface water discharge of treated groundwater. Discharge requirements are generally the federal and State AWQC. The discharge from the groundwater treatment system would be designed to meet the federal AWQC and the anti-degradation limits.

Alternatives MC-5 and MC-6 are expected to achieve other ARARs including the RCRA requirements for treatment facilities, the Department of Transportation (DOT) requirements for off-site transportation of any residual materials, and the New York Solid and Hazardous Waste Regulations and the Occupational Safety and Health Act (OSHA). In addition, the operation of the treatment system in Alternative MC-4 would comply with federal and state air standards.

10.2.3 Long- Term Effectiveness and Permanence

Alternatives SC-1, MC-1 and MC-2 would not remove or contain contaminants in the groundwater in a continuous or active manner, with the exception of what would be removed by the reactive barrier wall that is currently in place and operating. Contaminants would continue to migrate and the volume of contaminated groundwater would increase. The No-Action alternative, MC-1, and the alternative water supply alternative, MC-2, are not considered to be effective over the long-term because contaminated groundwater, other than that captured via the reactive barrier wall, remains on-site and some migration off of the property would occur. This condition currently does not affect the drinking water of off-site residents and groundwater modeling has indicated that the concentrations of contaminants would be below drinking water standards by the time the groundwater reaches these wells. These alternatives would require long-term monitoring and sampling.

Alternatives MC-3, MC-5 and MC-6 are all expected to be equal in providing long-term permanence, since each alternative would operate until the desired concentration levels are achieved. The limiting factor in achieving this goal is the rate at which contaminants can be flushed out of the soil matrix. Since the aquifer matrix is glacial till and is high in clay content, diffusion is likely to play an important role in releasing contamination from the aquifer. This means the time for cleanup would be long, estimated to be approximately 45 years. MC 3a is expected to take 15 years.

Alternative SC-2 is ranked high for long-term effectiveness and permanence since all materials would be excavated and disposed of in an off-site landfill. Once in the landfill, the contaminated materials are permanently entombed. However, since this alternative does not permanently fix the contaminants and involves such large volume of soil, these wastes may not be as permanently entombed as Alternative SC-4. Therefore, although SC-2 is ranked high for permanence, Alternative

SC-4 is ranked the highest for long-term effectiveness and permanence. Under this alternative, contaminants are consolidated, by soil washing, and permanently fixed by stabilization/solidification. Soil washing and stabilization/solidification technology are considered reliable. Following treatment, the stabilized waste would be disposed of in an off-site landfill. The remaining materials left on-site would be free of metals and PAHs. Therefore, SC-4 is considered the best from the standpoint of permanence. Although some metals and PAH impacted soil would remain at the site under Alternatives SC-3 and SC-5, these alternatives are expected to be generally effective in providing long-term permanence. Waste materials would be isolated within either the NCFL or where the materials are currently located, and they would be covered. Providing that the covers remain in-place, the waste materials would not pose a threat due to direct contact and would, therefore, be permanent. Both alternatives are equally permanent for long-term leaching, since the landfills have been in-place for decades without causing a concern due to leaching. Perhaps, Alternative SC-5 is somewhat more attractive, since all other alternatives, except the no-action alternative, include excavation, which could cause materials, such as metals, to become more leachable, either through interaction with other waste materials or from an increase in the surface area of the waste, following excavation and sorting.

10.2.4 Reduction in Toxicity. Mobility, or Volume

Alternatives MC-1, MC-2 and SC-1 would not provide for any active, continuous mechanisms for the containment, removal, treatment, or disposal of contaminated groundwater, other than what would be accomplished by the reactive barrier wall. Alternatives SC-2, SC-3, and SC-5 would not reduce the toxicity, mobility or volume, as there is no treatment performed. For these alternatives, materials are either land filled or covered in-place. SC-2 would include some reduction in mobility following off-site disposal in a landfill. However, there could also be an increase in mobility if disposed waste from the Ash Landfill were to interact with leachate produced from other waste products at the Subtitle D landfill. Presumably, the landfill would have provisions to accumulate and handle any leachate produced; nonetheless, the possibility that a leak could occur is remote. SC-4 would provide the greatest reduction in toxicity, mobility, or volume by providing the most amount of treatment. This alternative involves reduction in volume by soil washing followed by fixation. Chemical fixation, i.e. stabilization/solidification, would decrease the toxicity by making the materials less available for bio-uptake, and reduce the mobility through the chemical bonding that would occur during fixation. Eventually, the stabilized waste would be disposed of in an off-site landfill but the amount would be less than what would have been necessary if soil washing had not been performed. SC-5 involves the least amount of off-site land filling and therefore is the alternative that meets the goal of the NCP to minimize the amount of material that is disposed of in an off-site landfill.

Alternatives MC-3, MC-3a, MC-4 and MC-5 rely on either active pumping or passive treatment of groundwater and are dependent upon yields from the till aquifer. Therefore, these alternatives would all result in reduction in mobility and volume. However, since MC-3a and MC-6 chemically destroy the contaminant, there is a decrease in toxicity, as well.

10.2.5 Short-Term Effectiveness

Providing that groundwater at the site is not used for drinking water, all migration control alternatives provide limited effectiveness in the short-term. Installation of interceptor trenches or barrier trenches could be accomplished without large excavations, thereby effectively achieving contaminant reduction in the short term. However, alternatives, such as MC-4 and MC-5 that involve construction of a treatment facility, would require a longer time for construction. The system would not be effective in recovering groundwater during the periods of the year when the water table is low. MC-3a is considered to be the best for short-term effectiveness, since it would require the least amount of time to be implemented and to be effective and would operate throughout the entire year.

The source control alternatives that require excavation are also effective in the short-term. However, large excavations such as those included under SC-2, SC-3 and SC-4 would require extended time for completion. Alternative SC-5 can be implemented quickly and would require the shortest time to be effective.

10.2.6 Implementability

Excluding the No-Action alternatives, MC-1 and SC-1, which would not require any effort to implement and therefore are the easiest to implement, SC-5 is ranked the highest for implementability of the source control alternatives. This is because the excavation portion of this alternative is minimal and construction of the cover over the Ash Landfill and NCFL would involve a small amount of material to import. The cover would not be an impermeable RCRA landfill cover but would be a vegetative cover, which is easy to implement. Alternative SC-4, the soil washing alternative, was considered to be the most difficult to implement and was therefore ranked the lowest for implementability. This is because soil washing requires specialized equipment and personnel who have expertise in the technology. Although such equipment and experts are available, they are less available than local excavation contractors who can easily implement alternatives such as SC-2 and SC-3. While alternatives that involve excavation may be easy to implement from a technical sense, large excavations pose their own complexities. Complexities of the excavation alternatives include: verification and confirmational testing, soil stockpile management, excavation pit dewatering, available landfill space, weather factors, dust and noise abatement, logistical truck traffic control, and availability of trucks to transport a large amount of materials. Further, due to the requirements of the RCRA Land Disposal Restriction (LDR), results of confirmational testing could require that excavated soil be treated to stabilize the soil prior to disposal. This would add an additional aspect of the work that would lead to difficulty in implementation.

Alternatives MC-2, MC-3 and MC-3a would be the easiest to implement. Minimal effort would be required to install an alternative water line and perform the monitoring. Several of the wells to be used for monitoring already exist. Alternative MC-3a would also be easily implemented, requiring installation of additional reactive barrier walls. The 650-foot long existing reactive wall at the site was installed in one week. This alternative could be implemented immediately and would be effective in reducing off-site migration and the on-site concentrations. The time required to implement Alternative MC-3a is estimated to be 6 months for design and construction. Alternatives MC-5 and MC-6 involve standard construction practices for contaminated groundwater and would be technically easy to implement. These alternatives were ranked lower than MC-3a because of the need to construct an aboveground treatment facility.

The extraction trench proposed under Alternatives MC-5 and MC-6 could be designed and installed relatively easily. The effectiveness of the groundwater pumping would be dependent upon the productivity of the glacial till aquifer. Information obtained during the RI indicates that it may not be possible to extract groundwater during all times of the year. In addition, the extracted groundwater is anticipated to be high in iron and alkalinity, which would cause long-term performance issues.

Installation of the alternative water pipeline extension and connections is a simple engineering task, but would require coordination with local officials.

10.2.7 Costs

There is no capital cost associated with Alternatives SC-1 and MC-1. The capital cost for Alternative SC-2, excavation and off-site disposal of the Ash Landfill and NCFL, is estimated to be $17,500,000. There is no annual O&M cost associated with this alternative, since no residual materials would remain on-site. The capital cost for Alternative SC-3, excavation of the Ash Landfill and Debris Piles and consolidation at the NCFL, is estimated to be $1.4 million. The 30-year present worth O&M cost is estimated to be $490,000. The total present worth cost is estimated to be $1.89 million. The capital cost for Alternative SC-4, excavation, soil washing, stabilization/solidification, is estimated to be $31.5 million. The 30-year present worth O&M cost is estimated to be $490,000. The total present worth cost for Alternative SC-4 is estimated to be $32 million. The capital cost for Alternative SC-5, excavation and off-site disposal of the Debris Piles/vegetative cover of the Ash Landfill and the NCFL, is estimated to be $237,000. The 30-year O&M cost is estimated to be $490,000. The total present worth cost for SC-5 is estimated to be $727,000.

The capital cost for Alternative MC-2, the alternative water supply option, is estimated to be $160,000. The 30-year present worth O&M cost is estimated to be $794,000. The total present worth cost is estimated to be $954,000. The capital cost for Alternative MC-3, air sparging of the plume, is estimated to be $668,000. The 30-year O&M cost for maintenance of the sparging system and for long-term groundwater monitoring is estimated to be $1.79 million. The interest rate used to calculate the present worth cost was 10% and the compounding period was 30 years. The total present worth cost for Alternative MC-3 is estimated to be $2.46 million. The capital cost for Alternative MC-3a, the zero valence iron reactive walls, is estimated to be $2.05 million. The 30-year O&M cost of the reactive wall system and for long-term groundwater monitoring is estimated to be $813,000. The total 30-year present worth cost for Alternative MC-3a is estimated to be $2.86 million. No capital or present worth costs have been estimated for MC-4, groundwater extraction and treatment using activated carbon, since this alternative was dropped from further consideration during the alternatives screening portion of the feasibility study. The capital cost for Alternative MC-5, groundwater extraction and treatment using air stripping is estimated to be $543,000. The 30-year O&M cost for maintenance of the air stripping system and for long-term groundwater monitoring is estimated to be $1.2 million. The interest rate used to calculate the present worth cost was 10% and the compounding period was 30 years. The total present worth cost for Alternative MC-5 is estimated to be $1.8 million. The capital cost for Alternative MC-6, groundwater extraction and treatment using UV/Ozone, is estimated to be $556,000. The 30-year O&M cost for maintenance of the sparging system and for long-term groundwater monitoring is estimated to be $1.3 million. The interest rate used to calculate the present worth cost was 10% and the compounding period was 30 years. The total present worth cost for Alternative MC-6 is estimated to be $1.9 million.

10.3 SUMMARY OF THE COMPARISON OF ALTERNATIVES

Source Control

Alternatives SC-3, SC-4 and SC-5 were determined to meet the site specific remedial objectives for soil. That is, they would be protective against dermal contact with and ingestion of soils in the Debris Piles and the landfills.

Alternative SC-5 received the highest overall score due to its low costs, protectiveness of human health and the environment, implementability and availability.

Alternative SC-4 ranks highest for long-term protectiveness of human health and the environment, permanence, and reductions in toxicity, mobility, and volume of hazardous contaminants. Alternative SC-3 ranks next highest for costs because the present worth cost of this alternative is $1.89 million, which is the lowest cost of the remaining alternatives involving remedial actions.

Migration Control

As described above, all of the alternatives described in the detailed analysis would be effective for the Migration Control remedial action at the Ash Landfill for the future intended use of the site.

Alternatives MC-2, MC-3, MC-5, and MC-6 were determined to meet the site specific remedial objectives for groundwater. All four alternatives rank equally for long-term protectiveness of human health and the environment. That is, the alternatives are effective in reducing the concentration of

COCs to below the NYSDEC GA or federal standards and in protecting off-site receptors. All alternatives rank equally in reducing toxicity, mobility, and volume of hazardous contaminants. The difference between the alternatives is in the time-to-compliance.

Alternative MC-2 ranks highest in terms of technical implementability. Alternatives MC-5 and MC-6 rank lower in terms of technical implementability, and Alternative MC-3 ranks lower because it is an innovative technology.

Alternative MC-2 ranks highest for costs because the only costs associated with this alternative are for groundwater monitoring and possible land use controls.

Alternative MC-3a ranked high for total costs but low on short-term protectiveness and long term monitoring.

11.0 SELECTED REMEDY

Based on an evaluation of the various options, the selected remedy is Alternative SC-5 for source control and Alternative MC-3a for migration control (**Figure 11-1**). The elements that compose the selected remedy include the following:

- Excavation and off-site disposal of debris piles and establishment and maintenance of a vegetative soil cover for the Ash Landfill and the Non-Combustion Fill Landfill (NCFL) for source control;
- Installation of three in-situ permeable reactive barrier walls filled with 100% zero valence iron, and maintenance of the proposed walls and the existing wall for migration control of the groundwater plume;
- Contingency plan including additional monitoring and air sparging, as necessary;
- Land Use Controls (LUCs) to attain the remedial action objectives, including ensuring that the integrity of the 12 inch vegetative soil layer is maintained to limit ecological contact and preventing future owners from ingesting site groundwater until ARARs are achieved; and,
- Five-year review to evaluate whether the response actions remain protective of public health and the environment.

During the excavation of the Debris Piles, the Ash Cooling Pond area will be re-graded to fill the pond.

Since this alternative will result in contaminants remaining at the site that are above levels that allow unlimited use and unrestricted exposure, LUCs (*e.g.*, deed restrictions such as easements and covenants, deed notices, land use restrictions such as zoning and local permitting, groundwater use restrictions, five-year reviews) will be required to ensure that the integrity of the 12 inch vegetative soil layer is maintained to limit ecological contact with materials below the cover, and a temporary LUC will be required to ensure no withdrawal and/or use of groundwater until ARARs are achieved. These land use controls will be implemented over the area of the groundwater plume, NCFL, and the Ash Landfill, as shown on **Figure 2-3**. For this site, the Army's selected LUCs will include supplemental measures that will be documented in detail in the Remedial Design Plan. An implementation and enforcement plan detailing implementation actions will be provided in the Remedial Design Plan. Entities expected to be responsible for implementing and maintaining the remedy are the Army and any other entity (*e.g.*, a transferee) who the Army subsequently identifies to the regulators through timely written notice, which shall include the entity's name, address, and general remedial responsibility.

The five-year reviews are intended to evaluate whether the response actions remain protective of public health and the environment, and they will consist of document review, ARAR review, interviews, inspection/technology review, and reporting.

A contingency plan will be developed as part of this preferred alternative. The contingency plan will include additional monitoring and air sparging, as necessary. Following installation of the reactive walls, groundwater from monitoring well MW-56 will be analyzed, and the VOC results will be compared to the Class GA groundwater standards (trigger criteria). If a statistical analysis of the data for this well shows exceedances of Class GA standards, additional remedial action would be required. Temporary wells will be installed in the vicinity of MW-56, and the results will be used to develop an approach for air sparging. A description of the air sparging process is summarized in Alternative MC-3. If concentrations at MW-56 continue to exceed the trigger values following air sparging, an activated carbon system for the farmhouse water supply system would be installed or public water would be delivered to the house. More extensive air sparging would be performed until trigger values are no longer exceeded.

Alternative SC-5 was selected as the preferred source control alternative because the vegetative cover will be an effective barrier against exposure and is therefore one of the highest ranked alternatives for protectiveness to human and ecological receptors. The alternative minimizes the negative short-term effects, such as truck traffic and dust problems, that a large excavation would cause. SC-5 will be compliant with all ARARs. This alternative also minimizes the amount of off-site land filling that will be required. SC-5 is the easiest to implement and has the lowest cost.

Alternative, MC-3a, was selected as the preferred management of migration alternative because it will achieve substantial risk reduction by chemically destroying the dissolved chlorinated ethene compounds in groundwater. This alternative is effective in achieving these reductions. The alternative will be protective of human health and the environment by preventing off-site migration of the VOC plume. Monitoring of the plume will ensure that downgradient receptors are protected. The monitoring plan will provide adequate warning should monitoring data indicate that the plume is threatening the drinking water supply wells of site neighbors, i.e., the farmhouse wells.

12.0 STATUTORY DETERMINATIONS

As noted previously, CERCLA §121(b)(1), 42 U.S.C. §9621(b)(1), mandates that a remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions, which employ treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, or contaminants at a site. CERCLA §121(d), 42 U.S.C. §9621(d), further specifies that a remedial action must attain a degree of cleanup that satisfies ARARs under federal and state laws, unless a waiver can be justified pursuant to CERCLA §121(d)(4), 42 U.S.C. §9621(d)(4).

For reasons discussed below, the remedial action selected for implementation at the Ash Landfill site is consistent with CERCLA §121, 42 U.S.C. §9621 and, to the extent practical, the NCP. The selected remedy is protective of human health and the environment, attains ARARs, and is cost effective.

12.1 THE SELECTED REMEDY IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy is protective of human health and the environment through the use of a combination of treatment/engineering controls. The source control remedy uses engineering and treatment controls to further reduce acceptable human health and ecological risks by eliminating the highest levels of lead found in soils and by reducing the potential of exposure to low levels of selective metals and PAHs in soils using a vegetative soil cap. This action also reduces the potential for these contaminants to migrate to groundwater, even though their migration potential is considered very low in both the short-term and long-term. The migration control remedy protects human health and the environment through the use of treatment controls to reduce the concentrations of both TCE and 1,2-DCE in the groundwater to below 5 μg/L, the NYSDEC criteria for Class GA groundwater.

12.2 THE SELECTED REMEDY ATTAINS SITE ARARS

The selected remedy complies with all ARARs. The concentrations of VOCs in groundwater would be reduced to concentrations below the NYSDEC Class GA Standards. A list of the ARARs for this remedy are shown in **Appendix D**.

12.3 THE SELECTED REMEDY IS COST-EFFECTIVE

The selected remedy for source control (SC-5) is the most cost-effective alternative of the five alternatives retained for detailed evaluation after the no-action alternative. This alternative attains ARARs, is technically feasible, provides overall protectiveness to human health and the environment proportionate to its cost, and therefore, represents a reasonable value. The small incremental benefit that may be present in the evaluation criteria for the other source control alternatives is not proportionate to the costs and, therefore, does not justify using these alternatives.

Although the selected remedy for migration control (MC-3a) has the highest total cost of the migration control alternatives retained for detailed evaluation, this alternative affords overall protectiveness of human health and the environment, attains ARARs over time, and provides good short-term and long-term effectiveness. This remedial alternative is considered to be moderately technically feasible and implementable. The other alternatives do not provide any significant incremental benefits for the various evaluation criteria and their greater difficulty in implementation do not justify using these alternatives.

12.4 THE SELECTED REMEDY UTILIZES PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT OF RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedy meets the statutory requirement for a permanent solution by ensuring that the VOC plume does not impact any potential on-site or off-site receptors and the permeable reactive barrier walls would gradually reduce the concentrations below the site-specific cleanup goals. Groundwater monitoring would be used to assess the progress of this system and, possibly, to detect any off-site migration of the plume front. The selected remedy provides the best balance of trade-offs among the alternatives with the respect to the evaluation criteria.

The alternative remedies evaluated do not provide incremental benefits that justify the dramatic increase in costs. The selected remedy would be considered permanent when the concentrations of VOCs in groundwater are reduced to the site-specific cleanup levels for groundwater. The selected remedy for source control (SC-5) meets the statutory requirement for permanence by disposing of the excavated soils off-site in a secure, non-hazardous, Subtitle D landfill and by the construction and maintenance of a vegetative soil cap for the Ash Landfill and the NCFL. The selected remedy also meets the statutory requirement for utilizing alternative treatment or resource recovery technologies to the maximum extent practicable by weighing costs as a primary factor. The selected remedy affords the most cost-effective, and most easily implementable remedy while providing the required level of overall protectiveness of human health and the environment. Alternative treatment technologies such as alternative SC-4 (soil washing and solidification) do not provide enough additional significant benefits to justify the high costs ($32 million) associated with this remedy.

12.5 THE SELECTED REMEDY SATISFIES THE PREFERENCE FOR TREATMENT THAT PERMANENTLY AND SIGNIFICANTLY REDUCES THE TOXICITY, MOBILITY OR VOLUME OF THE HAZARDOUS SUBSTANCES AS A PRINCIPAL ELEMENT

The statutory preference for treatment as a principal element is satisfied by the selected remedy for migration control (MC-3a) although the remedy for source control (SC-5) does not use treatment. The source control remedy relies on off-site disposal in a landfill and the migration control alternative relies on a zero valence iron treatment system to treat the concentrations of VOCs in groundwater. Although the selected source control remedy does not rely on treatment as the principal element, it does address the principal threats posed by soils. The permeable reactive barrier walls use reactive iron metal as a treatment system for the chlorinated compounds in the groundwater. These selected remedies provide the most cost-effective and easily implementable alternatives that can achieve the maximum extent of overall protection of human health and the environment.

13.0 DOCUMENTATION OF SIGNIFICANT CHANGES

(Reserved).

14.0 STATE ROLE

(Reserved)

PARSONS

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RECORD OF DECISION
ASH LANDFILL

DEPT.	DWG NO
ENVIRONMENTAL ENGINEERING	734516-01001

FIGURE 2-1

LOCATION MAP

SCALE	DATE
1"= 8 MILES APPROX.	JULY 2002

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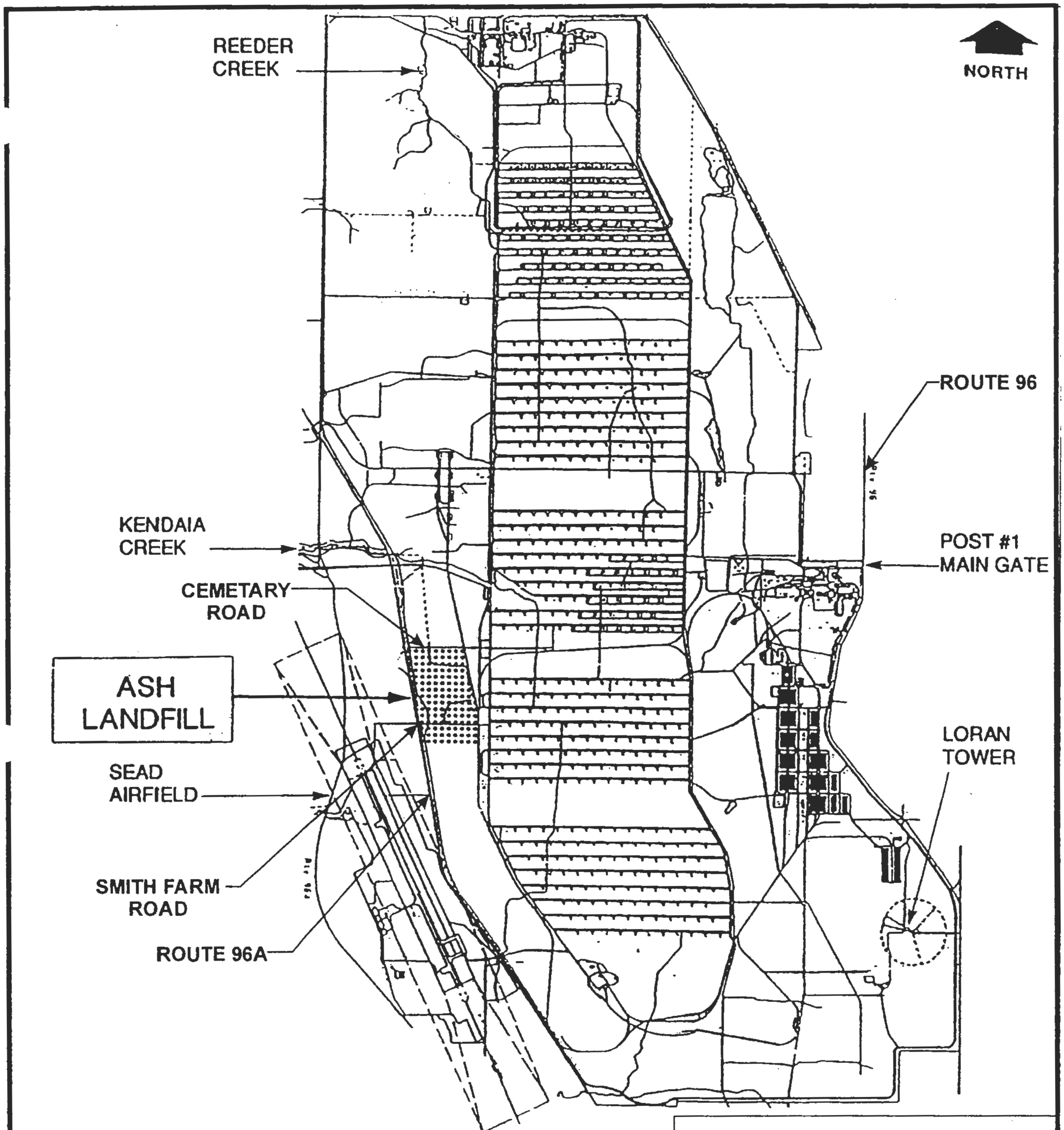

PARSONS

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY

RECORD OF DECISION
ASH LANDFILL SITE

DEPT. ENVIRONMENTAL ENGINEERING	DWG NO 726510-02007

FIGURE 2-2

LOCATION OF ASH LANDFILL AT SEDA

SCALE NA	DATE July 2002

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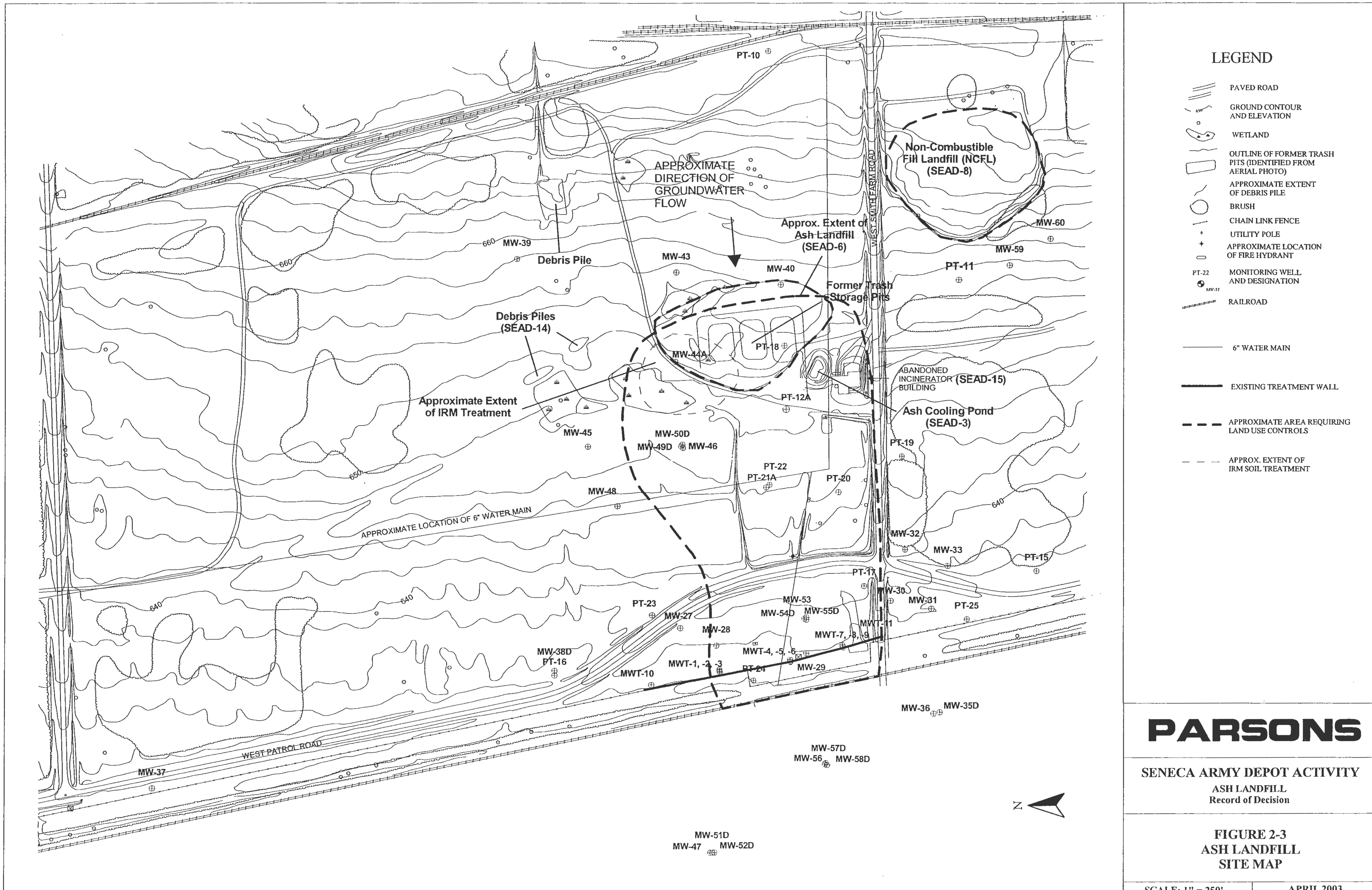
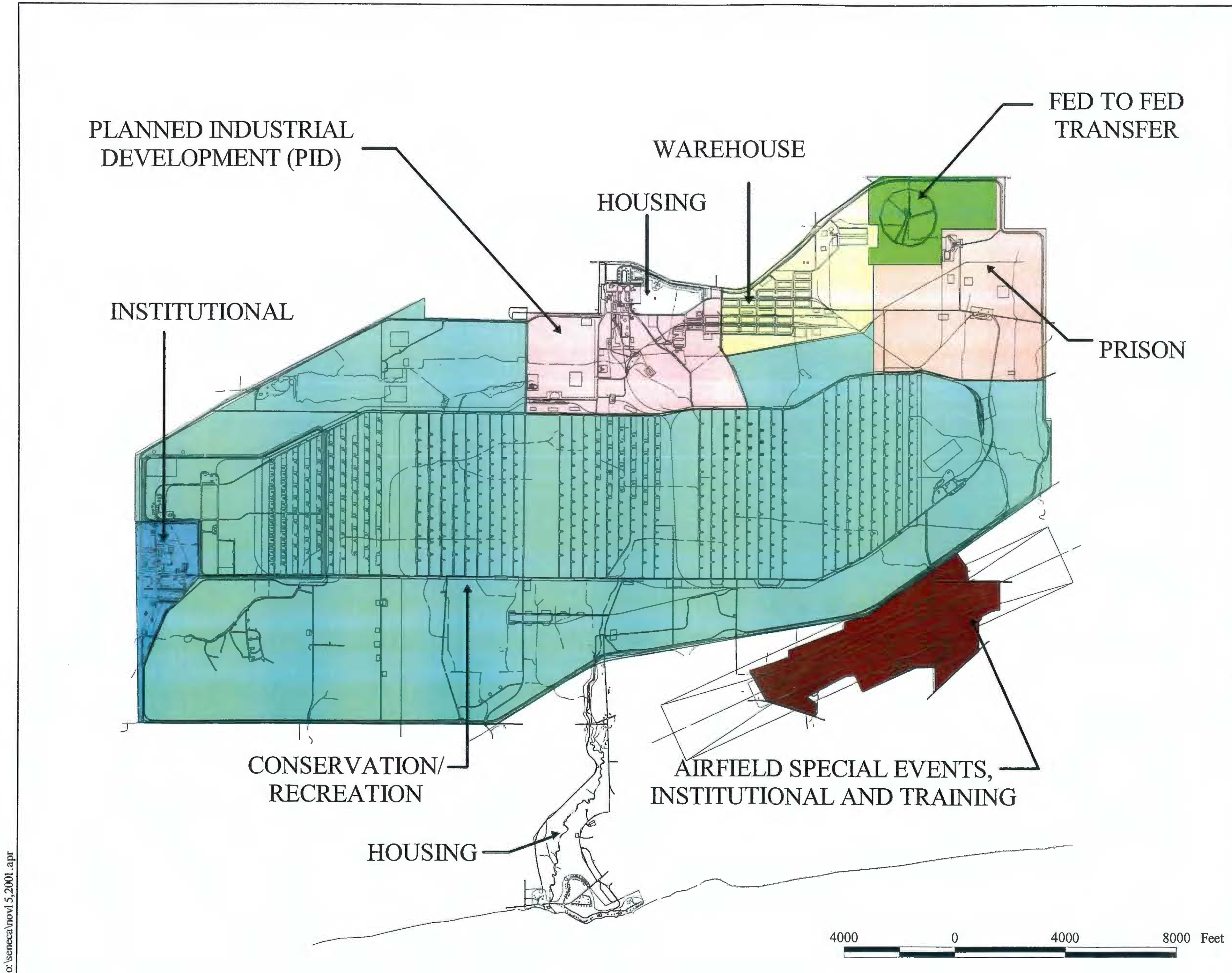


PARSONS

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
Record of Decision

FIGURE 2-3
ASH LANDFILL
SITE MAP

SCALE: 1" = 250' | APRIL 2003



LEGEND

- Airfield
- Conservation
- Federal
- Industrial
- Institutional
- Prison
- Warehouse
- Housing

N

PARSONS

SENECA ARMY DEPOT ACTIVITY
Ash Landfill
Record of Decision

FIGURE 3-1
SENECA ARMY DEPOT ACTIVITY
LAND REUSE MAP

Scale as Shown | DATE: APRIL 2003

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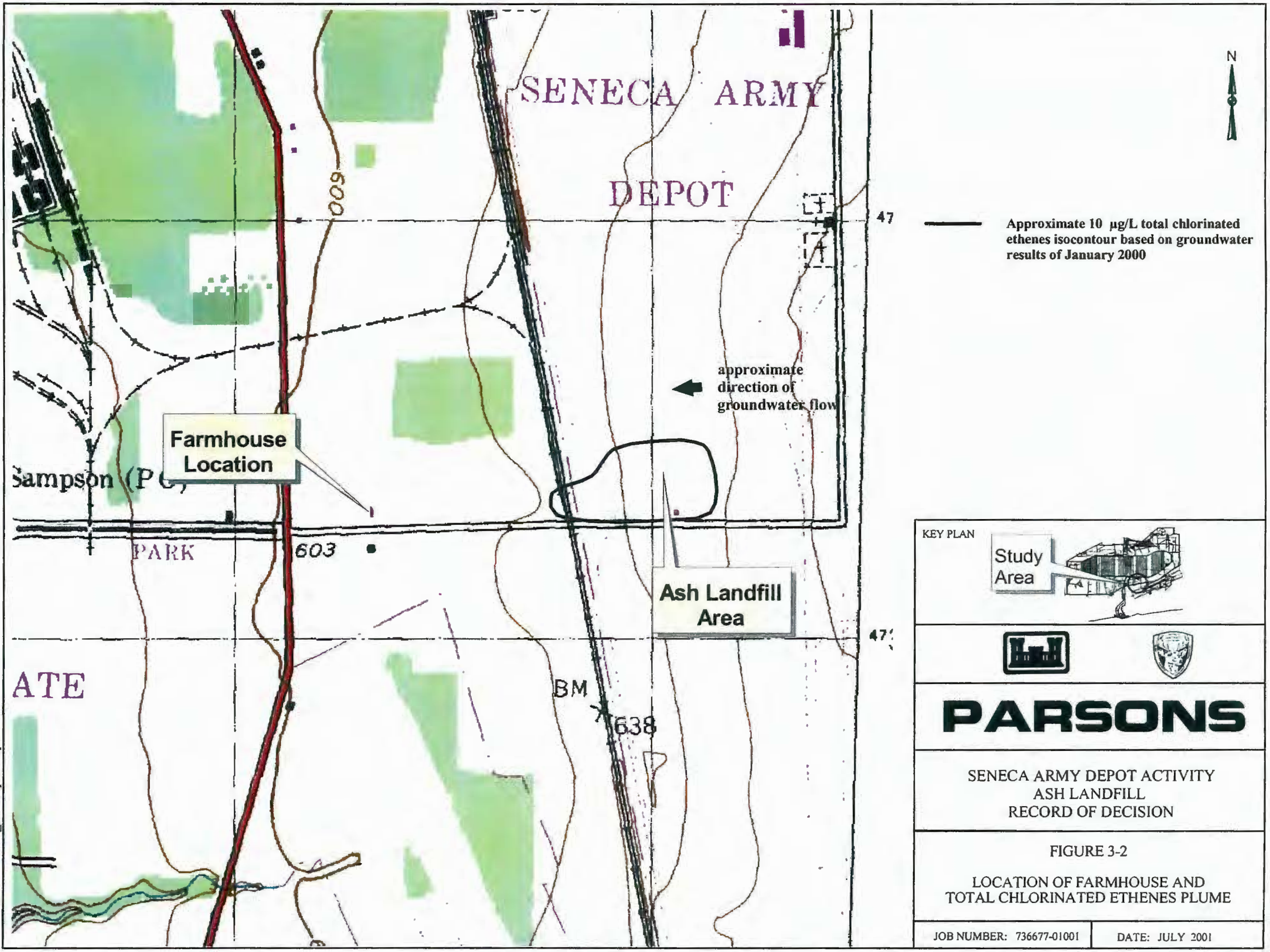


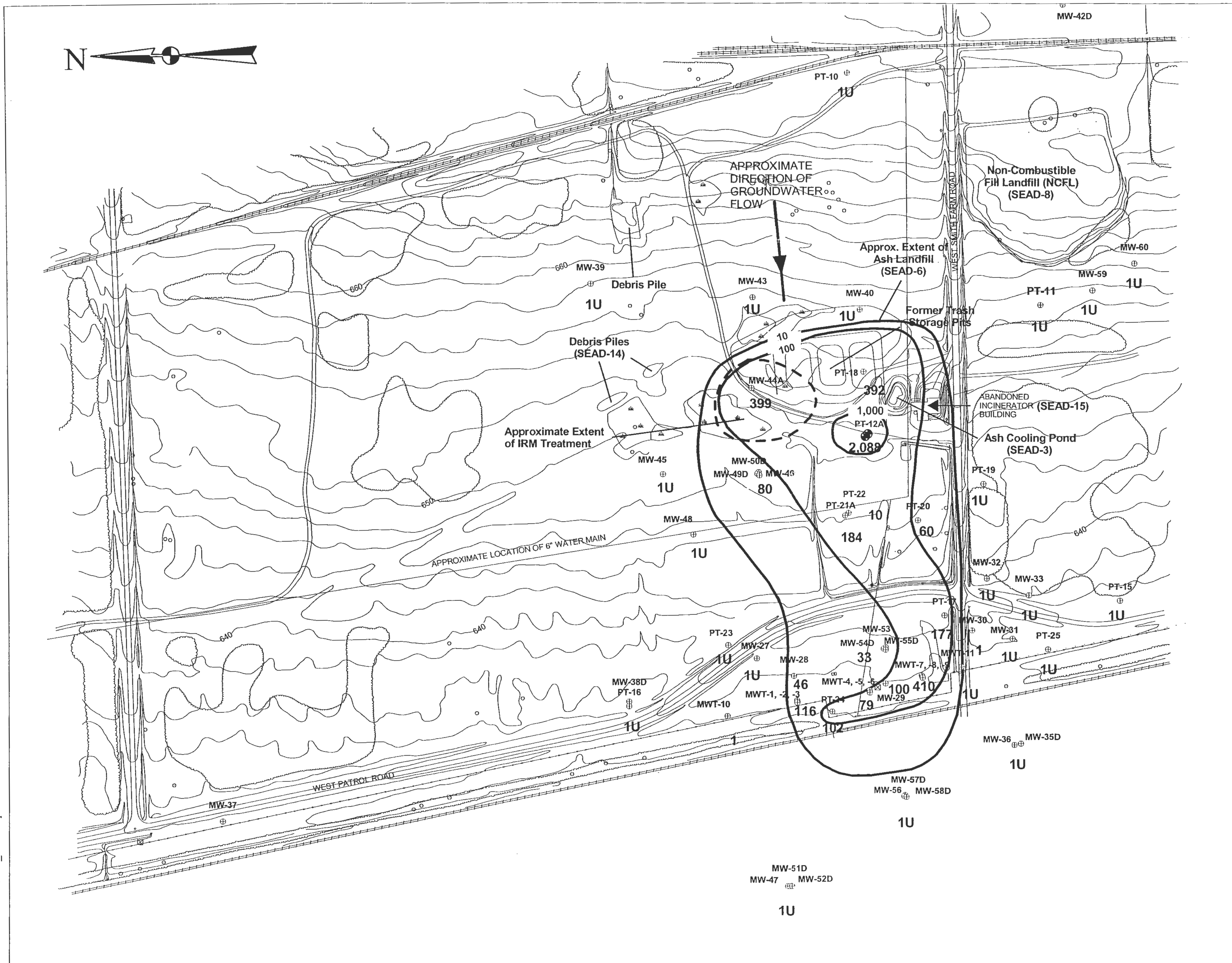
PARSONS

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
RECORD OF DECISION

FIGURE 3-2

LOCATION OF FARMHOUSE AND TOTAL CHLORINATED ETHENES PLUME

JOB NUMBER: 736677-01001 | DATE: JULY 2001



LEGEND

- PAVED ROAD
- GROUND CONTOUR AND ELEVATION
- WETLAND & DESIGNATION
- OUTLINE OF FORMER TRASH PITS (IDENTIFIED FROM AERIAL PHOTO)
- APPROXIMATE EXTENT OF DEBRIS PILE
- BRUSH
- CHAIN LINK FENCE
- UTILITY POLE
- APPROXIMATE LOCATION OF FIRE HYDRANT
- PT-22 MONITORING WELL AND DESIGNATION
- MW-37 RAILROAD
- 6" WATER MAIN
- 1,000 GROUNDWATER ISOCONTOUR (ug/L)
- 75 TOTAL CHLORINATED ETHENES (ug\L) FROM SAMPLES COLLECTED IN JANUARY 2000
- 10U NO CHLORINATED ETHENES DETECTED

NOTE:
THE CONCENTRATIONS SHOWN ON THIS FIGURE ARE FOR WELLS SCREENED IN THE TILLED/WEATHERED SHALE AQUIFER.

SCALE: 1" = 250'

PARSONS

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
Record of Decision

ENVIRONMENTAL ENGINEERING	726209-01000

FIGURE 6-1
TOTAL CHLORINATED ETHENES IN GROUNDWATER JANUARY 2000

SCALE: 1 INCH = 250 FEET	APRIL 2003

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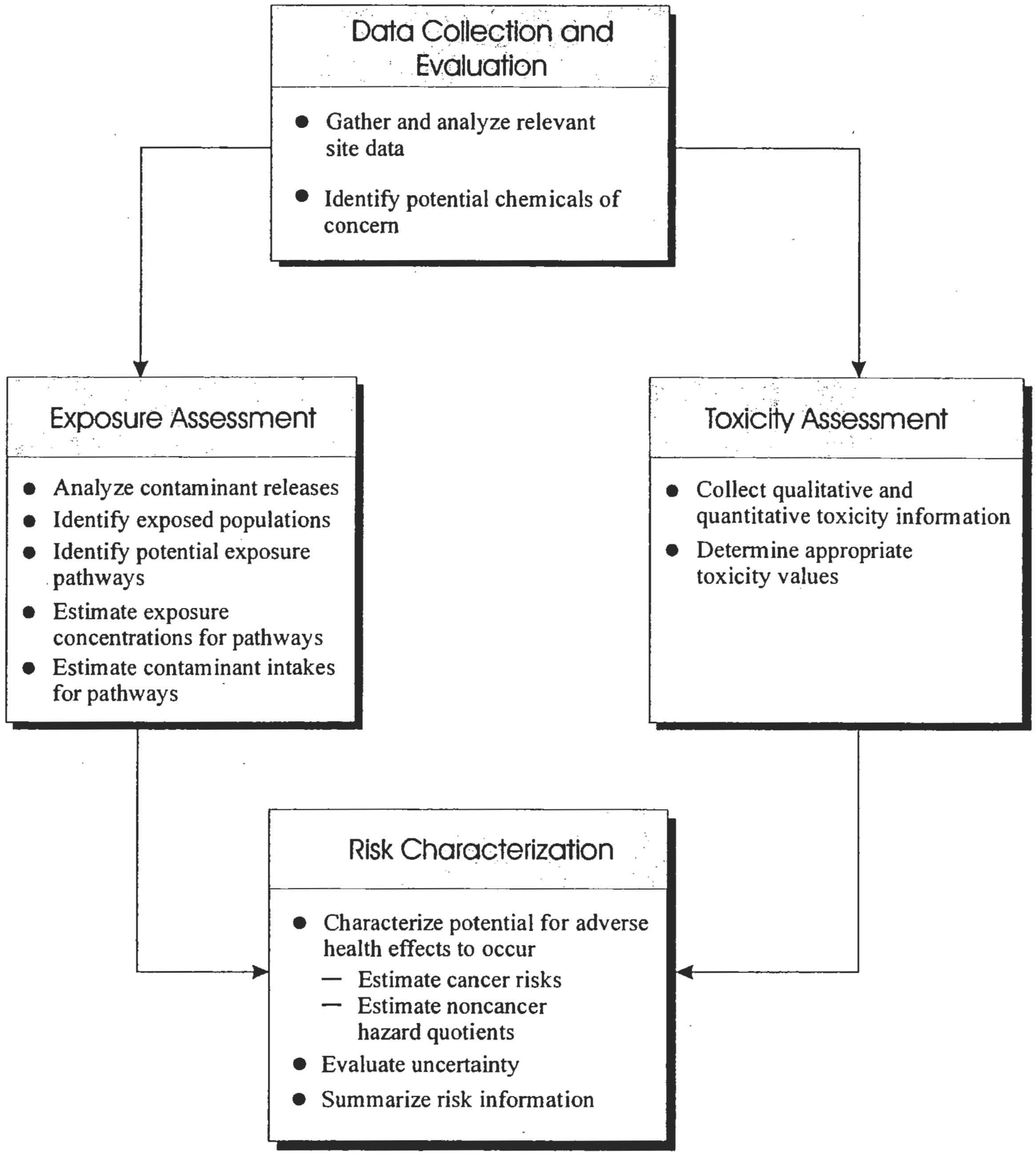

Source: USEPA, 1989a

PARSONS

CLIENT/PROJECT TITLE

SENECA ARMY DEPOT ACTIVITY
RECORD OF DECISION
ASH LANDFILL

DEPT. ENVIRONMENTAL ENGINEERING DWG NO. 736677

FIGURE 7-1

BASELINE RISK ASSESSMENT PROCESS

SCALE Not Applicable DATE JULY 2002

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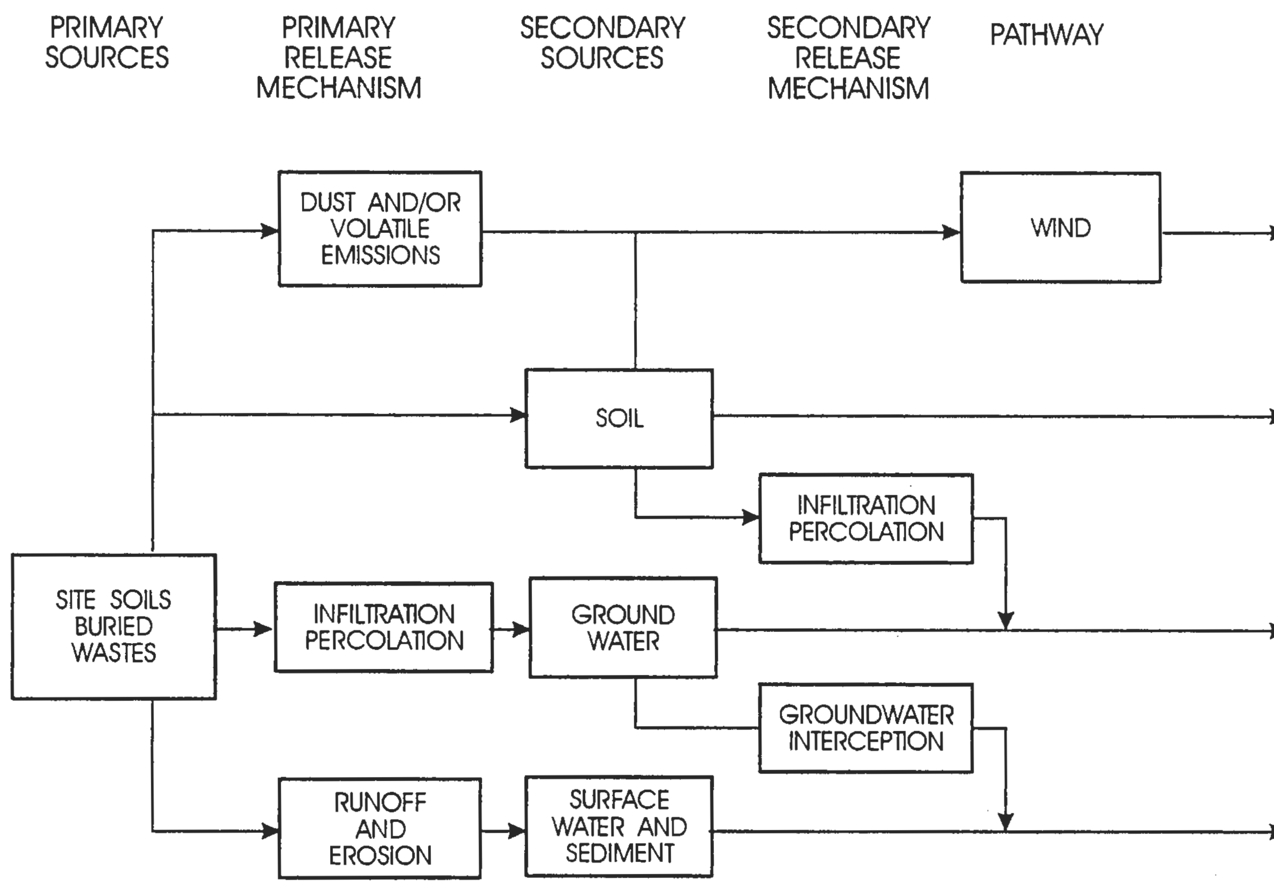

EXPOSURE ROUTE	RECEPTOR: HUMAN – CURRENT OFF-SITE RESIDENT	HUMAN – ON-SITE FUTURE RESIDENT	HUMAN – FUTURE SITE WORKERS	HUMAN – CURRENT HUNTER	BIOTA – TERR.	BIOTA – AQUATIC
INHALATION	X	X	X	X	X	X
INGESTION	●	●	●	●	X	X
DERMAL CONTACT	X	X	X	X	X	X
INGESTION	X	●	●	●	●	X
DERMAL CONTACT	X	●	●	●	●	X
INGESTION	●	●	X	X	X	X
INHALATION	●	●	X	X	X	X
DERMAL CONTACT	●	●	X	X	X	X
INGESTION	X	X	X	X	●	●
DERMAL CONTACT	●	●	X	●	●	●

● PATHWAY CONSIDERED TO POSE POTENTIAL RISK

X PATHWAY DISCOUNTED AS SIGNIFICANT RISK

PARSONS

CLIENT/PROJECT TITLE
SENECA ARMY DEPOT ACTIVITY
RECORD OF DECISION
ASH LANDFILL

DEPT. ENVIRONMENTAL ENGINEERING | DWG NO. 720446-01026

FIGURE 7-2
EXPOSURE PATHWAY SUMMARY

SCALE NA | DATE July 2002

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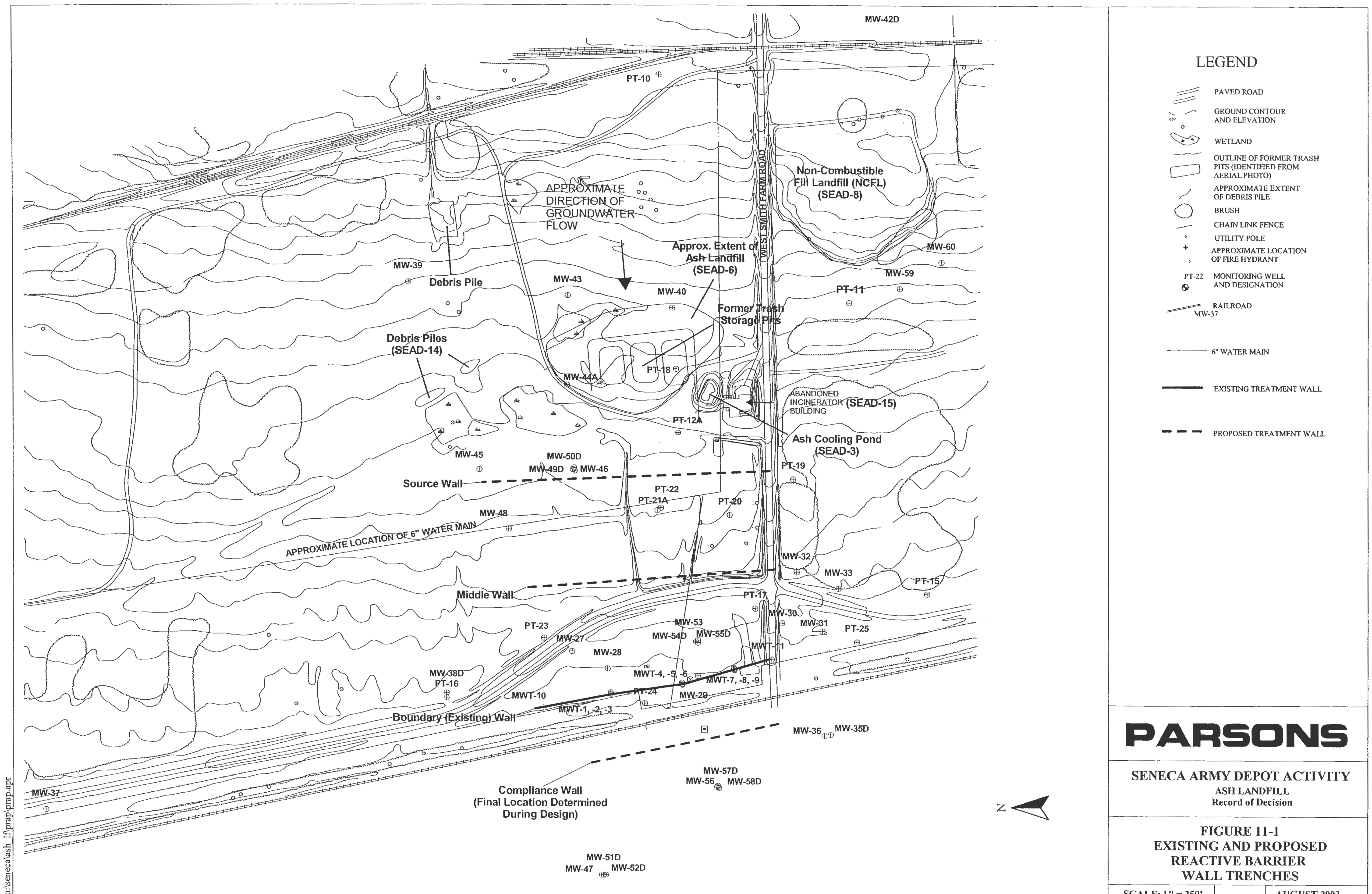

PARSONS

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL
Record of Decision

FIGURE 11-1
EXISTING AND PROPOSED
REACTIVE BARRIER
WALL TRENCHES

SCALE: 1" = 250' | AUGUST 2003

Table 6-1a

ALL SOIL SAMPLE RESULTS - PRE IRM (1)

Record of Decision - Ash Landfill
Seneca Army Depot Activity

COMPOUND	UNITS	NYSDEC TAGM (2)	COUNT	MAXIMUM	95 th UCL of the MEAN (3)	MEAN (4)	STD.DEV
Volatile Organics							
Vinyl Chloride	ug/kg	200	169	14,500	62.5	173	1,134
1,2-Dichloroethene (total)	ug/kg	300	169	79,000	1,712	1,989	8,288
Trichloroethene	ug/kg	700	169	540,000	2,268	9,373	57,446
Semivolatiles							
2-Methylnaphthalene	ug/kg	36,400	164	3,600	441	393	483
Acenaphthylene	ug/kg	41,000	105	510	265	248	108
Dibenzofuran	ug/kg	6,200	164	7,000	398	373	568
Phenanthrene	ug/kg	50,000	164	43,000	658	882	3,693
Benzo(a)anthracene	ug/kg	220 or MDL(5)	164	9,600	520	531	1,143
bis(2-Ethylhexyl)phthalate	ug/kg	50,000	164	230,000	715	2,051	17,995
Benzo(b)fluoranthene	ug/kg	1,100	164	9,500	498	513	1,068
benzo(k)fluoranthene	ug/kg	1,100	164	6,700	469	448	759
Benzo(a)pyrene	ug/kg	61 or MDL(5)	164	9,000	491	486	1,000
Indeno(1,2,3-cd)pyrene	ug/kg	3,200	164	4,800	431	397	543
Dibenz(a,h)anthracene	ug/kg	14 or MDL(5)	164	2,900	411	368	335
Benzo(g,h,i)perylene	ug/kg	50,000	164	5,000	431	392	527
Pesticides/PCBs							
Aroclor-1260	ug/kg	1,000	164	770	157	143	110
Metals							
Cadmium	mg/kg	1.74	163	43.1	3.84	2.47	3.74
Chromium	mg/kg	26.49	163	62	27.7	26.7	7.66
Copper	mg/kg	25	162	836	40.5	43.6	83.1
Lead	mg/kg	30	147	2,890	90	115	387
Zinc	mg/kg	88.89	163	55,700	409	860	4,887

Notes:
1. This table reflects the soil sample results at all depths at the site prior to the Interim Remedial Measure (IRM).
2. NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-92-4046, January 24, 1994. The TAGMs are soil cleanup guidelines and are for comparison.
3. 95th Upper Confidence Limit of the mean is a probabilistic estimate of the true site mean. Non-detects were assumed to be at one-half of the detection limit for all statistical calculations.
4. Mean is the arithmetic mean, i.e. the sum of the values divided by the number of samples.
5. For semivolatile organic compounds, the Minimum Detection Limit (MDL) is 330 ug/Kg.

Table 6-1b

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
SOIL SAMPLE RESULTS from outside of the IRM AREA ONLY - PRE IRM (1)

COMPOUND	UNITS	NYSDEC TAGM (2)	COUNT	MAXIMUM	95 th UCL of the MEAN (3)	MEAN (4)	STD.DEV
Volatile Organics							
Vinyl Chloride	ug/kg	200	116	92	6.60	6.68	8.09
1,2-Dichloroethene (total)	ug/kg	300	116	1,300	11.1	23.6	125
Trichloroethene	ug/kg	700	116	540	18.4	22.5	63.8
Semivolatiles							
2-Methylnaphthalene	ug/kg	36,400	112	1,600	359	326	217
Acenaphthylene	ug/kg	41,000	72	510	279	258	109
Dibenzofuran	ug/kg	6,200	112	7,000	406	382	657
Phenanthrene	ug/kg	50,000	112	43,000	819	1,113	4,449
Benzo(a)anthracene	ug/kg	220 or MDL(5)	112	9,600	620	620	1,359
bis(2-Ethylhexyl)phthalate	ug/kg	50,000	112	230,000	901	2,811	21,763
Benzo(b)fluoranthene	ug/kg	1,100	112	9,500	576	591	1,269
benzo(k)fluoranthene	ug/kg	1,100	112	6,700	513	499	890
Benzo(a)pyrene	ug/kg	61 or MDL(5)	112	9,000	556	555	1,186
Indeno(1,2,3-cd)pyrene	ug/kg	3,200	112	4,800	463	423	623
Dibenz(a,h)anthracene	ug/kg	14 or MDL(5)	112	2,900	430	376	350
Benzo(g,h,i)perylene	ug/kg	50,000	112	5,000	456	422	600
Pesticides/PCBs							
Aroclor-1260	ug/kg	1,000	164	770	157	143	110
Metals							
Cadmium	mg/kg	1.74	163	43.1	3.84	2.47	3.74
Chromium	mg/kg	26.49	163	62	27.7	26.7	7.7
Copper	mg/kg	25	162	836	40.5	43.6	83.1
Lead	mg/kg	30	147	2,890	90.0	115	387
Zinc	mg/kg	88.89	163	55,700	409	860	4,887

Notes:
1. This table reflects soil sample results at all depths at the site prior to the Interim Remedial Measure (IRM). Table 2 is different from Table 1 in that the VOCs and SVOCs from soil samples within the areas where the IRM was performed were excluded from the calculations.
2. NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-92-4046, January 24, 1994. The TAGMs are soil cleanup guidelines and are for comparison.
3. 95th Upper Confidence Limit of the mean is a probabilistic estimate of the true site mean. Non-detects were assumed to be at one-half of the detection limit for all statistical calculations.
4. Mean is the arithmetic mean, i.e. the sum of the values divided by the number of samples.
5. For semivolatile organic compounds, the Minimum Detection Limit (MDL) is 330 ug/Kg.
6. Metals are total metal concentrations in soil.

Table 6-1c

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
SOIL SAMPLE RESULTS within the IRM AREA ONLY - PRE IRM (1)

COMPOUND	UNITS	NYSDEC TAGM(2)	COUNT	MAXIMUM	95th UCL of the MEAN (3)	MEAN (4)	STD.DEV
Volatile Organics							
Vinyl Chloride	ug/kg	200	53	14,500	2,262	536	1,991
1,2-Dichloroethene (total)	ug/kg	300	53	79,000	406,336	6,292	13,942
Trichloroethene	ug/kg	700	53	540,000	1,690,008	29,839	100,199
Semivolatiles							
2-Methylnaphthalene	ug/kg	36,400	52	3,600	669	539	782
Acenaphthylene	ug/kg	41,000	33	365	257	227	104
Dibenzofuran	ug/kg	6,200	52	2,050	423	354	300
Phenanthrene	ug/kg	50,000	52	2,050	472	386	378
Benzo(a)anthracene	ug/kg	220 or MDL(5)	52	2,050	412	341	312
bis(2-Ethylhexyl)phthalate	ug/kg	50,000	52	2,050	489	413	333
Benzo(b)fluoranthene	ug/kg	1,100	52	2,050	417	346	312
benzo(k)fluoranthene	ug/kg	1,100	52	2,050	408	337	314
Benzo(a)pyrene	ug/kg	61 or MDL(5)	52	2,050	410	338	315
Indeno(1,2,3-cd)pyrene	ug/kg	3,200	52	2,050	411	341	307
Dibenz(a,h)anthracene	ug/kg	14 or MDL(5)	52	2,050	418	349	301
Benzo(g,h,i)perylene	ug/kg	50,000	52	2,050	399	328	311
Pesticides/PCBs							
Aroclor-1260	ug/kg	1,000	52	770	216	181	155
Metals							
Cadmium	mg/kg	1.74	52	4.4	2.23	1.87	1.59
Chromium	mg/kg	26.5	52	34.8	25.2	24.2	4.48
Copper	mg/kg	25	52	146	34.2	29.6	20.2
Lead	mg/kg	30	50	696	54.4	46.3	103
Zinc	mg/kg	88.9	52	3,540	244	241	508

Notes:
1. Soil samples results at all depths in the Interim Remedial Measure area only, prior to the IRM, are included..
2. NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-94-4046, January 24, 1994. The TAGMs are cleanup guidelines and are for comparison.
3. 95th Upper Confidence Limit of the mean is a probabilistic estimate of the true site mean. Non-detects were assumed to be at one-half of the detection limit for all statistical calculations.
4. Mean is the arithmetic mean, i.e. the sum of the values divided by the number of samples.
5. For semivolatile organic compounds the Minimum Detection Limit (MDL) is 330 ug/Kg.

Table 6-1d

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
SOIL SAMPLE RESULTS within the IRM AREA ONLY - POST IRM (1)

COMPOUND	UNITS	NYSDEC TAGM (2)	COUNT	MAXIMUM	95th UCL of the MEAN (3)	MEAN (4)	STD.DEV
Volatile Organics							
Vinyl Chloride	ug/kg	200	156	28	9.24	8.29	7.17
1,2-Dichloroethene (total)	ug/kg	300	156	47	9.41	8.35	8.04
Trichloroethene	ug/kg	700	156	46	9.62	8.05	8.14
Semivolatiles							
Napthalene	ug/kg	13,000	156	470	239	222	128
Phenanthrene	ug/kg	50,000	156	2,200	145	115	204
Fluoranthene	ug/kg	50,000	156	2,500	187	133	237
Pyrene	ug/kg	50,000	156	1,800	222	127	186
Bis(2-ethylhexyl) phthalate	ug/kg	50,000	156	3,500	511	452	449
Indeno(1,2,3-cd) pyrene	ug/kg	3,200	156	930	1,238	159	169
Benzo(a)anthracene	ug/kg	220 or MDL(5)	156	760	133	74.5	114
Chrysene	ug/kg	400	156	700	217	103	150
Benzo(a)pyrene	ug/kg	61 or MDL(5)	156	860	147	78.2	145
Dibenzo(a,h)anthracene	ug/kg	14 or MDL(5)	156	990	2.37	43.8	114

Notes:
1. Soil results, following thermal treatment during the Interim Remedial Measure, prior to backfilling. Data obtained from International Technology Corp. "Ash Landfill Immediate Response, July 1995". Total metal concentrations in the treated soil were not analyzed.
2. NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-94-4046, January 24, 1994. The TAGMs are cleanup guidelines and are for comparison.
3. 95th Upper Confidence Limit of the mean is a probabilistic estimate of the true site mean. Non-detects were assumed to be at one-half of the detection limit for all statistical calculations.
4. Mean is the arithmetic mean, i.e. the sum of the values divided by the number of samples.
5. For semivolatile organic compounds the Minimum Detection Limit (MDL) is 330 ug/Kg.

TABLE 6-2

SENECA ARMY DEPOT ACTIVITY
ASH LANDFILL OPERABLE UNIT
TOTAL CHLORINATED ETHENES OF GROUNDWATER SAMPLES FOR FIVE SAMPLING EVENTS

Monitoring Well Designation	Location	Total Chlorinated Ethene Concentrations, µg/l				
		Jun-93	Jun-97	Oct-99	Jan-00	Aug-02
MW-12A or PT-12	Plume	2,461	3,570	2,123	2,088	--
MW-27	North of Impact Area	ND	ND	ND	ND	--
MW-28	Plume	88	88	47	46	36
MW-29	Plume	101	157	152	100	--
MW-30	South of West Smith Farm Road	1	ND	2	1	--
MW-31	South of West Smith Farm Road	ND	ND	ND	ND	--
MW-32	South of West Smith Farm Road	ND	ND	ND	ND	--
MW-33	South of West Smith Farm Road	ND	ND	ND	ND	--
MW-35D	Off of SEDA facility	ND	ND	ND	ND	--
MW-37	North of Impact Area	ND	--	ND	ND	--
MW-38D	North of Impact Area	ND	ND	ND	ND	--
MW-39	Northeast of Impact Area	ND	--	ND	ND	--
MW-40	East of Impact Area	ND	ND	ND	ND	--
MW-43	East of Impact Area	6	--	ND	ND	--
MW-44 or MW-44A	IRM area	132,360	930	1,104	399	--
MW-45	North of Impact Area	0.5	ND	ND	ND	--
MW-46	Plume	167	126	157	80	--
MW-47	Off of SEDA facility, Upgradient of Farmer's well	ND	ND	ND	--	--
MW-48	North of Impact Area	ND	ND	ND	ND	--
MW-49D	Plume	--	--	23	30	--
MW-50D	Plume	--	ND	ND	ND	--
MW-51D	Off of SEDA facility, Upgradient of Farmer's well	--	ND	ND	ND	--
MW-52D	Off of SEDA facility, Upgradient of Farmer's well	--	ND	ND	ND	--
MW-53	Plume	--	55	22	33	--
MW-54D	Plume	--	--	2.7	1	--
MW-55D	Plume	--	--	ND	ND	--
MW-56	Off of SEDA facility, Upgradient of Farmer's well	--	1.6	ND	ND	--
MW-57D	Off of SEDA facility, Upgradient of Farmer's well	0.2	--	ND	ND	--
MW-58D	Off of SEDA facility, Upgradient of Farmer's well	--	--	ND	ND	--
MW-59	South of West Smith Farm Road	ND	ND	ND	ND	--
MW-60	South of West Smith Farm Road	ND	ND	ND	ND	--
PT-11	South of West Smith Farm Road	ND	ND	ND	ND	--
PT-16	North of Impact Area	ND	ND	ND	ND	--
PT-17	Plume	233	233	132	177	--
PT-18 or PT-18A	Plume	13,953	3,014	10,591	392	--
PT-19	South of West Smith Farm Road	ND	ND	ND	ND	--
PT-20	Plume	90	90	75	60	--
PT-21A	Plume	254	17	28	10	--
PT-22	Plume	--	--	193	184	--
PT-23	North of Impact Area	ND	ND	ND	ND	--
PT-24	Plume	66	147	121	102	75
PT-25	South of West Smith Farm Road	ND	ND	ND	ND	--
MWT-1	2.5 ft Upgradient of Existing Wall	--	--	--	116	31
MWT-4	2.5 ft Upgradient of Existing Wall	--	--	--	79	99
MWT-7	2.5 ft Upgradient of Existing Wall	--	--	--	410	572

Notes:
1. Total Chlorinated Ethene means the sum of the concentration of Trichloroethene, Cis-1,2-Dichloroethene, Vinyl Chloride, and Tetrachloroethene.
2. Results of Monitoring Wells more than 500 ft away from impact area are not presented in this table.
3. ND means that no chlorinated ethenes were detected above the detection limit in the sample collected.
4. -- means that the well was not sampled.
5. The higher concentration of a sample and a duplicate is presented in this table

Table 7-1a
EXPOSURE POINT CONCENTRATIONS-CHEMICALS OF CONCERN
SURFACE SOIL ANALYSIS RESULTS (0-2 Foot Depths)
VALIDATED DATA (PHASES I & II)

Record of Decision - Ash Landfill
Seneca Army Depot Activity

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	Exposure Point Concentration
Volatile Organics					
Vinyl Chloride	ug/kg	750	16.02	33.24	16.02
1,2-Dichloroethene (total)	ug/kg	38000	584.27	1,545.47	584.27
Trichloroethene	ug/kg	150000	1,592.88	5,564.81	1,592.88
Semi-volatiles					
2-Methylnaphthalene	ug/kg	1250	360.05	318.57	360.05
Acenaphthylene	ug/kg	510	251.08	209.08	251.08
Dibenzofuran	ug/kg	1400	407.83	352.36	407.83
Phenanthrene	ug/kg	15000	1,047.87	998.34	1,047.87
Benzo(a)anthracene	ug/kg	9600	915.76	741.85	915.76
bis(2-Ethylhexyl)phthalate	ug/kg	230000	987.69	4,749.60	987.69
Benzo(b)fluoranthene	ug/kg	9500	833.22	744.38	833.22
Benzo(k)fluoranthene	ug/kg	6700	711.51	595.21	711.51
Benzo(a)pyrene	ug/kg	9000	876.03	702.87	876.03
Indeno(1,2,3-cd)pyrene	ug/kg	4800	635.36	493.98	635.36
Dibenz(a,h)anthracene	ug/kg	2000	466.15	385.94	466.15
Benzo(g,h,i)perylene	ug/kg	5000	680.92	506.77	680.92
Pesticides/PCB's					
Aroclor-1260	ug/kg	340	161.11	141.39	161.11
Metals					
Cadmium	mg/kg	43.1	5.53	3.22	5.53
Chromium	mg/kg	62	30.55	28.34	30.55
Copper	mg/kg	836	71.55	69.80	71.55
Lead	mg/kg	2890	264.93	208.08	264.93
Zinc	mg/kg	55700	1,579.68	2,111.63	1,579.68

TABLE 7-1b

EXPOSURE POINT CONCENTRATIONS-CHEMICALS OF CONCERN
SOIL ANALYSIS RESULTS (All Depths)
VALIDATED DATA (PHASES I & II)

Record of Decision - Ash Landfill
Seneca Army Depot Activity

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	EXPOSURE POINT CONC.
Volatile Organics					
Vinyl Chloride	ug/kg	14,500	62.47	172.65	62.47
1,2-Dichloroethene (total)	ug/kg	79,000	1,712.18	1,989.32	1,712.18
Trichloroethene	ug/kg	540,000	2,267.98	9,373.25	2,267.98
Semivolatiles					
2-Methylnaphthalene	ug/kg	3,600	441.35	393.12	441.35
Acenaphthylene	ug/kg	510	265.48	248.15	265.48
Dibenzofuran	ug/kg	7,000	397.55	373.26	397.55
Phenanthrene	ug/kg	43,000	657.71	882.10	657.71
Benzo(a)anthracene	ug/kg	9,600	520.48	531.23	520.48
bis(2-Ethylhexyl)phthalate	ug/kg	230,000	714.92	2,050.95	714.92
Benzo(b)fluoranthene	ug/kg	9,500	498.22	513.04	498.22
benzo(k)fluoranthene	ug/kg	6,700	468.90	447.89	468.90
Benzo(a)pyrene	ug/kg	9,000	490.78	486.21	490.78
Indeno(1,2,3-cd)pyrene	ug/kg	4,800	430.56	396.93	430.56
Dibenz(a,h)anthracene	ug/kg	2,900	410.55	367.55	410.55
Benzo(g,h,i)perylene	ug/kg	5,000	431.19	392.32	431.19
Pesticides/PCBs					
Aroclor-1260	ug/kg	770	157.24	143.06	157.24
Metals					
Cadmium	mg/kg	43.1	3.84	2.47	3.84
Chromium	mg/kg	62	27.72	26.73	27.72
Copper	mg/kg	836	40.46	43.64	40.46
Lead	mg/kg	2,890	90.05	115.46	90.05
Zinc	mg/kg	55,700	409.06	860.14	409.06

* NYSDEC TAGM values based on Technical and Administrative Guidance Memorandum HWR-92-4046, November 16, 1992. The TAGMs are TBCs and are for comparison purposes only.

** For semivolatile organic compounds the Minimum Detection Limit (MDL) is 330 ug/Kg.

TABLE 7-1c

EXPOSURE POINT CONCENTRATIONS - CHEMICALS OF CONCERN
GROUNDWATER ANALYSIS RESULTS
VALIDATED ON-SITE DATA (PHASES I & II)

Record of Decision - Ash Landfill
Seneca Army Depot Activity

COMPOUND	UNITS	MAXIMUM	95th UCL of the mean	MEAN	Exposure Point Concentration
Volatile Organics					
Vinyl Chloride	ug/L	23,000.00	59.81	648.56	59.81
1,2-Dichloroethene (total)	ug/L	130,000.00	845.01	2,656.02	845.01
1,1,1-Trichloroethane	ug/L	2,100.00	10.20	27.66	10.20
Trichloroethene	ug/L	51,000.00	605.60	1,431.20	605.60
Semi-volatiles					
2-Methylnaphthalene	ug/L	13.00	5.58	5.38	5.58
Metals					
Aluminum	ug/L	306,000.00	254,061.90	20,713.04	254,061.90
Cadmium	ug/L	64.60	3.09	3.03	3.09
Chromium	ug/L	418.00	62.23	31.04	62.23
Copper	ug/L	412.00	30.26	24.67	30.26
Lead	ug/L	147.00	21.10	10.76	21.10
Nickel	ug/L	622.00	56.73	42.61	56.73
Zinc	ug/L	1,750.00	441.98	157.35	441.98

TABLE 7-1d

EXPOSURE POINT CONCENTRATIONS - CHEMICALS OF CONCERN
SURFACE WATER ANALYSIS RESULTS
VALIDATED DATA (PHASES I & II)

Record of Decision - Ash Landfill
Seneca Army Depot Activity

COMPOUND	UNITS	MAXIMUM	95 th UCL of the mean	MEAN	Exposure Point Concentration
Volatiles Organics					
Chloroform	ug/L	2.00	2.00	2.00	2.00
Metals					
Aluminum	ug/L	2,410.00	96,163.98	818.34	2,410.00
Antimony	ug/L	141.00	74.34	43.56	74.34
Arsenic	ug/L	2.90	2.23	1.86	2.23
Beryllium	ug/L	1.20	0.81	0.56	0.81
Chromium	ug/L	7.60	5.64	4.05	5.64
Cobalt	ug/L	6.90	8.87	4.70	6.90
Copper	ug/L	21.70	15.86	11.04	15.86
Lead	ug/L	42.30	3,485.81	8.08	42.30
Manganese	ug/L	941.00	636.3	328.59	636.30
Nickel	ug/L	11.20	15.4	6.48	11.20
Zinc	ug/L	187.00	2,235.23	59.85	187.00

TABLE 7-1e

EXPOSURE POINT CONCENTRATIONS - CHEMICALS OF CONCERN
SEDIMENT ANALYSIS RESULTS
VALIDATED DATA (PHASES I & II)

Record of Decision - Ash Landfill
Seneca Army Depot Activity

COMPOUND	UNITS	MAXIMUM	95 th UCL of the mean	MEAN	Exposure Point Concentration
Semivolatiles					
2-Methylnaphthalene	ug/kg	30.00	30.00	30.00	30.00
Acenaphthylene	ug/kg	170.00	151.82	95.00	151.82
Phenanthrene	ug/kg	1,200.00	499.46	379.78	499.46
Benzo(a)anthracene	ug/kg	4,900.00	1,696.30	698.44	1,696.30
Benzo(b)fluoranthene	ug/kg	4,500.00	1,609.62	692.56	1,609.62
Benzo(k)fluoranthene	ug/kg	3,700.00	1,424.29	602.78	1,424.29
Benzo(a)pyrene	ug/kg	3,900.00	1,658.39	621.35	1,658.39
Indeno(1,2,3-cd)pyrene	ug/kg	2,400.00	1,263.37	513.83	1,263.37
Dibenz(a,h)anthracene	ug/kg	1,300.00	537.25	423.61	537.25
Benzo(g,h,i)perylene	ug/kg	2,300.00	971.19	508.72	971.19
Metals					
Aluminum	mg/kg	20,900.00	15,013.53	13,763.33	15,013.53
Antimony	mg/kg	10.80	6.51	5.54	6.51
Arsenic	mg/kg	12.10	7.40	6.23	7.40
Barium	mg/kg	227.00	123.30	105.96	123.30
Beryllium	mg/kg	1.20	0.89	0.79	0.89
Cadmium	mg/kg	4.10	2.49	1.92	2.49
Chromium VI	mg/kg	33.40	24.62	22.83	24.62
Cobalt	mg/kg	17.00	11.19	10.09	11.19
Copper	mg/kg	58.60	39.69	34.59	39.69
Lead	mg/kg	219.00	95.63	70.48	95.63
Manganese	mg/kg	1,050.00	675.43	562.94	675.43
Nickel	mg/kg	45.90	32.05	29.41	32.05
Thallium	mg/kg	0.52	0.50	0.33	0.50
Vanadium	mg/kg	30.70	23.86	21.94	23.86
Zinc	mg/kg	834.00	455.05	365.39	455.05

Table 7-2

CALCULATION OF TOTAL NONCARCINOGENIC AND CARCINOGENIC RISKS

Record of Decision - Ash Landfill
Seneca Army Depot Activity

RECEPTOR	EXPOSURE ROUTE	HAZARD INDEX	CANCER RISK
CURRENT RESIDENTIAL			
CURRENT OFF-SITE RESIDENTS	Dermal Contact to Surface Water while Wading	3.1E-003	9.2E-006
	Dermal Contact to Sediment while Wading	2.0E-003	0.0E+000
	Ingestion of Groundwater	1.4E-001	5.6E-006
	Dermal Contact to Groundwater	3.2E-003	2.5E-007
	Inhalation of Groundwater while Showering	3.1E-007	1.1E-007
	Inhalation of Volatile Organics in Ambient Air	2.6E-004	3.2E-007
TOTAL RECEPTOR RISK (Nc & CAR)		1.5E-001	1.5E-005
CURRENT AND FUTURE ON SITE			
ON-SITE HUNTERS	Dermal Contact to Surface Water while Wading	3.1E-003	9.2E-006
	Dermal Contact to Sediment while Wading	2.0E-003	0.0E+000
	Ingestion of Onsite Soils	9.5E-004	2.2E-007
	Dermal Contact to Onsite Soils	1.4E-003	4.4E-008
	Inhalation of Volatile Organics in Ambient Air	1.3E-005	1.6E-008
TOTAL RECEPTOR RISK (Nc & CAR)		7.5E-003	9.5E-006
FUTURE ON-SITE CONSTRUCTION WORKERS	Ingestion of Onsite Soils	9.2E-003	1.9E-006
	Dermal Contact to Onsite Soils	5.4E-002	1.4E-006
	Inhalation of Volatile Organics in Ambient Air	4.7E-004	4.9E-007
TOTAL RECEPTOR RISK (Nc & CAR)		6.4E-002	3.8E-006
FUTURE RESIDENTIAL			
FUTURE ON-SITE RESIDENTS	Ingestion of Onsite Soils	3.4E-001	2.1E-005
	Dermal Contact to Onsite Soils	3.8E-001	4.6E-006
	Dermal Contact to Surface Water while Wading	3.1E-003	9.2E-006
	Dermal Contact to Sediment while Wading	2.0E-003	0.0E+000
	Ingestion of Groundwater	3.2E+000	1.4E-003
	Dermal Contact to Groundwater	2.0E-001	7.1E-005
	Inhalation of Groundwater while Showering	1.0E-003	2.9E-005
	Inhalation of Volatile Organics in Ambient Air	1.1E-003	1.4E-006
TOTAL RECEPTOR RISK (Nc & CAR)		4.2E+000	1.5E-003
TOTAL SOIL RISK		7.9E-001	3.1E-005
TOTAL GROUNDWATER RISK		3.6E+000	1.5E-003
TOTAL SEDIMENT RISK		5.9E-003	0.0E+000
TOTAL SURFACE WATER RISK		6.2E-003	1.8E-005
CURRENT SOIL RISK		6.6E-002	4.4E-006

Table 8-1

SITE-SPECIFIC CLEANUP GOALS FOR SOIL AND GROUNDWATER
Record of Decision - Ash Landfill
Seneca Army Depot Activity

	Soil Clean-up Goals (ug/kg)	Source
Volatile Organic Compounds		
1,1,1-Trichloroethane		
Vinyl Chloride	200	NYSDEC TAGM
1,2-Dichloroethene (total)	300	NYSDEC TAGM
Trichloroethene	700	NYSDEC TAGM
Semivolatile Organic Compounds		
2-Methylnaphthalene	36,400	NYSDEC TAGM
Acenaphthylene	41,000	NYSDEC TAGM
Dibenzofuran	6,200	NYSDEC TAGM
Phenanthrene	50,000	NYSDEC TAGM
Benzo(a)anthracene	220 or MDL(2)	NYSDEC TAGM
bis(2-Ethylhexyl)phthalate	50,000	NYSDEC TAGM
Benzo(b)fluoranthene	1,100	NYSDEC TAGM
benzo(k)fluoranthene	1,100	NYSDEC TAGM
Benzo(a)pyrene	61 or MDL(2)	NYSDEC TAGM
Indeno(1,2,3-cd)pyrene	3,200	NYSDEC TAGM
Dibenz(a,h)anthracene	14 or MDL(2)	NYSDEC TAGM
Benzo(g,h,i)perylene	50,000	NYSDEC TAGM
Pesticides/PCBs		
Aroclor-1260	1,000	NYSDEC TAGM
Metals		
Cadmium	1,800	NYSDEC TAGM (SB)
Chromium	26,000	NYSDEC TAGM (SB)
Copper	25,000	NYSDEC TAGM
Lead	500,000	Site-specific goal
Zinc	89,100	NYSDEC TAGM (SB)

	Groundwater Clean-up Goals (ug/L)	Source
Volatile Organic Compounds		
1,1,1-Trichloroethane	5	NYSDEC AWQS (GA)
Vinyl Chloride	2	NYSDEC AWQS (GA)
1,2-Dichloroethene (total)	5	NYSDEC AWQS (GA)
Trichloroethene	5	NYSDEC AWQS (GA)
Metals		
Cadmium	10	NYSDEC AWQS (GA)
Chromium	50	NYSDEC AWQS (GA)
Copper	200	NYSDEC AWQS (GA)
Lead	25	NYSDEC AWQS (GA)
Zinc	300	NYSDEC AWQS (GA)

1. NYSDEC TAGM = values are based on Technical and Administrative Guidance Memorandum HWR-92-4046, January 24, 1994. SB indicates that the site background for soil was used.
2. MDL = Minimum Detection Limit; for semivolatile organic compounds, the MDL is 330 ug/Kg.
3. NYSDEC AWQS (GA) = values are based on Water Quality Standards for Class GA groundwaters from 6 NYCRR Subparts 701-705.

Table 10-1
SUMMARY OF DETAILED EVALUATION OF SOURCE CONTROL OPTIONS
Record of Decision - Ash Landfill
Seneca Army Depot Activity

Criteria	Alternative SC-1 No Action	Alternative SC-2 Excavate Ash Landfill and NCFL Dispose in Off-site Subtitle D Landfill	Alternative SC-3 Excavation/Consolidation to On-site Landfill/Cap	Alternative SC-4 Excavation/Soil Washing/ Solidify Fines/Cap	Alternative Sc-5 Excavation of Debris Piles/ Off-Site Subtitle D Landfill
OVERALL PROTECTIVENESS OF HUMAN HEALTH AND THE ENVIRONMENT					
Human Health Protection (EPA target range is 1 x 10E-4 to 1 x 10E-6 for carcinogenic risk and an HI < 1.0 for noncarcinogenic risk)	Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker 2.9 E-05 HI = 0.22	Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker 2.87E-005 HI = 0.1911	Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker 2.87E-005 HI = 0.1911	Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker 2.83E-005 HI = 0.1934	Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker 2.87E-005 HI = 0.1911
Exposure Pathways Include: Ingestion of Groundwater Dermal Contact Inhalation of Volatile Organics Ingestion of Soils (Future On-site hunter and construction worker only)	Protective for Humans due to exposure to soils; IRM has eliminated risk due to VOCs in soil.	Protective of human health; dependant on landfill maintenance	Protective of human health; dependant on landfill maintenance	Protective of human health; Soils > NYSDEC Criteria excavated, washed, fines solidified	Protective of human health; dependent on landfill maintenance
Protection of Ecological Receptors	Not protective for ecological; Metals remain in-place.	Protects ecological receptors; Sediments > NYSDEC Criteria removed from Ash Landfill area.	Protects ecological receptors; Sediments > NYSDEC Criteria removed from Ash Landfill area.	Protects ecological receptors; Sediments > NYSDEC Criteria excavated, washed, fines solidified	Protects ecological receptors; Sediments > NYSDEC Criteria removed from Ash Landfill area.
COMPLIANCE WITH ARARs	Will comply with all ARARs	Will comply with all ARARs	Will comply with all ARARs	Will comply with all ARARs	Will comply with all ARARs
LONG-TERM EFFECTIVENESS AND PERMANENCE					
Magnitude of Residual Risk	Sources have not been removed. Potential threat will remain.	No residual risk will exist , all materials will be removed.	No residual risk will exist , providing landfill does not leak.	Treatment residuals consisting of coarse fraction will remain on-site but will be tested to assure that no unacceptable levels contamination. Fines solidified to render unreactive	No residual risk will exist providing maintenance of cover integrity. Also, the Debris Piles will be disposed of off-site.
Permanence	Not a permanent solution.	Once soils are placed in the off-site landfill, the remedial action would be permanent.	Once soils are placed in the on-site landfill, the remedial action would be permanent, provided cap integrity is maintained.	Upon completion this action will be considered permanent.	Once soils are placed in the off-site landfill, the remedial action would be permanent, provided cap integrity is maintained.

Table 10-1
SUMMARY OF DETAILED EVALUATION OF SOURCE CONTROL OPTIONS
Record of Decision - Ash Landfill
Seneca Army Depot Activity

Criteria	Alternative SC-1 No Action	Alternative SC-2 Excavate Ash Landfill and NCFL Dispose in Off-site Subtitle D Landfill	Alternative SC-3 Excavation/Consolidation to On-site Landfill/Cap	Alternative SC-4 Excavation/Soil Washing/ Solidify Fines/Cap	Alternative Sc-5 Excavation of Debris Piles/ Off-Site Subtitle D Landfill
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
Reduction of Toxicity, Mobility, or Volume	Little to none; The Army believes that some attenuation is expected due to natural mechanisms.	Very effective in reducing mobility; no effect on toxicity or volume of contaminated soils.	Very effective in reducing mobility; no effect on toxicity or volume of contaminated soils.	Very effective in reducing volume, toxicity, and mobility. Solidification reduces toxicity and mobility. Soil washing reduces the volume.	Very effective in reducing mobility; no effect on toxicity or volume of contaminated soils.
SHORT-TERM EFFECTIVENESS					
Community Protection	Most protective under current conditions as current risk is within acceptable ranges.	Least protective as large volume of contaminated soils is excavated. Dust and truck traffic is threat, transported on-site for disposal.	Most protective of remedial actions as no transportation of waste materials off-site will occur. Some dust will be produced during filling and construction of landfill.	Least protective as large volume of contaminated soils is required. Hazardous materials (acids) may be transported on-site for extraction.	Moderately protective as transportation of waste materials off-site will occur.
Worker Protection	Not applicable.	Least protective ; Excavation and off-site transportation of waste materials increase potential for worker exposure and risk.	Most protective of remedial actions as no transportation of waste materials off-site will occur. Some dust will be produced during filling and construction of landfill. Protection required from exposure.	Least protective ; Excavation and off-site transportation of waste materials increase potential for worker exposure and risk. Use of hazardous materials will also increase potential for worker exposure.	Moderately protective ; Excavation and off-site transportation of waste materials increase potential for worker exposure and risk.
Environmental Impacts	Not applicable.	Least protective due to disruption from excavation. Restoration will require years before site is fully restored.	Excavation will increase potential for dispersion of contaminated soil	Least protective due to increased potential for spills during washing.	Excavation will increase potential for dispersion of contaminated soil
Time Until Action is Complete	Not applicable	Remdial action: 12 to 18 months	Remdial action: 4 to 6 months	Mob. & Prove-out: 1 to 2 months Soil Washing: 1 to 3 months Backfilling & Demob.: 1month. Moderate time required to attain goals, due to soil washing process rate.	Remediation action: 4 to 6 months.

Table 10-1
SUMMARY OF DETAILED EVALUATION OF SOURCE CONTROL OPTIONS
Record of Decision - Ash Landfill
Seneca Army Depot Activity

Criteria	Alternative SC-1 No Action	Alternative SC-2 Excavate Ash Landfill and NCFL Dispose in Off-site Subtitle D Landfill	Alternative SC-3 Excavation/Consolidation to On-site Landfill/Cap	Alternative SC-4 Excavation/Soil Washing/ Solidify Fines/Cap	Alternative Sc-5 Excavation of Debris Piles/ Off-Site Subtitle D Landfill
IMPLEMENTABILITY					
Technical Feasibility	Not applicable.	Very feasible; area with VOC has been remediated. Equipment required for excavation is standard.	Very feasible; area with VOC has been remediated. Equipment required for excavation is standard.	Soil washing is feasible but least feasible of the four remedial actions as this technology is considered the most innovative and least proven for Ash landfill conditions.	Very feasible; area with VOC has been remediated. Equipment required for excavation is standard.
Ease of Doing More Action if Needed	Least interference, as nothing would be done to prevent required future action.	Little to no interference, site conditions would be restored to original condition.	Most interference as on-site landfill will hamper any future actions.	Moderate level of interference as some equipment slabs and roadways may interfere with future actions. Solidified fines mass fairly permanent	Least level of interference as Debris Piles will be removed and NCFL and Landfill will be covered.
Ability to Obtain Approvals and Coordinates with Other Agencies	No approval necessary	Landfill space is available locally, permitted landfills will accept waste.	Cap technology considered a temporary solution by the EPA.	Moderately likely to be approved as this alternative will involve the construction of a waste treatment facility.	Landfill space is abundant in the region. Permitting will not be req. providing the waste meets the requirements of the landfill. Standard bill of lading required to transport waste materials to facility. Most likely to be approved.
Availability of Services and Materials	No services or capacities required	Moderately available, requires large amount of trucks and excavators, limited amount of equipment available	Moderately available, requires specialized materials and installation contractors.	Least available, as technology is available from small, specialized group of soil washing contractors.	Very available; Subtitle D landfills located nearby.
COST					
Capital Cost	$0	$17.5 Million	$1.37 Million	$31.50 Million	$240,000
Annual O&M Cost	$0	$0	$52,000	$52,000	$52,000
30 Year Present Worth O&M Cost	$0	$0	$490,000	$490,000	$490,000
30 Year Present Worth Cost	$0	$17.5 Million	$1.89 Million	$32.00 Million	$730,000

Table 10-2
SUMMARY OF DETAILED EVALUATION OF MIGRATION CONTROL OPTIONS
Record of Decision - Ash Landfill
Seneca Army Depot Activity

Criteria	Alternative MC-1 No Action	Alternative MC-2 Alternate Water Source with Natural Attenuation of Plume	Alternative MC-3/MC-3a Air Sparging of Plume/ Funnel and Gate with Zero Valence Iron	Alternative MC-5 Collection/Filtration/Air Stripping/Discharge	Alternative MC-6 Collection/Filtration/ UV Oxidation/Discharge
PROTECTIVENESS OF HUMAN HEALTH AND THE ENVIRONMENT Human Health Protection (EPA target range is 1 x 10E-4 to 1 x 10E-6 for carcinogenic risk and an HI < 1.0 for noncarcinogenic risk)	Sum of risks to current off-site resident, future on-site hunter and future on-site construction worker 2.9E-005 HI = 0.22	Sum of risks remaining to off-site resident, hunter & construction worker following elimination of groundwater exposure 2.9E-05 - 5.6E-06 = 2.34E-05 HI = (0.22 - 0.14 = 0.08)	Sum of risks remaining to off-site resident, hunter & construction worker following elimination of groundwater exposure 2.9E-05 - 5.6E-06 = 2.34E-05 HI = (0.22 - 0.14 = 0.08)	Sum of risks remaining following elimination of groundwater as an exposure pathway 2.9E-05 - 5.6E-06 = 2.34E-05 HI = (0.22 - 0.14 = 0.08)	Sum of risks remaining following elimination of groundwater as an exposure pathway 2.9E-05 - 5.6E-06 = 2.34E-05 HI = (0.22 - 0.14 = 0.08)
Exposure Pathways Include : Ingestion of Groundwater Dermal Contact Inhalation of Volatile Organics Ingestion of Soils (Future On-site hunter and construction worker only)	Not Protective; Ingestion of groundwater at site boundary could result in exposure	Protective; Alternative water supply eliminates exposure to groundwater.	Protective; Groundwater exposure is eliminated.	Protective; Groundwater exposure is eliminated.	Protective; Groundwater exposure is eliminated.
Protection of Ecological Receptors	Protective; Depth to groundwater prevents ecological expsoure; Natural mechanisms reduces conc.	Protective; Depth to groundwater prevents ecological expsoure; Natural mechanisms reduces conc.	Protective; No Exposure from groundwater	Protective; Conc. of groundwater is reduced prior to discharge	Protective; Conc. of groundwater is reduced prior to discharge
COMPLIANCE WITH ARARs	Not Compliant with ARARs	Not Compliant with ARARs	Will comply with all ARARs	Will comply with all ARARs	Will comply with all ARARs
LONG-TERM EFFECTIVENESS AND PERMANENCE					
Magnitude of Residual Risk	Source of VOCs have been removed. On-site risk is above target range, if water is ingested. Off-site migration can lead to unacceptable risk.	Source of VOCs have been removed. On-site risk is above target range, if water is ingested. Off-site risk is controlled by providing a water supply.	No residual risk will exist , groundwater will be treated until it meets treatment criteria.	No residual risk will exist , groundwater will be treated until it meets treatment criteria.	No residual risk will exist , groundwater will be treated until it meets treatment criteria.
Permanence	Will be permanent once natural mechanisms reduce conc. to State and Federal criteria.	Will be permanent once natural mechanisms reduce conc. to State and Federal critieria.	Once State and Federal groundwater quality criteria is attained the action is permanent.	Once State and Federal groundwater quality criteria is attained the action is permanent.	Once State and Federal groundwater quality criteria is attained the action is permanent.

Table 10-2
SUMMARY OF DETAILED EVALUATION OF MIGRATION CONTROL OPTIONS
Record of Decision - Ash Landfill
Seneca Army Depot Activity

Criteria	Alternative MC-1 No Action	Alternative MC-2 Alternate Water Source with Natural Attenuation of Plume	Alternative MC-3/MC-3a Air Sparging of Plume/ Funnel and Gate with Zero Valence Iron	Alternative MC-5 Collection/Filtration/Air Stripping/Discharge	Alternative MC-6 Collection/Filtration/ UV Oxidation/Discharge
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT					
Reduction of Toxicity, Mobility, or Volume	Biodegradation and attenuation will not be efficient to prevent migration and increase the volume of contaminated groundwater. The breakdown product vinyl chloride is a toxic by-product of 1,2-DCE. Vinyl chloride is more mobile that the parent compound.	Biodegradation and attenuation will not be efficient to prevent migration. The breakdown product vinyl chloride is a toxic by-product of 1,2,-DCE. Vinyl chloride is more mobile than the parent compound. Documentation of migration will be monitored to prevent volume increase	Effective; Constituents are removed or destroyed	Effective; Constituents are removed, trenches will eliminate mobility.	Effective; Constituents are destroyed, trenches will eliminate mobility.
SHORT-TERM EFFECTIVENESS					
Community Protection	Protective under current conditions as current risk is within acceptable ranges.	Protective under current conditions as current risk is within acceptable ranges.	Protective of community; air emissions from sparging eliminated via carbon, will comply with air quality standards.	Protective of community; air emissions from stripping eliminated via carbon, will comply with air quality standards.	Protective of community; No air emissions produced, will comply with air quality standards.
Worker Protection	Protective under current conditions as current risk is within acceptable ranges.	Protective under current conditions as current risk is within acceptable ranges.	Dust produced during construction will be eliminated via personnel protective equipment.	Dust produced during construction will be eliminated via personnel protective equipment.	Dust produced during construction will be eliminated via personnel protective equipment.
Environmental Impacts	Current, short-term, conditions are protective of the environment.	Current, short-term, conditions are protective of the environment.	Protective; Any soil excavated will not contain hazardous constituents.	Protective; Any soil excavated will not contain hazardous constituents.	Protective; Any soil excavated will not contain hazardous constituents.
Time Until Action is Complete	Not Applicable; No action is performed	Estimated to be 45 years with a degradation rate of 0.0003/day	Estimated to be 30 years for sparging; estimated to be 30 years with funnel and gate system, and 15 years with permeable walls.	Estimated to be 30 years with three trenches	Estimated to be 30 years with three trenches

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IMPLEMENTABILITY					
Technical Feasibility	Feasible, Nothing is implemented	Feasible, water line can be installed; Natural mechanisms may be degrading pollutants. Degradation may attain acceptable levels. Monitoirng will ensure protection.	Feasible; Some uncertainty as zero valence iron is innovative; will require treatability/pilot testing	Feasible; Air stripping is a proven technology for VOC removal in groundwater.	Feasible; UV oxidation is a proven tech. for chlorinated VOCs in groundwater.
Ease of Doing More Action if Needed	Not Applicable; as nothing would be performed in the future	Least interference, as nothing would be done to prevent required future action.	This technology will not interfere with any other remedial activities.	Will not interfere with other remedial activities.	Will not interfere with other remedial activities.
Ability to Obtain Approvals and Coordinates with Other Agencies	No Action will be unacceptable to regulatory agencies due to off-site migration	Will require approval for waterline construction from town and the Dept. of Health.	Construction permits are readily available. Regulatory issues will be addressed.	Construction permits are readibly attainable.	Construction permits are readibly attainable.
Availability of Services and Materials	No services required	All services required to install waterline and monitor the plume are readily available.	Material and Services are available. All equipment required is standard	Materials and Services are readily available. All equipment is standard.	Materials and Services are specialized; not as available UV equipment is specialized.
COST					
Capital Cost	$0	$160,000 includes installation of 10 MWs and 4800 l.f. of 6" water main	MC-3 $668,000 MC-3a $2.05 Million	$543,000	$556,000
Annual O&M Cost	$0	$84,000	MC-3 $99,000 MC-3a $86,000	$114,309	$119,546
Operating Life in Years	0	30	30 yr. for MC-3 and 15 yr. for MC-3a	30	30
Operating Life Present Worth O&M Cost	$0	$794,500	MC-3 $1.79 Million MC-3a $656,000 MC-3a $813,000 assuming 30 years	$1.22 Million	1.31 Million
Total Present Worth Cost (Assumes 10% Interest)	$0	30 year Cost $954,500	30 year Cost MC-3 $2.50 Million 15 year Cost MC-3a $2.71 Million 30 year Cost MC-3a $2.86 Million	30 year Cost $1.76 Million	30 year Cost $1.86 Million

APPENDIX A

ADMINISTRATIVE RECORD INDEX

ADMINISTRATIVE RECORD

NYSDEC, 2000 - Division of Water Technical and Operational Guidance Series 1.1.1 (TOGS 1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, June 1998 as amended January 1999 and April 2000.

NYSDEC, 1999 - Technical Guidance for Screening Contaminated Sediments, November 1993, as amended July 1994, March 1998, and January 1999.

NYSDEC, 1994 - Technical and Administrative Guidance Memorandum #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, Jan 24, 1994.

Parsons, 1994 – Remedial Investigation Report, Ash Landfill, Seneca Army Depot Activity, Final, July 1994.

Parsons, 1994 - SWMU Classification Report, Seneca Army Depot Activity, Final, September 1994.

Parsons, 1996 - Feasibility Study Report , Ash Landfill, Seneca Army Depot Activity, 1996.

Parsons, 2000 - Feasibility Memorandum for Groundwater Remediation Alternatives using Zero Valence Iron Continuous Reactive Wall at the Ash Landfill, Seneca Army Depot Activity, Draft, August 2000.

Parsons, 2002 - Proposed Plan for the Ash Landfill, Seneca Army Depot Activity, Final, December 2002.

Title 40, Code of Federal Regulations, Part 261, Identification and Listing of Hazardous Waste.

Title 40 Code of Federal Regulations, Part 300, National Oil and Hazardous Substances Pollution Contingency Plan.

Title 42 US Code Chapter 103, Comprehensive Environmental Response, Compensation, and Liability, Section 9620.

USATHAMA, 1988 - Update of the Initial Installation Assessment of Seneca Army Depot, NY, prepared by Environmental Science and Engineering Inc. (ESE), Report No. AMXTH-IR-A-157(U), August 1988.

USATHAMA, 1980 - Installation Assessment of Seneca Army Depot, Report No. 157, Aberdeen Proving Grounds, MD, January 1980.

USEPA, Army, and NYSDEC, 1993 - Federal Facility Agreement Under CERCLA Section 120, Docket Number: II-CERCLA-FFA-00202, January 1993.

USEPA, 2002 - Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Integrated Manual, NTIS-PB2002105715, EPA SW-846, 2002.

USEPA, 2001 - National Primary Drinking Water Standards, EPA 816-F-01-007, March 2001

USEPA, 1999 - A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents, EPA 540-R-98-031, OSWER 9200.1-23P, PB98-963241, July 1999.

USEPA, 1992 - Secondary Drinking Water Regulations, EPA 810/K-92-001, July 1992.

Woodward-Clyde Federal Services, 1997 – U.S. Army Base Realignment and Closure 95 Program, Environmental Baseline Survey Report, March 1997.

APPENDIX B

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION DECLARATION OF CONCURRENCE

APPENDIX C

RESPONSIVENESS SUMMARY AND PUBLIC COMMENTS

No public comments were received on the Ash Landfill.

APPENDIX D

SUMMARY OF ARARS FOR THE SELECTED REMEDY

APPENDIX D: SUMMARY OF ARARS FOR THE SELECTED REMEDY

D.1 ARAR-BASED REMEDIAL OBJECTIVES

The investigation and cleanup of Ash Landfill falls under the jurisdiction of both the State of New York regulations (administered by NYSDEC) and Federal regulations (administered by USEPA Region II). Three categories of potentially applicable state and federal requirements are reviewed separately in the subsequent subsections. The three categories of ARARs are chemical specific, location specific and action specific. A brief regulatory discussion of ARARs is given below.

In 40 CFR 300.5, USEPA defines applicable requirements as those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental, or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable. Relevant and appropriate requirements are defined as those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

Any standard, requirement, criterion, or limitation under any federal or state environmental or facility siting law may be either applicable or relevant and appropriate to a specific action. The only state laws that may become ARARs are those promulgated such that they are legally enforceable and generally applicable and equivalent to or more stringent than federal laws. A determination of applicability is made for the requirements as a whole, whereas a determination of relevance and appropriateness may be made for only specific portions of a requirement. An action must comply with relevant and appropriate requirements to the same extent as an applicable requirement with regard to substantive conditions, but need not comply with the administrative conditions of the requirement.

As mentioned earlier in this section, three categories of ARARs were analyzed. They are as follows: chemical-specific, location-specific, and action-specific. Chemical-specific ARARs address certain contaminants or a class of contaminants and relate to the level of contamination allowed for a specific pollutant in various environmental media (water, soil, air). Chemical-specific ARARs are discussed below, in the media-specific sections. Location-specific ARARs are based on the specific setting and nature of the site. Action-specific ARARs relate to specific actions proposed for implementation at a site. Both location-specific and action-specific ARARs are independent of the media. In addition to ARARs, advisories, criteria or guidance may be evaluated as "To Be Considered" (TBC) regulatory items. CERCLA indicates that the TBC category could include advisories, criteria or guidance that were developed by EPA, other federal agencies or states that may be useful in developing CERCLA remedies. These advisories, criteria or guidance are not promulgated and, therefore, are not legally enforceable standards such as ARARs.

D.2 CHEMICAL SPECIFIC ARARs AND TBCs

Chemical-specific ARARs are usually health or risk-based standards limiting the concentration of a chemical found in, or discharged to, the environment. They govern the extent of site remediation by providing actual cleanup levels, or the basis for calculating such levels for specific media. A number of federal and state regulations are potential ARARs for this site. For each of the ARARs listed below 4 categories of information are provided.

D.2.1 Water Quality

- 40 CFR Part 141 (applicable): National Primary Drinking Water Regulations. This part establishes primary drinking water regulators pursuant to Section 1412 of the Public Health Service Act as amended by the Safe Drinking Water Act. Consideration: MCLs and NY state groundwater standards (GA) were used as a frame of reference for the applicable constituents; the lower, more conservative of the two standards were used to set clean-up levels in groundwater at the Ash Landfill sites.

- 40 CFR Part 141.11 (applicable): Maximum Inorganic Chemical Contaminant Levels. This section establishes maximum contaminant levels (MCLs) for inorganic chemicals in drinking water including the following:

Maximum Contaminant Level

Metal	(mg/L)	(μg/L)
Arsenic	0.05	50
Barium	2.0	2000
Cadmium	0.005	5
Chromium	0.1	100
Lead	0.015*	15*
Mercury	0.002	2
Selenium	0.05	50

*—Action Level

Consideration: MCLs and NY State groundwater standards (GA) were used as a frame reference for the applicable constituents; the lower of the two standards were used to set clean-up levels in groundwater at the Ash Landfill sites.

- 40 CFR Part 141.12 (applicable): Maximum Organic Chemical Contaminant Levels. This section establishes MCLs for organic chemicals in drinking water including the following:

Maximum Contaminant Level

Metal	(mg/L)	(μg/L)
TCE	0.005	5
Benzene	0.005	5
Total trihalomethanes	0.10	100

Consideration: MCLs and NY State groundwater standards (GA) were used as a frame of reference for the applicable constituents; the lower of the two standards were used to set clean-up levels in groundwater at the Ash Landfill sites.

- 40 CFR Part 264 Subpart F (applicable): Releases from Solid Waste Management Units. Standards for protection of groundwater are established under this citation. This ARAR is applicable to long-term monitoring of the site.

- 6 NYCRR subparts 701 and 702 (applicable): These subparts provide classification definitions for surface water and groundwaters and describe procedures that may be used to obtain guidelines or standards that will be protective of human health and aquatic life. Consideration: Definitions of local surface water and groundwater classifications at the site were obtained from these subparts.

- 6 NYCRR subpart 703 (applicable): This subpart establishes groundwater standards specified to protect groundwater for drinking water purposes. Consideration: The groundwater at the Ash Landfill has been classified as GA, which means the best usage is as a source of potable water. Given the current and future intended uses of the site, these standards are the most appropriate for comparison to on-site concentrations. Also, groundwater effluent standards apply to a discharge from a point source or outlet (that may be associated with a remedial measure) that will or may enter the unsaturated or saturated zones.

- 6 NYCRR subpart 373-2.6 and 373-2.11 (applicable): This regulation requires groundwater monitoring for releases from solid waste management units.

- 6 NYCRR subpart 373-2 (relevant and appropriate): This regulation establishes post closure care and groundwater monitoring requirements. Consideration: This regulation applies after the Ash Landfill sites has been closed under CERCLA requirements.

- 6 NYCRR Part 5 (relevant and appropriate): This regulation establishes criteria for drinking water supplies. Specifically, NYSDOH has established MCLs for water. Consideration: These criteria are relevant and appropriate to drinking water sources in NY State.

- NYSDEC TOGS 1.1.1 (relevant and appropriate): This document compiles water quality standards and guidance values for use in NYSDEC programs. Consideration: This document was used as a reference for the NYSDEC water quality standards and guidance values.

D.2.3 Soil Quality

NYSDEC Technical and Administrative Guidance Manuals (TAGMs) (TBCs): The New York State rules for inactive hazardous waste disposal sites are provided in these documents. Cleanup levels for hazardous constituents in soil have been proposed by the State of New York through Technical and Administrative Guidance Manuals (TAGMs) specifically, #HWR-92-4046.

D.2.4 PCBs

- 40 CFR Part 761 (TBC): Polychlorinated Biphenyls (PCBs) Manufacturing, processing, distribution in commerce and use prohibition. This part establish and the requirements for the storage and disposal of PCBs. Consideration: No action is required in regard to this regulation.

- 40 CFR Part 761 subpart G (TBC): PCB Spill Clean Up Policy, This regulation establishes criteria EPA will use to determine the adequacy of the clean up of spills resulting from the release of materials containing PCBs.

- EPA OSWER 8/90 (TBC): A Guide to Remedial Actions at Superfund sites with PCB contamination.

D.3 LOCATION-SPECIFIC ARARS

Location-specific ARARs may serve to limit contaminant concentrations, or even to restrict or to require some forms of remedial action in environmentally or historically sensitive areas at a site, such as natural features (including wetlands, flood-plains, and sensitive ecosystems) and manmade features (including landfills, disposal areas, and places of historic or archaeological significance). These ARARs generally restrict the concentration of hazardous substances or the conduct of activities based solely on the particular characteristics or location of the site.

Potential federal and State location-specific ARARs considered in connection with this response action include the following:

Federal:

- Executive Orders 11593, Floodplain Management (May 24, 1977), and 11990, Protection of Wetlands (May 24, 1977).
- National Historic Preservation Act (16 USC 470) Section 106 and 110(f) and the associated regulations (i.e. 36 CFR part 800) (requires federal agencies to identify all affected properties on or eligible for the National Register of Historic Places and consult with the State Historic Preservation Office and Advisory Council on Historic Presentation)
- RCRA Location Requirements and 100-year Floodplains (40 CFR 264.18(b)).
- Clean Water Act, Section 404, and Rivers and Harbor Act, Section 10 (requirements for Dredge and Fill Activities) and the associated regulations (i.e. 40 CFR part 230).
- Wetlands Construction and Management Procedures (40 CFR part 6, Appendix A).

New York State:

- New York State Freshwater Wetlands Law (New York Environmental Conservation Law (ECL) articles 24 and 71).
- New York State Freshwater Wetlands Permit and Classification Requirements (6 NYCRR 663 and 664).
- New York State Floodplain Management Act, ECL, article 36, and Floodplain Management regulations (6 NYCRR part 500).
- New York State Inactive Hazardous Waste Disposal Sites (6 NYCRR 375).

- Endangered and Threatened Species of Fish and Wildlife, Species of Special Concern Requirements (6 NYCRR part 182).
- New York State Flood Hazard Area Construction Standards

D.4 ACTION-SPECIFIC ARARS

Action-specific ARARs are usually technology or activity-based requirements or limitations that control actions involving specific substances. Action-specific ARARs generally set performance or design standards, controls, or restrictions on particular types of activities. To develop technically feasible alternatives, applicable performance or design standards must be considered during the development of all response action alternatives.

Potential federal and state action specific ARARs considered in connection with this response action include the following:

Federal:

- RCRA Subtitle C Hazardous Waste Treatment Facility Design and Operating Standards for Treatment and Disposal systems, (i.e., landfill, incinerators, tanks, containers, etc.) (40 CFR parts 264 and 265); RCRA section 3004(o), 42 USC 6924(o) (RCRA statutory minimum technology requirements.)
- RCRA, Subtitle C, Closure and Post-Closure Standards (40 CFR 264, Subpart G).
- RCRA Groundwater Monitoring and Protection Standards (40 CFR, Subpart F).
- RCRA Generator Requirements for Manifesting Waste for Off-site Disposal (40 CFR part 262, subpart B).
- RCRA Transporter Requirements for Off-Site Disposal (40 CFR part 263).
- RCRA, Subtitle D, Non-Hazardous Waste Management Standards (40 CFR part 257).
- Safe Drinking Water Act, Underground Injection Control Requirements (40 CFR parts 144 and 146).
- RCRA Land Disposal Restrictions (40 CFR part 268) (on and off-site disposal of excavated soil).
- CWA--NPDES Permitting Requirements for Discharge of Treatment System Effluent (40 CFR parts 122-125).
- CWA--Effluent Guidelines for Organic Chemicals, Plastics and Synthetic Fibers (discharge limits) (40 CFR part 414).
- CWA--Discharge to POTW—general Pretreatment regulations (40 CFR part 403).

- DOT Rules for Hazardous Materials Transport (49 CFR part 107, and 171.1-171.500).
- OSHA Standards for Hazardous Waste Operations and Emergency Response, 29 CFR 1910.120, and procedures for General Construction Activities (29 CFR parts 1910 and 1926).
- RCRA Air Emission Standards for Process Vents, Equipment Leaks, and Tanks, Surface Impoundments, and Containers (40 CFR subparts AA, BB, and CC.)

New York State:

- New York State Pollution Discharge Elimination System (SPDES) Permit Requirements (Standards for Stormwater Runoff, Surface Water, and Groundwater Discharges (6 NYCRR 750-757).
- New York State RCRA Hazardous Management Standards for Hazardous Waste Treatment Facilities (*i.e.,* landfills, incinerators, tanks, containers, etc.) and Minimum Technology Requirements (6 NYCRR 370-373).
- New York State Solid Waste Management and Siting Restrictions (6 NYCRR 360-361).
- New York State RCRA Generator and Transporter Requirements for Manifesting Waste for Off-Site Disposal (6 NYCRR 364 and 372).